TRANSFORMING STEM HIGHER EDUCATION
Discovery, Innovation, and the Value of Evidence

November 2-4, 2017 | San Francisco, California

Dear Colleagues,

Welcome to the 2017 AAC&U STEM Conference. This year, our focus on *Discovery, Innovation, and the Value of Evidence* captures the urgency of undergraduate STEM reform and directs us toward solutions for addressing imminent threats to cybersecurity, economic stability, and global prosperity. Indeed, our work as STEM higher education reformers has never been more necessary than it is now.

Each year, the Association of American Colleges and Universities (AAC&U) and its Project Kaleidoscope (PKAL) host this Conference – as part of the AAC&U Network for Academic Renewal Conferences – that focuses on deep exploration and examination of evidence-based models, strategies, and practices that will empower us to produce more competitively trained, liberally educated STEM graduates. We know that you have many choices in conference venues, and we are honored that you have chosen to share your valuable time and insight into STEM higher education reform with us.

As part of our effort to ensure that you have a rewarding professional development experience, we are pleased to feature **NSF HOURS**, a series of concurrent sessions that feature and offer insight into the most recent funding priorities of the National Science Foundation for advancing the reform of U.S. undergraduate STEM education. During these sessions, NSF program officers, along with the Deputy Assistant Director of the Education and Human Resources Directorate, will discuss the future directions of undergraduate STEM education reform (including NSF's Ten Big Ideas and the NSF INCLUDES program). They will also review funding mechanisms for broadening participation in STEM, provide technical assistance for proposal development and submission, and present information about multiple projects funded by the NSF Divisions of Human Resource Development (HRD) and Undergraduate Education (DUE). Please see concurrent sessions 8, 16, and 20 for details.

Again, thank you for joining us. We are extremely excited about this year's conference. We trust that your experience will be very rewarding, and we look forward to learning from you and your institutional accomplishments, classroom best practices, and professional experiences related to undergraduate STEM reform.

Kelly Mack
Vice President for Undergraduate STEM Education and Executive Director of Project Kaleidoscope

Karen Ann Kalla
Director, Network for Academic Renewal

CONFERENCE PLANNING COMMITTEE

AAC&U extends its sincere appreciation to and recognition of the individuals listed below for their many contributions to conceptualizing, developing, and presenting this conference program.

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Willamette University
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Associate Dean for Faculty Development

OPPORTUNITIES TO CONNECT

In an effort to provide more networking opportunities for conference participants, we are offering a few ways for you to connect with colleagues both within and outside of conference sessions. Badge ribbons indicating particular areas of interest will be available at the conference registration desk. Please select a ribbon(s) that best matches your primary area(s) of interest and reason for attending the conference. These ribbons provide a way to help you meet and interact with those of mutual interests. Sign-up sheets for lunch and dinner groups, organized by areas of interest will be available in the registration area. Join the conversation on Twitter at #aacustem17.

LIBERAL EDUCATION AND AMERICA'S PROMISE (LEAP FEATURED SESSIONS)

Throughout the conference program, sessions noted with the (LEAP) designation highlight the innovative work of colleges and universities that are members of AAC&U's LEAP Campus Action Network. The LEAP Campus Action Network brings together campuses and organizations that are committed to liberal education and helps them to improve their efforts to ensure that all students achieve essential liberal education outcomes. Participants in these sessions will learn how members of the Network are using the LEAP framework and resources to advance their educational and improvement efforts. For information about LEAP visit www.aacu.org./LEAP.

FUTURE NETWORK FOR ACADEMIC RENEWAL CONFERENCES

February 15-17, 2018 | Philadelphia, Pennsylvania; Philadelphia Marriott Downtown
General Education and Assessment: Foundations for Democracy

March 22-24, 2018 | San Diego, California; The Westin Gaslamp Quarter
Diversity, Equity, and Inclusive Democracy: The Inconvenient Truths

October 11-13, 2018 | Seattle, Washington; The Westin Seattle
Global Engagement and Social Responsibility

November 8-10, 2018 | Atlanta, Georgia; Hyatt Regency Atlanta
Transforming STEM Higher Education

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The Association of American Colleges and Universities thanks the following sponsor for its generous support of this Network for Academic Renewal conference.

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SCHEDULE AT A GLANCE

Wednesday, November 1, 2017

6:00 P.M. – 8:00 P.M.   **Conference Registration and Membership Information**

Thursday, November 2, 2017

10:00 A.M. – 6:00 P.M.   **Conference Registration and Membership Information**

12:00 P.M. – 3:00 P.M.   **Pre-Conference Workshops**
(Separate registration and fee required)

3:30 P.M. – 4:45 P.M.   **Keynote Address**
Michael Crow, President—Arizona State University

5:00 P.M. – 6:30 P.M.   **Poster Sessions and Reception**

Friday, November 3, 2017

7:30 A.M. – 6:00 P.M.   **Conference Registration and Membership Information**

7:30 A.M. – 9:00 A.M.   **Continental Breakfast and Poster Sessions**

8:15 A.M. – 9:00 A.M.   **Newcomers Welcome**

9:15 A.M. – 10:15 A.M.   **Plenary**
Timothy McKay, Arthur F. Thurnau Professor of Physics, Director of LSA Honors Program—University of Michigan

10:30 A.M. – 11:30 A.M.   **Concurrent Sessions**

11:30 A.M. – 1:15 P.M.   **Lunch on your own**

1:30 P.M. – 2:45 P.M.   **Concurrent Workshops**

3:15 P.M. – 4:15 P.M.   **Concurrent Sessions**

4:30 P.M. – 6:00 P.M.   **Poster Sessions and Reception**

Saturday, November 4, 2017

8:00 A.M. – 8:45 A.M.   **Continental Breakfast**

9:00 A.M. – 10:15 A.M.   **Concurrent Workshops**

10:30 A.M. – 11:30 A.M.   **Plenary**
Kumar Garg, Senior Fellow, Society for Science and the Public and Former Assistant Director for Learning and Innovation, White House Office of Science and Technology Policy

PROGRAM OF EVENTS

MEZZANINE FOYER
6:00 P.M. – 8:00 P.M. CONFERENCE REGISTRATION AND MEMBERSHIP INFORMATION

MEZZANINE FOYER
10:00 A.M. – 6:00 P.M. CONFERENCE REGISTRATION AND MEMBERSHIP INFORMATION

12:00 P.M. – 3:00 P.M. PRE-CONFERENCE WORKSHOPS
(Separate registration and fee: $125 members; $195 non-members)

ELIZABETHAN ROOM A, SECOND FLOOR
Workshop 1: Achieving Science Practice Skills for STEM Success
Based on a growing body of literature in science education, the academic community knows "what works" in the STEM classroom to help students better understand the content of a discipline and gain the 21st century skills necessary to conduct investigations and be successful in different areas of STEM. What works are the evidence-based, active-learning methods that should populate every STEM course, in all "lectures," laboratories, and discussion sections. These methods include practice in using and analyzing data, critical thinking, quantitative reasoning, communication, and experimental design. While we know what works and while faculty have knowledge of evidence-based methods, the problem in gaining widespread use of these improved pedagogies relates to the implementation and sustained use of active learning in the classroom. This workshop will focus on providing faculty with the tools they need to help students develop the skills necessary for today's technology and science-driven world. *Participants wi*ll engage with examples of evidence-based methods and activities to adapt or implement and strategies to improve the success of all STEM students, regardless of their science background.
***Gordon E. Uno**, David Ross Boyd Professor, Department of Microbiology and Plant Biology—University of Oklahoma*

ELIZABETHAN ROOM B, SECOND FLOOR
Workshop 2: Becoming HIP: Embedding High-Impact Practices in STEM to Increase Equity, Student Success, and ELOs
Intentional inclusion of High-Impact Practices (HIPs) and AAC&U's Essential Learning Outcomes (ELOs) in STEM courses produces better scientists and increases student achievement, especially for traditionally underrepresented students. These "new majority" students show even higher gains in learning from HIPs than their peers, fostering equity in STEM. *Participants will* explore how to maximize the number of ELOs in introductory science courses without removing essential content. They will discuss strategies for building students' higher-order cognitive and metacognitive skills and growth mindset to increase student resilience. Not only does making STEM courses more "HIP" help students, it also increases instructor satisfaction and enjoyment. Participants will learn how to incorporate ELOs and HIPs into STEM courses; consider how practices may unintentionally place certain students at greater risk of attrition; comprehend the distinctive roles that writing and collaborative projects play in student learning; and envision ways to adopt and assess these practices in courses and across a department.
***Ellen Goldey**, Dean of the Wilkes Honors College, Florida Atlantic University; and **Michael Reder**, Director, Joy Shechtman Mankoff Faculty Center for Teaching and Learning, Connecticut College*

Workshop 3: The Pre-Tenure and Post-Tenure Faculty Experience: An Alternative Mentoring Framework

This workshop will begin a new type of discussion about mentoring by describing the common problems that pre-tenure and post-tenure faculty experience and examine why traditional mentoring programs fail to meet those needs. The facilitator will propose and engage participants in an alternative framework for mentoring that focuses on needs assessment and shifts the idea of mentoring from a relationship between two faculty members towards building a broad network of support, community and accountability. The workshop will conclude with a presentation of best practices in mentoring pre-tenure, under-represented and mid-career faculty.

Kerry Ann Rockquemore, President and CEO—National Center for Faculty Development and Diversity

Workshop 4: Achieving Gender Diversity in Engineering

Despite continued efforts to attract and retain women, the percentage of women earning degrees in engineering remains low nationally. At the Thayer School of Engineering at Dartmouth College, however, more than 50% of the undergraduate degrees in engineering went to women in 2016, and well over 40% of the current engineering students are women, a level more than twice the national average. Dartmouth, along with a few other campuses, are approaching gender parity. What are these institutions doing differently? How can the approaches used at these institutions be adapted at other campuses with different missions or different scales? During this workshop, participants will examine and evaluate approaches used to attract and retain women including courses that are open-ended, interdisciplinary and project-based; focused on design and innovation; and that offer multiple entry points to engineering. They will consider approaches that provide a flexible curriculum, an emphasis on the liberal arts, and more. Participants will analyze data from programs that have achieved noteworthy gender diversity, explore the evidence and research that supports these programs, and develop and analyze plans for achieving gender diversity in engineering at their own campuses.

Joseph J. Helble, Dean and Professor of Engineering, Thayer School of Engineering and Vicki V. May, Professor of Engineering—both of Dartmouth University

Workshop 5: Project Kaleidoscope Leadership Development for STEM Faculty

For the past two decades, Project Kaleidoscope has provided leadership development for hundreds of early and mid-career STEM faculty through its STEM Leadership Institute (SLI). This Institute strategically utilizes a combination of deep introspection and experiential learning to empower a cadre of undergraduate STEM reformers who are equipped to lead change with courage; embrace diverse perspectives with authenticity and legitimacy; and communicate bold, new ideas with thoughtfulness and clarity. Participants will learn about the underlying theory that supports Project Kaleidoscope's unique approach to leadership development and engage both SLI alumni and other STEM faculty and administrators in hands-on leadership training experiences designed to impart immediate efficacy in directing campus-based and/or national undergraduate STEM reform initiatives.

Judith Dilts, Professor Emerita, and former Associate Dean, College of Science and Mathematics—James Madison University; Mary Majerus, Lee Hunter Professor of Mathematics and Physics—Westminster College; Sylvia Nadler, Professor Emerita, and former director Pryor Leadership Studies Program—William Jewell College; Brandon E. Schwab, Associate Provost for Academic Affairs—Western Carolina University; and William B. Davis, Associate Dean for Undergraduate Education, College of Veterinary Medicine, and Associate Professor and Associate Director of Undergraduate Studies, School of Molecular Biosciences—Washington State University

3:30 P.M. – 3:45 P.M.   **WELCOME REMARKS**

Kelly Mack, Vice President, Office of Undergraduate STEM Education and Executive Director, Project Kaleidoscope—AAC&U

3:45 P.M. – 4:45 P.M.   **KEYNOTE**

Science, Technology, Engineering, and Math: What STEM Can Help Us Achieve

Michael Crow, President—Arizona State University

The complex challenges facing modern society require the rapid evolution of science and technology. Solutions to these questions demand moonshot thinking generated by adaptive learners with leading-edge STEM knowledge. Dr. Crow will discuss the real changes in innovation and mindset needed to advance student STEM proficiency, and to empower institutions and educators to embrace new, creative teaching methods for preparing the problem-solvers of the future.

ITALIAN/COLONIAL ROOM, MEZZANINE
5:00 P.M. – 6:30 P.M.   **POSTERS AND RECEPTION**

<u>**THEME I: UNDERGRADUATE STEM TEACHING AND LEARNING: CONTEXTS, CONTENT, AND RELEVANCY**</u>

POSTER 1: Professional Learning Communities: Supporting First Generation STEM Majors
This poster will describe how student and faculty learning communities can increase science literacy and representation of first-generation college students in STEM majors. It will detail the construct of a professional learning community (PLC); its effectiveness in course design and faculty team building; and examine the experience, barriers, and backgrounds of target students. Facilitators will discuss how participation in the PLC affected their teaching philosophies, approaches and attitudes. *Participants will* gain insight into the factors that inform development of a broadly reaching program and the consequent institutional challenges, issues of recruitment of faculty and students, coordination issues, interpersonal concerns, disciplinary approaches to course design, and attitudes about teaching. They will also look at course design frameworks and review initial qualitative and quantitative data to assess effectiveness for faculty and students.
Nina Goodey, Associate Professor of Chemistry and BioChemistry—Montclair State University

POSTER 2: Cross-Disciplinary Research Collaboration Identifies Critical Factors in STEM Student Success
Introductory biology courses are "gateway" courses for many majors. In many colleges and universities, attrition and achievement problems are barriers to student success and program effectiveness. This poster will illustrate the effectiveness of cross-disciplinary partnerships among different departments including administration, in the identification of important factors associated with student success. Facilitators will describe how this collaborative approach has helped identify at least two critical factors associated with biology student success thus far – class size and writing proficiency. *Participants will* become familiar with the problems introductory biology students encounter and the conundrums of finding the best approach to better understand these challenges. They will learn about this cross-disciplinary research approach, including the nature of the experimental design, data collection, data analysis and final publication in peer-reviewed journals. Participants will be able to discuss how this approach represents an effective method to identify critical factors associated with success.
Kirkwood Land, Associate Professor of Biological Sciences, Eileen Camfield, Director of University Writing Programs, and Alex Miller, Doctoral Student in Educational and School Psychology—all of the University of the Pacific

POSTER 3: Engaged Learning through Creativity in Science and Mathematics
What is creativity? How is it relevant to undergraduate STEM education? The Creativity in Science and Mathematics project, funded by the NSF, challenges the common notion that creativity is relegated to the artistic realm. To offer an alternative to traditional, lecture-style instruction and call upon students to question their preconceptions about the nature of STEM, faculty created undergraduate STEM course modules to embrace creativity. Through these modules, students are encouraged to ask questions and test assumptions. *Participants will* learn about a model for incorporating creativity into STEM courses and consider the role of creativity in STEM education. They will learn how to generate ideas for instructional innovations that encourage students to embrace STEM as creative endeavor and how instructional practices that consider creativity might impact students' perceptions of and enrollment in the sciences.
Mika Munakata, Professor of Mathematics Education—Montclair State University

POSTER 4: Building Transdisciplinary Teams to Address Sustainability Challenges
This poster will identify a framework for bridging student engagement in STEM learning from the classroom into applied, sustainability research. Poster presenters will explain how seemingly disparate projects can be linked via systems thinking to leverage broader impact (both in community and in scholarship) and frame such projects as publishable research. *Participants will* learn how to identify examples of local and regional sustainability projects in which they can engage and describe key project elements, including interdisciplinary collaborators, external partners, and roles for undergraduate students. They will discern how such projects might fit into their respective STEM curricula and list undergraduate student learning objectives for student collaborators.
John Quinn, Assistant Professor—Furman University

POSTER 5: Implementing a Living Learning Community Project for Health Sciences Students
The Health Sciences Scholars Program (HSSP) is a living learning community that supports first year, pre-health students as they transition from high school to university. It gives them access to programs, resources, and mentors as they explore careers in the health professions. This poster will describe how HSSP students were given the opportunity to individualize their learning in the required core courses and how to develop a year-long collaborative assignment where students partner with a peer interested in a similar topic to complete and present a project. *Participants will* understand the steps needed to carry out a year-long project and appreciate lessons learned regarding the ambitious goal of meeting and providing feedback to every student in a 120-student health sciences course.
Adam Eickmeyer, Lecturer in American Culture and the Health Sciences Scholars Program—University of Michigan

POSTER 6: Undergraduate Researchers Reflect on High-Stakes Scholarship and Fellowship Writing
This poster will illustrate STEM undergraduate researchers' experiences writing for competitive fellowships and scholarships and the context of the support mechanisms which make the application process a transformative experience regardless of whether the student receives the award. Analysis of student focus groups and interviews about the application process will highlight the benefits of competitive writing for students. Students stressed that the process of writing, reflection, peer and professional feedback, and revision changed their understanding of and ability to clearly articulate their work and the value of STEM to society. *Participants will* learn about student's experiences with high-stakes competitive application writing and explore how a specific feedback support structure fosters insights into new ideas and ways of thinking and writing.
*Natasha Oehlman, Writing and Professional Communication Associate and **Heather Haeger**, Assessment and Education Research Associate—both of California State University, Monterey Bay*

POSTER 7: Building Excellence in Science and Teaching (BEST)
The Building Excellence in Science and Technology (B·E·S·T) program grew from a reflective discussion in the School of Sciences and Social Sciences concerning the challenges that prevent students from completing STEM degrees. Institutional data suggested that STEM programs were losing three groups of students: STEM-interested and STEM-capable students who do not formally declare STEM majors, STEM-interested students who struggle to complete STEM gateway courses, and well qualified STEM students who transfer to other institutions to complete STEM degrees. This poster will describe overarching goal of the B·E·S·T program to increase the number of STEM graduates in biology, chemistry, computer science, geology, mathematics, and physics by approximately 50%. *Participants will* learn how the program elements have contributed to increasing the number of declared majors in biology, chemistry, computer science, geology, mathematics, and physics; and how the number of students participating in undergraduate research through this program annually has increased.
*Shari Bemis, Assistant Dean, Associate Professor and **Karen Stanish**, Assistant Professor of Mathematics—both of Keene State College*

POSTER 8: HERE We Go: A Versatile, Student-Driven Learning Activity for Seminar courses
This poster will present a versatile, student-driven assignment dubbed HERE (Hypothesize—Read—Explain) that was designed for the small, upper-level course to encourage students to follow their own curiosity and help them critically read primary literature. HERE asks students to come up with their own questions as well as hypotheses regarding the lecture material, find and read relevant papers, and present them to the class. HERE was implemented in a course in Spring 2017 and students indicated in the midterm survey that they like the opportunity to explore the topics of their own interest and to learn various subjects from their peers' presentations. As evidence of the effectiveness of HERE, students' responses to pre- and post-course questionnaires will be analyzed and presented in the poster. In addition, the structure and examples of HERE as well as future improvement efforts will be shared. *Participants will* learn how to design an active and constructive learning activity and integrate it in a small/seminar course. They will see how students responded to non-traditional assignments.
Youngeun Choi, Assistant Teaching Professor—Georgetown University

POSTER 9: From General Education to STEM Teaching: A Project-based STEM Course as a Foundation for STEM Teacher Preparation
Effective teacher preparation in STEM requires teacher candidates to develop integrated STEM skills and knowledge linking general education coursework to instructional methodology coursework. For candidates with limited interest in STEM learning, opportunities to experience hands-on, applied STEM activities are critical to the development of their skill and enthusiasm as teachers of STEM content. This poster will describe content, activities, and outcomes from an integrated STEM class that merges general education STEM content with hands-on learning and teacher preparation coursework. *Participants will* explore how to link STEM general education courses to teacher preparation courses through integrated STEM instruction; examine how an integrated STEM course strengthens preparation of elementary teachers in urban schools and enthusiasm for STEM teaching and learning; and discuss challenges of culturally relevant integrated STEM instruction for teachers entering urban classrooms. They will learn how to develop linkages between an effective sequence of STEM education courses for teacher candidates and quality STEM education in the elementary schools.
*Margaret Clark, Director, Urban Learning Program and **Paula Arvedson**, Professor of Education—both of California State University, Los Angeles*

POSTER 10: Developing Engineering Capacity in Students
Engineering education has been a discipline for over 100 years, but limited research exists on the learning process in engineering (learning engineering) and how to teach this process. This poster will summarize and expand upon the existing scholarship and practices of Learning to Learn Engineering as well as introduce key components of new research that will strengthen the teaching of Learning to Learn Engineering. *Participants will* gain a conceptual framework of how engineering performance ties to Learning to Learn Engineering and the growth of Engineering Learning Capacity; learn about cultural change necessary for incorporating Learning to Learn Engineering; and see how to analyze models for implementing a Learning to Learn Engineering Course. They will have an opportunity to learn about joining a Professional Learning Community.
Steven Beyerlein, Professor and Chair—University of Idaho; Daniel Apple, Public Systems Analyst— Pacific Crest; and Tristan Utschig, Associate Director of Learning Sciences—Kennesaw State University

POSTER 11: Radically Transforming Mathematics Learning Experiences for All Students: Lessons from the Carnegie Math Pathways
Five years of data in the classroom show that students in Quantway and Statway succeed at a higher rate than their traditionally remediated peers; out-perform them in subsequent quantitative courses; transfer at significantly higher rates; and make lasting gains in key socio-emotional and motivational factors that support success. The Carnegie Math Pathways have been able to sustain these outcomes through a holistic design. This poster session will highlight key elements of this approach, including specific supports to faculty and students, that attendees can consider for their own institutional context. *Participants will* learn of design principles for the Carnegie Math Pathways; become familiar with evidence and data that supports these programs; and gain knowledge of how an improvement community critically supports collective learning and action. They will see this approach can collaboratively support more equitable learning and outcomes in math and leave with concrete recommendations of next steps to consider math redesign at their institution.
Jamylle Carter, Professor of Mathematics—Diablo Valley College; and Rachel Mudge, Professor— Foothill College and Carnegie National Faculty

POSTER 12: Peer-Assisted Team Research (PATR): A Model for Early Research Experiences
Peer-Assisted Team Research (PATR) is a research experience model designed to include more undergraduates earlier in research. Students design and carry out research plans, analyze data, and draw conclusions through a structured format designed to scaffold an understanding of the research process in a peer-led team setting. This flexible model is readily adaptable to many different institutional settings; effectively increases retention and persistence of underrepresented STEM students; and prepares students for faculty labs. The poster will describe the innovative aspects of PATR, its basic components, research topics already developed, and how and where students are engaging in PATR. *Participants will* develop an understanding of multiple implementation strategies that can be used to incorporate a wide range of peer-led research experiences (e.g. discipline-specific, interdisciplinary, course-based, extra-curricular) at their home institution. They will be able to identify potential obstacles and challenges to those strategies and generate practical and pragmatic solutions to incorporate research activities into various institutional settings.
Lori Sims, Research Programs Coordinator—Brooklyn College, City University of New York

POSTER 13: Faculty Mentoring to Maximize Impact in High-Impact Practices
This poster will examine the impact of mentoring strategies within undergraduate research on broadening access to STEM fields by examining how the quality of mentorship affects the development of research and academic skills for a diverse population of students at a minority serving institution. Results of a study conducted at a small, minority serving institution will be used as a launching point for a discussion of how to support faculty mentoring of diverse students including training strategies. *Participants will* learn of the barriers to productive mentoring, successful strategies for encouraging positive mentorship, and specific types of effective mentoring in high-impact-practices.
***Heather Haeger**, Assessment and Educational Research Associate—California State University, Monterey Bay*

THEME II: SUPPORTING, REWARDING, AND BUILDING CAPACITY OF STEM FACULTY

POSTER 14: Beyond Flipping: Supporting Faculty to Develop STEM Education Expertise
Flipping the class and clickers are trendy. They fall short, however, of helping STEM faculty understand why and how to integrate active learning methods into their practice. Two realities further encumber this challenge: 1) institutions typically have limited capacity to support faculty development; and 2) many STEM students transfer from 2-year to 4-year institutions, though there is no alignment of teaching practices across settings. This poster will explain how to leverage STEM faculty to maximize limited capacity and the added value of faculty working across 2- and 4-year colleges and universities to learn from and with each other how to support students' and their transitions. *Participants will* learn how to leverage STEM faculty for supporting faculty development and how this approach improves undergraduate teaching and learning in STEM for all students.
***Anne Baranger**, Director of Undergraduate Chemistry, Adjunct Professor of Chemistry and **Michelle Douskey**, Lecturer in Chemistry—both of the University of California, Berkeley*

POSTER 15: Assessing Departmental Climates for Supporting Innovative Teaching Practices
In order to better understand current conditions on campus and to help identify motivations and obstacles that influence instructor adoption of teaching innovations, faculty engaged in a systematic study of climate for teaching as perceived by instructors. The climate of STEM teaching was assessed by conducting semi-structured interviews with faculty and departmental executive officers (DEOs), classroom observations, an institutional climate survey, and a classroom practice survey. STEM Leadership Institutes designed to engage department executive officers and deans contributed to the learning process. This poster will present an analysis of open-text responses to a survey of research university faculty in which they were asked to comment on departmental climate for teaching, motivations for adopting teaching innovations, and obstacles to innovation. *Participants will* learn about strategies for characterizing and exploring department cultures regarding teaching. They will gain insights as to why instructors do (or do not) adopt and use evidence-based instructional strategies and how these views are influenced by department culture and leadership views about teaching and learning. They will also learn how leadership institutes can support chairs and deans in creating a culture that supports the sustained adoption of evidence-based teaching strategies.
***Ashlie Wrenne**, Postdoctoral Fellow and **Renee Cole**, Associate Professor—both of the University of Iowa*

POSTER 16: Fostering Effective Pedagogical Change: Findings from a Certificate Program for STEM Faculty
This poster will share the benefits and challenges of designing, administering, and evaluating a pedagogical certificate program to encourage STEM faculty to adopt inclusive, active learning strategies. Qualitative data on participants' teaching beliefs and methods, as well as perspectives on student learning will be presented. Data sources include: 1) faculty's written statements and reflection; 2) results from the Teaching Perspectives Inventory (TPI) (Pratt & Collins, 2001-14); and 3) the results of an observation of each participant's classroom teaching. Findings suggest that some faculty shifted their perspective on teaching from predominantly transmission-style teaching toward more learner-centered approaches. *Participants will* learn about research on pedagogical change strategies and how key elements of the research map onto faculty certificate program structures. Presenters will identify specific areas of strength of certificate programs and address challenges associated with evaluation and implementation. Participants will gain understanding of critical features of certificate programs, how they have been implemented and evaluated, and pitfalls to avoid.
Linda Hodges, Associate Vice Provost for Faculty Affairs and Director, Faculty Development Center and Kerrie Kephart, Associate Director for Pedagogical Innovation, Research, and Assessment, Faculty Development Center—both of the University of Maryland, Baltimore County

THEME III: INCLUSIVE EXCELLENCE/BROADENING PARTICIPATION IN STEM HIGHER EDUCATION

POSTER 17: Faculty-Driven, Student-Centered Change for Increased Success of ALL STEM Students
This poster will describe how a STEM division underwent significant culture changes regarding the ways in which students form community, interact with each other and faculty, and gain support by staff and faculty. These transformational changes are in part due to the MESA (Math, Engineering, Science Achievement) program and a RiSE (Relationships in Science Education) program. Faculty leading the program have created a Core leadership team, a Journal Club, and a Faculty Colloquium to discuss research and share best practices in pedagogy and student support. Through student events, undergraduate research, engaged instruction, a MESA Center, and a STEM Study Room, faculty have become increasingly engaged with students outside of the classroom and have built a community that supports all students. Quantitative and qualitative data will be shared on the effectiveness of these programs. *Participants will* learn about the STEM student support activities that have been implemented for all STEM students and the ongoing quantitative and qualitative assessment of these activities.
Jenny McFarland, Biology Faculty—Edmonds Community College

THEME IV: ASSESSMENT AND EVIDENCE FOR HIGH-QUALITY UNDERGRADUATE STEM LEARNING

POSTER 18: Teamwork Skills Evaluation in the Medical Sciences
During their course of study, medical science students are generally unaware that they are developing professional skills such as teamwork which are related to graduate capabilities. The issue resides at a degree program level where the institution finds it difficult to view the development of these capabilities over time and across disciplines. This poster will discuss a collaborative approach for implementation of ePortfolios and rubrics across courses and disciplines within a medical science degree program. *Participants will* learn about a cross-disciplinary skills awareness and development strategy that blends ePortfolios and reflective blogging with assessment rubrics. This mechanism is useful for capturing, quantifying, and recognizing skills development when coupled to authentic assessment tasks.
Patsie Polly, Associate Professor in Pathology—University of New South Wales, Sydney

POSTER 19: Assessing High-Quality Undergraduate STEM Learning
This poster will address how rubrics can be used to engage students in the learning process, guide students to understand how to effectively apply scientific information, and assess information that students have learned. The session will provide a display of rubrics used in various STEM courses and discuss the simple ways to create a rubric for various concepts without taxing the professor. *Participants will* see how the questions asked in rubrics can be used to formulate an assessment which will provide further evidence of high-quality undergraduate STEM learning.
***Tameka Clemons**, Assistant Professor of Biochemistry—Spelman College*

POSTER 20: Using Observational Tools to Assess Faculty and Student Behavior in STEM Courses
This poster will present the initial classroom observational findings produced by the The Generalized Observation and Reflection Protocol (GORP) and UTeach Observation Protocol (UTOP), two observational protocols modified for introductory science classes as part of a STEM research grant. GORP categorizes discrete time periods according to objective instructor and student behaviors such as asking/answering questions, writing on the board, and the use of manipulatives. The UTOP is a more subjective assessment tool that captures more holistic faculty/student interactions associated with the class learning environment and instructor preparedness including support and encouragement of active student learning. Both observational tools are currently undergoing pretesting as part of the course redesign phase of the research project. Preliminary observational data will be summarized and participants will have the opportunity to learn about the strengths and weaknesses of each protocol, the modifications made to each, and initial observational findings. *Participants will* learn about modifications that were made to each protocol to more effectively capture the extent to which teaching strategies advocated in the Next Generation Science Standards (activation of prior knowledge and application of concepts to real-life experience) are employed in specific science classes. They will be able to discuss the initial findings from these observations with project staff and the initial impact of these course observations on science course redesigns being carried out as part of this research project.
***Patrick Johnson**, Project Coordinator and **Sabrina Hussain Avila**, Project Coordinator—both of STEM Bridges Across Eastern Queens, Queens College, City University of New York*

POSTER 21: Assessing Student Developed Portfolios for Scientific and Information Literacy
Tidewater Community College (TCC) recently expanded its criminal justice program to align more closely with community needs and now includes a degree specialization and certificate in Forensic Science. As part of that overhaul, TCC's criminal justice faculty and program lead designed two new forensic science courses that focus more heavily on the development of high-impact student learning outcomes, such as information literacy, scientific reasoning, and written communication. As College-wide initiatives emphasize the incorporation and evaluation of general education competencies, it is necessary to demonstrate that the forensic science course sequence meets its core competencies and student learning outcomes. *Participants will* learn how an assessment strategy can evaluate student-developed portfolios on the dimensions of information literacy. Using an adapted AAC&U VALUE rubric, faculty will see how to assess these portfolios for evidence of proficiency as students complete these courses.
***Antonio Passaro, Jr.**, Associate Professor and Department/Program Lead of Criminal Justice, Division of Social Sciences and Public Services –Tidewater Community College*

POSTER 22: The Northwest PULSE Regional Network: Building Commitment to Vision and Change
This poster describes a network where institutional teams of three or more faculty members, including an administrator, attend a fall workshop that introduces systems-thinking approaches to organizational change. A systems-thinking approach emphasizes that departments, institutions, accrediting bodies, etc. are inter-connected, and helps participants develop strategies to identify leverage points to achieve change. Participants also learn leadership skills necessary to build the departmental consensus required to enact their goals and action plans. *Participants will* learn how to analyze departmental change strategies and evaluate their impact on faculty, departments, and institutions. This will occur through engagement with data related to the effectiveness of different approaches to departmental transformation. In addition, participants will explore preliminary findings regarding the potential long-term impact of the NW PULSE Community of Practice on regional life sciences departments so that they can locally adapt different long-term change strategies in STEM education.
*William Davis, Associate Professor—Washington State University; and **Jenny McFarland**, Professor—Edmonds Community College*

POSTER 23: Large-Scale Change across Science Departments: Embedded Expertise in Evidence-Based Teaching
The Carl Wieman Science Education Initiative has fostered change in teaching in a research-intensive university setting, transforming even high-enrollment science classes from more traditional lecture-based instruction to active learning. This poster will present the factors – some intentional and some which emerged in its early years – leading to this success as well as lessons learned over the 10 years of operation. It will summarize the evidence supporting the changes that have occurred in teaching practices and culture; from student-level, to course-level, to initiative-wide. *Participants will* learn of a successful model – and its associated challenges – for coordinated, department-focused faculty development in the context of a research university with large classes. They will be able to situate the observed successes within models for organizational change, and also leave with a summary of different approaches to establishing evidence of the extent and nature of change in a cross-department initiative.
***Sarah Gilbert**, Associate Director—University of British Columbia*

POSTER 24: Transforming Gateway STEM Courses to Feature Active Learning
St. Edward's University is in the midst of transforming its introductory biology, chemistry, and calculus I courses to feature active learning pedagogies. Student learning outcomes have been prepared and pedagogical resources assembled to facilitate the infusion of active learning into the gateway courses. Strategies to achieve institutional/cultural change include active learning workshops, a faculty learning community, an annual faculty survey designed to follow the change in pedagogy used by science and mathematics faculty, and debriefing/support sessions among course instructors. This poster will describe project planning process and the expansion of STEM living learning communities. *Participants will* learn how to organize a project of this nature, how to enlist support, and who must be involved to improve the chances for success. An overview of the baseline data collection process and ongoing assessment plan will be reviewed. Project outcomes will be discussed and relevant data presented to gauge progress towards meeting the goals.The synergy between living-learning communities, cohort scheduling, and active learning pedagogies will be discussed.
***Richard Kopec**, Associate Dean, Faculty Development and Director of Undergraduate Research—St. Edward's University; and **Michelle Burd**, Project Evaluator—Burd's Eye View*

Poster 24 A: How Early Research Experiences Contribute to Student Success: The Mediating Effect of Community-Building
This poster will describe how early undergraduate research experiences (UREs) can be intentionally structured to facilitate community building and the development of supportive relationships that ultimately serve as critical mechanisms for retention and flourishing among students in STEM majors. To illustrate the critical role of relationships, this presentation will report on the project design and describe the impact of an early, residential, and intensive URE in the context of a large state university in a diverse, educationally disadvantaged, and economically depressed region. *Participants will* gain a better understanding of the relational drivers of persistence among historically underrepresented groups in STEM education and their vital mediating role in achieving long-term outcomes. They will learn about key undergraduate research experience (URE) design and implementation features that are strongly linked with student perceptions of community and support. Participants will be exposed to a successful URE project model that is transferable and replicable across institutional contexts, which may be particularly useful in institutions characterized by high levels of underrepresented groups students and who are facing challenges in recruitment and retention of these populations.
Silvana McCormick, Executive Director—Redwood Consulting Collective

FRIDAY, NOVEMBER 3, 2017

MEZZANINE
7:30 A.M. – 6:00 P.M. CONFERENCE REGISTRATION AND MEMBERSHIP INFORMATION

ITALIAN/COLONIAL ROOM, MEZZANINE
7:30 A.M. – 9:00 A.M. POSTERS AND CONTINENTAL BREAKFAST

THEME I: UNDERGRADUATE STEM TEACHING AND LEARNING: CONTEXTS, CONTENT, AND RELEVANCY

POSTER 25: The Classroom as an Intervention: Disrupting Traditional Views of Competence
Pervasive narratives about who and what counts as brilliant in science disproportionately impact students historically underrepresented in STEM, and are perpetuated in the design of STEM courses. While equity- focused education literature argues for the need to develop robust learning ecologies that support and recognize all students' brilliance, this work largely focuses on K12 classrooms. The study presented investigates learning in a college chemistry course reorganized to disrupt hierarchies about smartness. Preliminary findings suggest that course redesign supported students to participate in scientific practice in ways that positioned them as competent and redefined how they understood science learning and themselves in relationship to it. *Participants will* learn how this study demonstrates the power of simultaneously engaging students in scientific practice, and providing students with explicit and expansive language for naming the practices that matter for scientific thinking and learning, in order to mitigate hierarchies of competence that show up as barriers to equity in STEM.
*Erin Palmer, Graduate Student, SESAME Program and **Sabriya Rosemond**, Postdoctoral Researcher, College of Chemistry—both of University of California, Berkeley*

POSTER 26: Let's Take this Outside: Blogging to Promote Course Discussion
Blogging has been shown to be an effective tool to allow for additional discussion of course content outside of the classroom setting. This poster will describe a blog piloted for a 120-student membership course for first year students in an undergraduate health sciences living learning community. Students take turns being leaders and commentators on the blog each week, with topics based on that week's

lecture topic(s). This has led to an increased level of student engagement. It is qualitatively believed that students are connecting with the material on a more personal level because of the fact that they have time to reflect and write their posts rather than being put on the spot in a discussion setting. They have the opportunity to discuss their posts in their discussion sections, facilitated by a graduate student instructor. Additionally, it has given the faculty and graduate student instructors an additional way to be in contact with the students, increasing their level of engagement. *Participants will* become familiar with engaging students outside of the classroom; and setting up, maintaining, and participating in a blog that is conducive to productive dialogue that would otherwise not happen in a course.
Adam Eickmeyer, Lecturer in American Culture and the Health Sciences Scholars Program—University of Michigan

POSTER 27: Providing Hands-On Lab Experience for Students in a Fully On-Line Science Course
This poster will describe the methodology used to develop and implement an on-line introductory chemistry course with a hands-on lab component for non-science majors. Specific features of the course management system (CMS) such as GradeMark from the "Turnitin" plug in and the active link feature at the submission text box were used to facilitate adoption of the on-line course in a large enrollment course format. In addition to issues related to safety, one of the biggest challenges of offering a hands-on lab component for a fully on-line course is validation of an individual's performance of laboratory exercises. This challenge is overcome by requiring students to submit recorded videos for specific steps in the experiments. A detailed summary of this process will be discussed, along with results from course surveys conducted at the end of the course. *Participants will* learn about tools used for addressing the safety issues regarding conducting experiments independently off-campus, an effective way to administrate hands-on lab experiment in an on-line learning environment, and how to use technological tools and tactics for verifying that students have performed the experiments. They will see how to establish an efficient strategy for grading lab reports in an on-line environment and how to cultivate an active learning community among students.
Karno Ng, Associate Professor—California State University San Marcos

POSTER 28: Forging a Campus Community for STEM: Galvanizing Students and Faculty Around a New STEM Center
Students at colleges and universities most readily identify with their specific major, program, or department. While students may know that their major falls under the umbrella of the STEM disciplines, they may not identify with STEM, or see that there is a reason to view themselves as part of this larger field. Faculty often stress the importance of the interdisciplinary nature of science, and model this in their research and connections with other departments, however the sense of belonging to a larger community is largely unrealized in undergraduate students. With the recent establishment of the Aisiku STEM Center at Worcester State University, faculty has looked for ways to define and establish a STEM identity for their students. This poster will go beyond developing interdisciplinary projects and/or initiatives to present how to develop student STEM identity and community galvanized around a new STEM Center. *Participants will* discuss the benefits, drawbacks, and methods of encouraging students to establish a STEM Identity that transcends departmental boundaries and what a STEM identity would look like at their own institutions. They will have the opportunity to identify possible barriers, and most importantly, how to overcome such obstacles. In addition, poster presenters hope to discuss how best to assess the impact of efforts to develop student STEM identity and how it can be a mechanism for institutional change.
Daron Barnard, Professor of Biology and Director, Aisiku STEM Center and Mary Fowler, Professor of Mathematics—Worcester State University

POSTER 29: Envisioning and Changing Undergraduate STEM Education: Inquiry, Research, and the Process of Science

The Departments of Biology and Chemistry have successfully obtained three National Science Foundation (NSF) grants which target the crucial first two years of STEM courses to improve STEM major experience and retention. Projects initially focused on introductory biology and chemistry sequences, but the addition of a vertical thread has increased the use of inquiry, active-learning, and new pedagogies in many upper division courses in both disciplines. Using research, inquiry, and studio-style laboratories, and pedagogy that enhances quantitative reasoning and critical thinking skills, courses have been transformed into student-centered, project-based, and hands-on experiences implementing the scientific process. These courses allow students to explore, build confidence and dispel misconceptions about topic or processes. *Participants will* examine the impact of large scale, vertically designed pedagogical change on students and faculty; examine methods to dispel student misconceptions about content, lack of scientific confidence and the process of science; and explore new ideas and evidence of effectiveness for curricular change in introductory and majors STEM courses.
Delana Gajdosik-Nivens, Dean of the College of Science and Technology, and Lea Padgett, Senior Lecturer of Chemistry—both of Armstrong State University

POSTER 30: An Intervention to Reduce Confirmation Bias in First Year STEM Students

This poster will describe a joint research project between a biologist and a philosopher, who created a classroom intervention (lecture/discussion and homework assignments) designed to increase students' critical thinking skills and reduce confirmation bias. Presentations from students with no intervention were compared to students who participated in the intervention. Results indicated that students with the intervention were more discriminating among sources of information ($p = 0.023$) and were more likely to include sources that refuted their own conclusions ($p = 0.003$). This poster will provide examples of the intervention assignments, as well as descriptions of the in-class exercises, examples, and discussion questions. Presenters will reflect on the structures in place that encourage collaborations across disciplines, including the intermingling of critical thinking and science outcomes that support the general education. *Participants will* learn about confirmation bias, become familiar with an intervention used to reduce confirmation bias in a first year general education science course designed for underrepresented students, and will have the opportunity to consider how to modify the intervention to use in their own classrooms. They will become familiar with an example of resource sharing across disciplinary boundaries.
Elizabeth Hane, Associate Head of School of Life Sciences—Rochester Institute of Technology

POSTER 31: The Yeast Orphan Gene Project: Finding a Place for ORFans to GO

The budding yeast Saccharomyces cerevisiae was the first eukaryote to have its entire genome sequenced. More than 20 years later, nearly 10% of this yeast's open reading frames (ORFs) are still considered uncharacterized. This poster will describe a consortium of undergraduate researchers and faculty at primarily undergraduate institutions (PUIs) who are working collaboratively to assign molecular functions to these orphan genes (ORFans). Through this work, undergraduate students learn important skills in bioinformatics, genomics, molecular biology, and genetics. The Orphan Gene Project also creates valuable opportunities for scientific collaboration and leadership development. Consistent with research on other course-based research experiences, analysis of yeast ORFans has increased students' self-reported learning and confidence. *Participants will* learn how undergraduate research on yeast orphan genes helps achieve core competencies in "Vision and Change", including the ability to apply the process of science, use modeling and simulation, and communicate and collaborate. Participants will learn about opportunities for involvement in this growing network of yeast researchers/educators.

Pamela Hanson, Professor of Biology—Birmingham-Southern College

POSTER 32: Mentoring and Community Involvement within an Integrated Sciences First Year Program
During the first years of the Integrated Sciences First Year Program, three overlapping, but distinct communities were created: the program research community, the campus community, and the broader scientific community. Within the program community, there was peer-peer, faculty-student, and faculty-faculty mentoring. As the study system was a new living building constructed on campus, students and faculty interacted with the campus community and facilities staff, giving tours to visitors, and campus-wide talks about the system and their research projects. Through these activities they met prospective students, staff, other faculty, administrators, and trustees of the college. Students were introduced to the scientific community by interacting with the builders and civil engineers who constructed the building and the academics in the field. *Participants will* learn about the types of communities to consider when designing a first year research program; how to structure a program that creates a strong program research community; and how to connect that community to the larger campus and industry scientific communities. Methods used to assess the impact of these communities will be described.
***Christina Cianfrani**, Associate Professor of Hydrology—Hampshire College*

POSTER 33: Mathematical Modeling and Computer Simulation: Deepening Understanding of Science and Improving STEM Student Retention
This poster will demonstrate how to employ mathematical modeling and computer simulation in undergraduate STEM courses to deepen students' understanding of their field and increase their appreciation of the interconnectedness of STEM disciplines. The presenters will provide strategies for using mathematical modeling and computer simulation in a first calculus course, demonstrate the benefits of doing so, and describe ways to extend the approach to other courses in STEM and beyond. *Participants will* learn strategies for incorporating mathematical modeling and computer simulation of biological processes into a first Calculus course; the benefits of doing so; and ways to employ mathematical modeling and computer simulation across STEM courses as well as in other disciplines where mathematical models can provide deeper insights for students.
***Ray Klump**, Professor and Chair of Computer and Mathematical Sciences—Lewis University*

POSTER 34: Stockton University's Quantitative Reasoning Across the Disciplines (QUAD) Program
This poster will describe one university's interdisciplinary approach to STEM through a Quantitative Reasoning Across the Disciplines (QUAD) program. It will review a unique graduation requirement in which students must complete three quantitative-reasoning-designated courses, including at least one quantitative-reasoning-intensive course and one quantitative-reasoning-across-the-disciplines course. These courses emphasize mathematical problem solving with special attention given to the development of problem-solving approaches. In addition, communication of mathematical ideas in both written and oral forms are emphasized. The results of a 2011 pilot and 2016 longitudinal study relevant to both students' attitudes towards mathematics and students' quantitative competencies will be reported. *Participants will* review a short summary of Stockton's Q requirement, an attitudinal survey, a set of problem-solving tasks, and a summary of the results of a 2011 pilot and 2016 longitudinal study. They will learn more about efforts that are being made to engage students in meaningful interdisciplinary, quantitative reasoning learning. This program/study provides a model for university-wide implementation and assessment of quantitative learning that can inform other STEM efforts.
***Betsy McShea**, Associate Professor of Mathematics and First Year Studies—Stockton University*

POSTER 35: Supporting STEM Education Tenure-Track Faculty Through Interdisciplinary Collaborations
This poster will examine how both the pre-tenured and tenured faculty members have grown professionally, both as scholars and teachers, in their interactions with school teachers and each other. In addition to working with K-12 teachers, an interdisciplinary group of university faculty members supported each other in the roles of scholar and teacher. Working with and for school teachers created opportunities for university level faculty members to engage in professional growth. Throughout this multi-year collaboration, members of departments both inside and outside STEM fields encouraged each other in professional development. Additionally, newer, pre-tenured faculty members were included in this group. *Participants will* investigate how interdisciplinary collaborations support pre-tenured faculty members in STEM-related fields and identify professional activities that harness the interests and expertise of tenured faculty members to support pre-tenured faculty members in pursuing tenure and promotion. Participants will dialogue on best practices for keeping faculty members in high demand STEM and STEM-related fields at their current institution and examine prior and new opportunities for collaboration in research and teaching across various academic departments involving faculty members in interdisciplinary fields.
Ryan Fox, Assistant Professor of Mathematics Education—Belmont University

POSTER 36: A Network for Research on Biology Graduate Teaching Assistant Teaching Professional Development
The Biology Teaching Assistant Project (BioTAP) is an NSF-funded Research Coordination Network with the goal to build capacity for collaborative research on biology graduate teaching assistants teaching professional development (GTA TPD). By helping practitioners assess their own TPD programs, and work with others to compare assessments across institutions, the network will build the empirical data necessary to make data-driven decisions about programmatic practices. This poster will discuss the goals and accomplishments of BioTAP to date, including data from a national survey on GTA TPD providers, and information about the Research Development Sessions and Virtual Learning Communities, which are components of the BioTAP Scholars Program. *Participants will* learn about the state of biology graduate teaching assistant teaching professional development programs, as reviewed by a national survey, approaches to promote research on GTA TPD, and of new information to support their projects, and form new collaborations.
Gili Marbach-Ad, Director, Teaching and Learning Center—University of Maryland

<u>THEME III: INCLUSIVE EXCELLENCE/BROADENING PARTICIPATION IN STEM HIGHER EDUCATION</u>

POSTER 37: Creating an Inclusive Pedagogical Environment for STEM
This poster will describe the impetus and development of a multifaceted approach to create an inclusive learning environment. With a focus on racial/ethnic minorities and women, the poster will describe the assembly of an interdisciplinary team of faculty and administrators committed to retention and success of students at-risk for attrition from STEM-related majors. Grounded in theoretical foundations of high-impact practices, the development, implementation, and assessment of specific strategies will be detailed, including successes, challenges, and structural considerations. The presentation will conclude with recommendations for STEM programs serving diverse student bodies, and implications for sustainability and scalability. *Participants will* be able to characterize unique barriers faced by racial/ethnic minorities and women in STEM-related disciplines; and summarize theoretical foundations of inclusive pedagogical contexts. They will learn about high-impact practices which create an inclusive learning environment, discuss strategies for formative assessment of inclusive pedagogical strategies,

and summarize considerations for sustainability and scalability of effective interventions.
Arnab Mukherjea, Assistant Professor of Health Sciences and Julie Glass, Professor and Chair of Mathematics—both of California State University, East Bay

POSTER 38: Empowering Students for Success in Public Health: A Pilot Program

First-generation and low-income (FGLI) college students experience an achievement gap that may be due to the emphasis on independence in the university setting. This poster will outline common reasons for attrition among first-generation and low-income college students in STEM disciplines; present the multi-layered and comprehensive structure of a department-specific pilot program aimed at increasing engagement of first-generation and low-income college students; and show quantitative and qualitative results from an evaluation of individual events and the program as a whole. *Participants will* identify common reasons for attrition, particularly in STEM disciplines, among first-generation and low-income college students. They will discuss department-specific initiatives to facilitate inclusive excellence and to broaden participation among first-generation and low-income college students in their academic programs and at the university level; and learn how to design an evaluation plan to ascertain whether students benefit from the proposed programming and resources.
Matthew De Leon, Intern, Empowering Students for Success in Public Health and Nicole DeVille, Graduate Student Researcher, Empowering Students for Success in Public Health—both of University of California, Irvine

POSTER 39: A Career Development Intervention to Improve Persistence of STEM Life Science Majors at Large Universities

This poster will address the impact of the course, "Career Exploration in the Life Sciences" created to increase persistence of undergraduate Life Science students at risk for switching out of a STEM major. The unique approach was to provide career mentoring, guiding students through interpretation of career assessments, which they applied to exploration of their career goals. In the process, a learning community was created. Students produced resumes, cover letters, conducted informational interviews and created a Linkedin profile. Alumni in a variety of industries were invited as guest speakers to expose students to career options both within and outside of health sciences. Students reported that they most valued the invited speakers, informational interview assignment, and personality assessment tools. Longitudinal data will determine if this integrated course format results in greater retention, particularly of URM's in the STEM majors. *Participants will* understand the topics covered in the course, the process of increasing enrollment, alumni engagement, administration of self-assessments and creating an inclusive learning community. In addition, the preliminary survey results and impact of the course on student's short term goals and attitudes will be shared. Participants will discuss interventions currently in place at their campuses that address persistence issues or target career development for undergraduate STEM majors, as well as gaps in programming or curriculum.
Rachel Kennison, Associate Director of Professional Development and Student Engagement, Center for Education, Innovation and Learning in Sciences and Casey Shapiro, Senior Research Analyst, Center for Educational Assessment—both of the University of California, Los Angeles

POSTER 40: The Strategic Undergraduate STEM Talent Acceleration Initiative (SUSTAIN)

The SUSTAIN project is designed to retain high-achieving, low-income students in STEM who are particularly vulnerable to attrition during their first two years of college. Faculty provide scholarships for selected students through their first and second years of study and engage them in a robust, multi-faceted series of curricular and co-curricular learning experiences and professional services. These services are designed to foster students' sense of preparedness for collegiate STEM work; enhance their access and motivation to pursue STEM pathways; and provide the academic and social supports

necessary to ensure their persistence in the STEM pipeline throughout the challenging first and second years of undergraduate study. This initial project specifically targets chemistry and biology majors with the goal of scaling up in a subsequent project to include earth sciences, physics, and engineering majors. *Participants will* learn about a model support program that offers an array of targeted interventions designed to promote retention of high-achieving, low-income undergraduates in biology and chemistry, including: long-term STEM faculty mentoring and an early immersion pre-research experience; a STEM residential learning community housing assignment; participation in Peer-Led Team Learning; and job shadowing/internships in STEM corporations. The SUSTAIN project also provides STEM faculty at Syracuse University and neighboring colleges with a professional development workshop series specifically designed to enhance faculty awareness and skills related to designing evidence-based teaching and learning practices in undergraduate STEM classrooms.
John Tillotson, Associate Professor and Chair—Syracuse University

POSTER 41: Using Empirically Validated Strategies to Create Inclusive Learning Environments for STEM
Helping to build a strong sense of belonging can influence persistence and retention in STEM disciplines. In an effort to build a more inclusive science learning community on campus, educators incorporated empirically validated strategies to build collaborative learning environments, reduce stereotype threat, and teach metacognitive skills. Application on campus increased sense of belonging and persistence in STEM course sequences for underrepresented students. his poster will share some of the theories and strategies adopted. *Participants will* learn about empirically validated psychological interventions and related theories; navigate resources which demonstrate their effectiveness in college learning environments and consider how to develop ways to apply them to diverse campus challenges.
Alyssa Perz, Academic Dean, Trinity College of Arts and Sciences and Lecturer, Biology Department and Claire Siburt, Assistant Director and STEM Learning Specialist, Academic Resource Center and Adjunct Instructor, Chemistry Department—both of Duke University

<u>THEME IV: ASSESSMENT AND EVIDENCE FOR HIGH-QUALITY UNDERGRADUATE STEM LEARNING</u>

POSTER 42: Using Iterative Storyboarding to Develop Student Inquiry, Analysis, and Oral Communication Skills
This poster will describe a senior-level, blended learning course, where undergraduate students worked in teams to design and conduct small-scale experiments using motion capture technology and to disseminate their findings in video-based presentations for a peer scientist audience. To support development of their inquiry and analysis skills, the students created visual outlines of their projects in the form of a storyboard, and updated it weekly. Each storyboard consisted of a series of ideas, with each idea composed as a slide with a textual message and visual evidence, and accompanying script. Frequent formative feedback from the instructor on their storyboards helped guide students through the inquiry and analysis process, and also helped them learn how to communicate their ideas more effectively through visualizations and scripting. Student skills assessed with AAC&U VALUE Rubrics improved as the semester progressed, suggesting that iterative storyboarding facilitated simultaneous development of both inquiry/analysis and oral communication skills. *Participants will* understand how iterative storyboarding as a visual outlining tool can be used to support and assess development of students' inquiry and analysis skills; used in conjunction with video-based presentations to develop oral communication and quantitative reasoning skills; and used to efficiently develop student storyboarding skills and enable frequent formative assessments.
Melissa Gross, Associate Professor of Movement Science—University of Michigan

POSTER 43: A Spatial Database Approach to Curriculum Mapping an Environmental Science Program
This poster will describe a curriculum map that documents the scaffolding of activities in classes leading to high-impact experiences in undergraduate research, study away, and internships. The mapping program allows the creation of a large database that can contain a limitless array of information about classes. This can include basic information for students such as prerequisites, how semester classes are taught, and information on levels of activities leading to high-impact practices and assessment. The map can be symbolized in a variety of ways depending on the information sought to reveal trends that can be used in assessment. *Participants will* examine the spatial database approach to curriculum mapping and consider its advantages designing a scaffolded program toward high-impact practices; judge the utility of a curriculum map produced for students attempting to navigate a complex course of study; and contemplate the extension of a spatial database approach into the realm of assessment of programmatic learning outcomes.
*John Haley, Professor of Earth Science and **Elizabeth Malcolm**, Professor of Ocean and Atmospheric Sciences—both of Virginia Wesleyan College*

POSTER 44: Engineering Engagement: Leveraging Formative Assessment Practices to Motivate and Enlighten
This poster will highlight the collaborative efforts of the College of Education and the College of Engineering to move from traditional lecture-based methods to more student-centered, active-learning approaches. It will describe formative assessment strategies and strategies for building community in large classes and share valuable resources. *Participants will* learn about formative assessment strategies and strategies for building community which include: note-takers; identifying misconceptions; concept cartoons; effective brainstorming techniques; pros and cons charts; categorizing grids; exit tickets; concentric circles; buzz groups; micro-essays; pause-reflect procedure; and commit, fold, and pass.
*Jennifer Meadows, Assistant Professor and **Leslie Suters**, Associate Professor—both of Tennessee Technological University*

POSTER 45: Characterizing Scientific Practices, Crosscutting Concepts, and Core Ideas in Science Assessments and Instruction
This poster will focus on a transformation effort that uses the three dimensions laid out in the NRC Framework for K-12 Science Education as the basis for assessment of student learning and instructional change in undergraduate science courses. When integrated together, the three dimensions—scientific practices, crosscutting concepts, and core ideas—compromise a vision for science education that focuses on deep understanding and use of knowledge. As the best available synthesis of current knowledge about teaching and learning in science, the Framework provides an approach that is easily applied to college courses. Development of a corollary protocol for characterizing the three dimensions in instruction is underway. *Participants will* be introduced to the three dimensions as well as the Three-Dimensional Learning Assessment Protocol for characterizing assessments. They will learn how to use the 3D-LAP to develop or refine their own assessment items; receive all relevant materials to take home; and discuss how assessment can be used as a leverage point for changing instruction, developing shared vision, and continuous improvement.
Becky Matz, Assistant Professor—Michigan State University

THEME V: UNDERSTANDING EFFECTIVE STRATEGIES FOR TRANSFORMING INSTITUTIONAL CULTURES FOR UNDERGRADUATE STEM REFORM

POSTER 46: Planning for Institutional Change
Within every institution, pockets of innovative, effective teaching strategies could be used more

intensively, used in other parts of the institution, or even used more widely. However, evidence of efficacy alone does not catalyze scaling of effective teaching practices. This poster will describe a set of tools to help change agents apply system-level thinking to scaling effective teaching practices or other pedagogical innovations. *Participants will* be able to: 1) describe the four levels of their instructional system; 2) identify the features of an instructional innovation that are relevant to its fit within the instructional system; and 3) learn common mistakes that change agents make in thinking about scaling educational innovations as well as strategies to avoid these errors.
Renee Cole, Associate Professor of Chemistry—University of Iowa

POSTER 47: Creating Teams for Department-Level Change: Learning from Research on Team Composition and Structure

Strategies for improving undergraduate STEM instruction are shifting from a focus on individual instructors to a focus on departments. These initiatives frequently use teams to pursue the desired changes. However, little has been done to identify how these teams can be designed for the greatest chance of success. This poster will present current research that explores how theories and empirical results from other contexts can provide valuable insights for higher education. It will describe three types of diversity–diversity in information, values, and status and how each tends to influence team processes and performance by examining literature from both within and outside of higher education. Other factors such as team size, how much time the team spends together, and the team's goals may influence team effectiveness are examined. The presenters suggest that increased attention to the potential challenges that teams face could benefit researchers and change leaders. *Participants will* learn three definitions of "diversity"; identify other key characteristics of teams that contribute to their effectiveness; and see how to create effective teams or improve the performance of existing teams.
*Alice Olmstead, Postdoctoral Research Associate and **Andrea Beach**, Co-Director—both of the Center for Research on Instructional Change in Postsecondary Education, Western Michigan University*

POSTER 48: Building a Culture of Inclusive Excellence in STEM at a Large University with a Diverse Mission.

This poster will review an institutional transformation program centered on expanding inclusive excellence in STEM, coordinated by the College of Science and Mathematics (CSM). It will identify the challenges such broad transformation programs usually encounter and successful strategies for addressing those challenges; highlight the four constituencies in successful transformations (administrators, faculty, staff, and students); and illustrate ways to bring all of them into a shared vision for increased inclusiveness. Presenters will also describe important features around the intersection between research (vital to STEM degrees) and instruction. *Participants will* evaluate the necessary components of a successful institutional transformation that can increase inclusiveness, address the barriers to transformation inherent within institutions broadly, and large institutions specifically and consider strategies for recruiting each of the necessary constituents for successful transformation.
*Scott Reese, Assistant Dean for Curriculum and Associate Professor of Biology, **Marla Bell**, Associate Dean for Student Success and Professor of Mathematics, and **Kadian Callahan**, Assistant Dean for Faculty and Student Success and Associate Professor of Mathematics Education—all of Kennesaw State University*

GEORGIAN ROOM, MEZZANINE

8:15 A.M. – 9:00 A.M.   NEWCOMERS' WELCOME

As the leading national association concerned with the quality, vitality, and public standing of undergraduate liberal education, AAC&U works closely with its member institutions to extend the advantages of a liberal education to all students, regardless of academic specialization, intended career,

or the type of institution they attend. *Participants will* learn how AAC&U's broad agenda for student learning—which focuses on quality, equity, inclusive excellence, student success, integrative and global learning—and its signature LEAP initiative together provide context, framework, and practical guidance for the undergraduate educational experience.

Lynn Pasquerella, *President and* **Tia Brown McNair**, *Vice President, Office of Diversity, Equity, and Student Success—both of AAC&U*

GRAND BALLROOM, MEZZANINE
9:15 A.M. – 10:15 A.M.   PLENARY

Transforming a University into a Learning Laboratory
Timothy McKay, *Arthur F. Thurnau Professor of Physics, Astronomy, and Education, Director of the Digital Innovation Greenhouse—University of Michigan*

What does it take to transform a university into a learning laboratory? With creativity and care, faculty can dissolve the traditional boundaries between educational research and practice, and study the efficacy of instruction within the continuously changing context of classrooms. This approach is especially effective when educating at scale – in large, foundational courses. Dr. McKay will explore the challenges faced in creating such a learning laboratory, featuring examples drawn from experiences at the University of Michigan. McKay will talk about education in an information age, data sources and management, privacy and ethical issues, research designs and funding, creating tools that personalize education at scale, and establishing systems that foster a culture of continuous reflection and response.

10:30 A.M. – 11:30 A.M.   CONCURRENT SESSIONS

THEME I: UNDERGRADUATE STEM TEACHING AND LEARNING: CONTEXTS, CONTENT, AND RELEVANCY

ELIZABETHAN ROOM C, SECOND FLOOR
CS 1: Transforming a University into a Learning Laboratory
This session will provide an opportunity for participants to further explore the issues, designs, and tools presented in the morning plenary. Participants will discuss the topics in detail and consider ways of adapting these practices to their own work and institution.
Timothy McKay, *Arthur F. Thurnau Professor of Physics, Astronomy, and Education, Director of the Digital Innovation Greenhouse—University of Michigan*

ELIZABETHAN ROOM A , SECOND FLOOR
CS 2: Increasing Faculty Awareness of Educational Context: Undergraduate Student Values and Experiences
The Survey of Teaching Beliefs and Practices for Undergraduates (STEP-U) assesses the extent to which students value specific skills needed for the workplace (e.g., scientific writing, collaboration), as well as their experiences with teaching practices thought to reinforce such skills (e.g., writing assignments, working in groups). Analyses showed significant disciplinary differences in educational values, as well as discrepancies between student and faculty values. These were discussed in a series of departmental faculty meetings and led to ongoing collaborations to assess and improve instruction. *Participants will* learn how to use the STEP-U to: 1) collect holistic feedback on students' values and experiences during their undergraduate studies; 2) better understand disciplinary differences in educational priorities; 3) stimulate department-level discussions about teaching priorities and practices; and 4) raise awareness

among faculty of opportunities for professional development.

***Gili Marbach-Ad**, Director, Teaching and Learning Center and **Michelle Bertke**, Postdoctoral Student—both of the University of Maryland*

CS 3: STEM Curricula for Authentic Learning Experiences (SCALE)

Undergraduate research is beneficial for undergraduate students in all disciplines, yet providing these opportunities to all students poses significant challenges. Approaches effective in addressing these challenges and expanding student participation in undergraduate research include interdisciplinary research methods course, course-based undergraduate research experiences (CUREs), and freshman and senior theoretical research projects. *Participants will* 1) learn how to develop course-based undergraduate research experiences; 2) examine tools used to assess undergraduate research experiences; and 3) consider how to develop unique undergraduate curricula that incorporate research.

***Jennifer Stanford**, Assistant Professor of Biology and Co-Director, Center for the Advancement of STEM Teaching and Learning Excellence, **Kevin Smith**, Assistant Teaching Professor of Biology, **Adam Fontecchio**, Vice Dean of the Graduate College and Director, Center for the Advancement of STEM Teaching and Learning Excellence, and **Jason Silverman**, Associate Professor Mathematics Education and Co-Director, Center for the Advancement of STEM Teaching and Learning Excellence—all of Drexel University*

CS 4: Re-Envisioning the Pathway to Calculus: Choosing Content and Pedagogy

Recent research has demonstrated that the traditional curriculum designed to prepare students for calculus is not working well. Because many of the students placing into and referred to these college algebra/precalculus courses are also underrepresented students, broadening participation in STEM requires a clear pathway—one free of the barriers (both pedagogy and content) it often presents to students. Session facilitators will use engaging activities to illuminate design considerations which math departments can use to re-envision their pathway to calculus. *Participants will* learn how research documents the failures of traditional college algebra/precalculus curriculum to prepare students for calculus. They will also discuss how to balance conceptual understanding with procedural fluency through backward mapping and experience the application of research shown to improve student learning by working through curriculum examples that have been designed to employ research based pedagogy and content.

***Rebecca Hartzler**, Manager for Advocay and Professional Learning, Charles A. Dana Center—University of Texas at Austin; and **Stuart Boersma**, Professor of Mathematics and Department Chair—Central Washington University*

THEME II: SUPPORTING, REWARDING, AND BUILDING CAPACITY OF STEM FACULTY

CS 5: Building Faculty Learning and Redesign Communities to Expand Inclusive Pedagogies

Session facilitators will describe the components of successful faculty learning communities (FLCs) for Science and Mathematics faculty. *Participants will* work together to consider important features of FLCs that encourage generative instructional change grounded in learning-centered teaching, and will leave with a plan for FLC development at their own institutions. They will also learn how FLCs have increased conversation among faculty colleagues about instructional innovations for first year science and mathematics courses as well as expansion in the use of evidence-based pedagogies that promote inclusive excellence. Participants will learn about mechanisms to recognize faculty's efforts to make instructional change and discuss the associated challenges and successes. ***Kadian Callahan**, Assistant*

*Dean for Faculty and Student Success and Associate Professor of Mathematics Education, **Marla Bell**, Associate. Dean for Student Success and Professor of Mathematics, and **Scott Reese**, Assistant Dean for Curriculum and Associate Professor of Biology—all of Kennesaw State University*

THEME III: INCLUSIVE EXCELLENCE/BROADENING PARTICIPATION IN STEM HIGHER EDUCATION

VICTORIAN ROOM, SECOND FLOOR
CS 6: Supporting STEM Student Success Through Peer Networks: Mentoring Throughout the Undergraduate Career

This program summarizes existing literature and theories related to peer mentoring as an effective retention method and showcases a grant-funded program as a model for engaging students identified as "at-risk" in behaviors aligned with increased levels of persistence and retention. With the College of Biological Sciences at the University of Minnesota's HHMI-supported program serving as a framework for discussion, participants will explore best practices in mentoring program design that can be implemented in their own institutional and programmatic contexts. Specifically, this session will highlight recruitment strategies, program delivery methods, and assessment techniques for high-impact peer mentoring programs that advance the participation of underrepresented STEM students. *Participants will* understand the conceptual framework for peer mentoring in relation to student retention and persistence and leave with tangible resources for designing peer mentoring programs that are applicable to STEM students at all levels of their undergraduate career.
***Meaghan Stein**, Education Success and Retention Coordinator and **Abby Conover**, Coordinator of Undergraduate Initiatives—both of University of Minnesota*

THEME IV: ASSESSMENT AND EVIDENCE FOR HIGH-QUALITY UNDERGRADUATE STEM LEARNING

GEORGIAN, MEZZANINE
CS 7: Strategies for Providing Feedback to STEM Students on Intellectual and Practical Skills

Session facilitators will address the assessment of intellectual and practical skills (such as teamwork, information processing, critical thinking, management, and communication) in STEM active learning environments. Specifically, participants will discuss the importance of aligning learning objectives, tasks, and assessments to influence student attention and effort towards developing these skills. Facilitators will primarily address strategies for providing formal and informal feedback to students regarding these skills. Additionally, they will present strategies for helping students see the connection between developing practical skills and mastering content knowledge to promote their success both in active learning classrooms and in STEM careers. *Participants will* be able to: 1) articulate the importance of explicitly assessing and providing feedback regarding intellectual and practical skills; 2) generate strategies for providing feedback to students regarding intellectual and practical skills; and 3) reflect on how the artifacts and data generated can inform their teaching decisions and classroom facilitation. They will learn about the resources (rubrics and accompanying implementation strategies) being developed by the Enhancing Learning by Improving Process Skills in STEM (ELIPSS) project to support instructors in providing formative feedback regarding the students' development of these skills.
***Juliette Lantz**, Professor—Drew University; and **Renee Cole**, Associate Professor and **Gilbert Reynders**, Graduate Student—both of the University of Iowa*

*NSF FEATURED SESSION|CALIFORNIA WEST, SECOND FLOOR
CS 8: National Science Foundation: Future NSF Investments
The National Science Foundation's Ten Big Ideas intend to catalyze interest and investment in fundamental research, invention, and innovation. The cutting-edge research agendas and processes will require collaborations with a broader range of industries including private foundations, scientific societies and colleges and universities. Coupled with these ideas are funding initiatives, such as the new NSF INCLUDES program and modifications to longstanding broadening participation efforts, which are intended to transform STEM higher education and career pathways at the national scale, thus, making them more fully and widely inclusive. Collectively, these efforts will not only redefine the frontiers of U.S. research and development related to reforming undergraduate STEM reform, but also provide space for redefining which scientific audiences are most suitable to address 21st century STEM reform challenges and opportunities. *Participants will* discuss the future of NSF and its major funding priorities.
Sylvia James, Deputy Assistant Director (Acting), Education and Human Resources Directorate—National Science Foundation.

ELIZABETHAN B, SECOND FLOOR
CS 9: Creating a Culture of Equity-Minded Evidence-Based Teaching through Faculty Professional Development
Facilitators and participants will explore strategies institutions may use to bring about systemic, sustainable change that leads to improved STEM student success. Drawing on Wenger's community of practice model for learning, and Elrod and Kezar's work on systemic change, facilitators will share a process for developing and implementing a holistic professional development model, dedicated to supporting the implementation of equity-minded evidence-based teaching and discuss the impact this model has had on student success. Participants will consider strategies for creating and sustaining a culture of inclusive, evidence-based teaching on their campuses; identify the obstacles and opportunities for systemic change; and articulate actions they might take as a result of information.
*Kirsten Fleming, Dean, College of Natural Sciences and **Kimberly Costino**, Faculty Director, Quarter to Semester Conversion—both of California State University, San Bernardino*

TOWER SALOON A, TOWER SALONS
CS 10: Creating Campus Climates for Student Success
This session will include two distinct campus presentations with time for questions.
Moderator: *J. Houston Miller, Professor of Chemistry, Laser Analytics Laboratory—George Washington University*

Incorporating Equity Frameworks in STEM Student Success
How can educators write classroom/campus language to reflect institutional values of inclusion, equity, diversity, and self-empowerment? Session facilitators will discuss how to shift program language from a place of deficit to a place of empowerment. The California State University is embarking on a system-wide effort aligning this work with a graduation initiative that includes a goal to eliminate the achievement gap across its 23 campuses. *Participants will* learn how a system-wide program incorporated asset-based language, revamped training models, and engaged 11 of its 23 campuses in conversations to advance equity in STEM student success efforts. *Participants will* learn of the benefits and challenges of the language used across higher education institutions to describe students

historically and currently underrepresented in STEM degree programs; expand knowledge of frameworks and models of theory; and deepen their capacity to advance STEM student success using an equity lens. Participants will leave with sample questions and a list of readings.
Kristina Barger, VISTA Program Manager, California State University STEM VISTA Program, Center for Community Engagement and Judy Botelho, Director, Center for Community Engagement—both of California State University, Chancellor's Office

Exploring Institutional Patterns in Teaching Practice and Organizational Climate
Most faculty have knowledge of evidence-based instructional practices and access to the resources to carry them out. Despite this, many efforts to transform postsecondary instruction have had only modest success. The underlying reasons for modest employment of evidence-based practices may be related to institutional environments and structures. The purpose of this project is to examine how one measure of institutional environment—climate—intersects with faculty teaching practices. Session facilitators will discuss data collected from 653 instructors from six institutions using valid and reliable surveys of teaching practice and organizational climate for instructional improvement. They will discuss the features of each cluster profile found as well as inferential statistics to compare the profiles for significant differences across demographic groups of interest. *Participants will* engage in discussion about the nature of the study, including learning about two valid and reliable (but reasonably new) surveys used to gather data and the unique method by which the data was analyzed. They will also unpack the implications of these findings for understanding the nature of institutional change and consider goals for future, and ideally collaborative, work in this area.
Emily Walter, Assistant Professor of Biology and Ivan Ceballos Madrigal, Undergraduate Researcher— both of California State University–Fresno

11:45 A.M. – 1:15 P.M.   LUNCH ON YOUR OWN

1:30 P.M. – 2:45 P.M.   CONCURRENT SESSIONS

THEME I: UNDERGRADUATE STEM TEACHING AND LEARNING: CONTEXTS, CONTENT, AND RELEVANCY

ELIZABETHAN ROOM A, SECOND FLOOR
CS 11: Using System and Emergent Change Theory to Reform a Multi-Department STEM Project
Developing the knowledge, skills, and confidence of young scientists, engineers, and mathematicians is a critical and important challenge. It is also a very complex problem, with many factors impacting students' success. A promising strategy is a systems approach of simultaneously improving the full set of courses that students take. Providing multiple opportunities for students to work on authentic projects can lead to increases in students' skill, self-efficacy, and identity as scientists. *Participants will* gain a better understanding of change theory, and how it can inform strategies at home institutions. They will produce a system map that describes where they can impact students' knowledge, skills and confidence in STEM that is relevant to their particular institution. Participants will also learn how to characterize those tasks by where they fit in a two-dimensional matrix with dual axes (prescribed vs emergent) and (changing environment or structures vs changing individuals).
Jo Anne Powell-Coffman, Professor and Department Chair, Genetics, Development and Cell Biology— Iowa State University

CS 12: Implementing Innovative STEM Pedagogies at Community Colleges: Challenges and Strategies for Success

Session facilitators will present and examine evidence supporting the use of innovative instructional practices in the STEM classroom. They will discuss challenges of implementing a faculty development program in innovative pedagogy at a community college and how active learning and other teaching strategies designed to increase student engagement impact community college students differently than those at four-year colleges. Participants will understand the evidence supporting the use of innovative instructional practices in the STEM classroom and develop strategies to overcome barriers to implementing active learning and evidence-based instructional practices at community colleges. They will examine the literature on those topics and examine data collected during a recent study at a large, urban, and minority-serving community college.

Michael Pullin, Associate Dean of Science—Broward College

CS 13: A Work in Context: Tracking the Success of Implementing CUREs at an HSI

The University of La Verne (ULV), a Hispanic Serving Institution (HSI), reaches populations of students who have traditionally been underrepresented in STEM fields. To broaden participation in undergraduate research, ULV implemented a Design Your Own Experiment (DYOE) pedagogy, a variant of Course-Based Undergraduate Research Experiences or CUREs, in laboratory learning modules of a required sophomore level cell biology course. This course was analyzed for learning, critical thinking, and affective gains over a three-year period. The results suggest that students benefited in all three domains from the DYOE experience. The role of lecture style and content on student learning in the lab will be discussed and recommendations provided. *Participants will* learn about assessment outcomes and best practices in learning, critical thinking, and affect of students in a DYOE-CURE model. They will gain a nuanced and contextualized understanding of barriers and strategies for CURE development, implementation, student buy-in, and student success. Participants will customize a strategy for their institutional setting and develop learning outcomes for a CURE of their own choosing.

Christine Broussard, Professor of Biology and Natural Science Division Chair, Jennifer Tsui, Assistant Professor of Biology, and Pablo Weaver, Instructor of Biology—all of the University of La Verne

THEME II: SUPPORTING, REWARDING, AND BUILDING CAPACITY OF STEM FACULTY

CS 14: Preparing Future STEM Faculty to Be Effective Research Mentors

STEM faculty leadership and professional development begins in graduate school when graduate students have the opportunity to develop skills that will have long-lasting impact on their career advancement and professionalization. Session facilitators will demonstrate the importance of acquiring research mentoring skills as part of graduate student/future faculty professional development using evidence from an NSF-funded study of an innovative graduate/undergraduate research mentoring program at University of California Berkeley. *Participants will* have the opportunity to collaboratively identify skills needed by STEM graduate students and faculty in mentoring undergraduates in research, assess how these research mentoring skills are developed on their campuses, and sketch out a plan appropriate to their campuses to assist graduate students and/or faculty in systematically developing these skills. Facilitators will share modules from a research mentoring toolkit will be shared.

Linda von Hoene, Assistant Dean for Professional Development and Director, Sabrina Soracco, Director,

*Graduate Writing Center, **Sarah Macdonald**, NSF-SMART Postdoctoral Fellow, and **Yukiko Watanabe**, Senior Consultant, Assessment and Evaluation—all of the University of California, Berkeley*

CS 15: Faculty Development Programs: Addressing STEM, Diversity, and Inclusion
This session will include two distinct session presentations on different forms of faculty development.
Moderator: *J. Houston Miller, Professor of Chemistry, Laser Analytics Laboratory—George Washington University*

Promoting Transfer of Scientific Literacy Skills (and Faculty Development) with a Modular STEM General Education Course
Session facilitators will descibe a modular, interdisciplinary general education course in which faculty members from a variety of STEM departments teach scientific skills in the context of multiple fascinating topics and then guide students to make appropriate comparisons. The presentation will include a workshop process for developing and coordinating instructors' modules, provide an "Elements of Science" learning goals sheet, and present examples of hands-on activities from multiple modules. *Participants will* learn of a model for a coordinated modular STEM course that teaches science literacy skills from multiple disciplinary perspectives. They will receive an "Elements of Science" learning goal sheet and sample materials for module and synthesis activities that teach those learning goals and learn about an easily-implemented workshop approach for developing and coordinating the class at their own institution. They will receive ideas for assessing the short/long-term effectiveness of this type of course.
***Michael Roberts**, Associate Professor of Psychology and Neuroscience and **Daniel Gurnon**, Associate Professor of Chemistry and Biochemistry—both of DePauw University*

Faculty Fellows for Inclusive Excellence: A Faculty Development Program on Diversity and Inclusion
The session facilitator will describe the structure and content of a faculty development program on diversity and inclusion and discuss potential successes and challenges of engaging STEM faculty members in the topics of diversity and inclusion. *Participants will* learn how to create and implement a year-long faculty development program focused on inclusive excellence, which aims to support biological sciences faculty members in developing a greater understanding of the impact of diversity and inclusion in the classroom and research lab. They will consider how to build their capacity to become more effective teachers and research mentors through understanding how the classroom or lab dynamic can affect individual students.
***Meaghan Stein**, Education Success and Retention Coordinator—University of Minnesota - Twin Cities*

THEME III: INCLUSIVE EXCELLENCE/BROADENING PARTICIPATION IN STEM HIGHER EDUCATION

CS 16: National Science Foundation: Interactive Technical Assistance for Funding Broadening Participation in STEM
As a direct result of the strategic investments of the National Science Foundation in improving the representation of all in STEM, a suite of best practices is now accepted, though not uniformly practiced or consistently expertly implemented with authenticity. As a result, eliminating disparities in STEM higher education remains a significant challenge for our nation. In this session, NSF program officers will showcase specific proposal case studies as a tool for equipping potential principal investigators with cultural awareness and the relevant grant writing skills that will likely yield better project efficacy. *Participants will* examine and explore proposal case studies relevant to STEM broadening participation.
***Clytrice Watson**, Program Officer and **Claudia Rankins**, Program Officer—both of National Science Foundation*

CS 17: Innovations with Engaged Digital Learning
This session includes two distinct campus presentations and time for questions.
Moderator: *Vida Rivera, Program Associate and Assistant to the Vice President, Office of Diversity, Equity and Student Success—AAC&U*

Improving STEM Retention and Graduation with an Online Community of Practice
The Deaf and Hard of Hearing Virtual Academic Community (DHHVAC) is an online community of practice designed for STEM majors who are deaf or hard of hearing and enrolled in one of three postsecondary programs: a community college, a large master's level university, and a very high research doctoral level university. Objectives include improving grades, increasing retention and graduation rates. To date, 61 students have enrolled, 25 have graduated and 7 (11%) have left school prior to graduation. GPAs often exceed program targets. This presentation describes project activities including online tutoring, mentoring, and sharing accessible media within a community of practice. *Participants will* have the opportunity to learn about three aspects of the DHHVAC. First, they will learn about the infrastructure of the DHHVAC model, including a discussion of the pros and cons of various platforms used for interaction such as the website, social media groups, and the video repository. Second, participants will learn about DHHVAC experiences conducting online tutoring for STEM courses and the online mentoring program. Finally, participants will learn about how to monitor engagement in an online community of practice.
Lisa Elliot, *Research Associate Professor—Rochester Institute of Technology*

Clickers, Self-Efficacy, and Inclusion
Session facilitators will talk about the relationships between teaching techniques used in introductory STEM courses, women's self-efficacy levels, and retention rates. A specific pedagogy using clickers, will be demonstrated to participants, along with evidence from experimental teaching sessions conducted during Spring 2017. *Participants will* learn the important effects of self-efficacy levels on retention rates of women in STEM majors, the impact of pedagogical practices on self-efficacy levels, and how the use of clickers affects students' self-efficacy levels in introductory STEM courses.
Aarthi Sridhar, *Ph.D. Candidate, Engineering—Duke University*

CS 18: Bring Project Kaleidoscope (PKAL) Closer to Home: Establishing a Regional Network to Support Faculty and Institutional Change
Faculty and administrators in this session will work with others in their geographic region to consider the benefits of, and begin to develop a local PKAL Regional Network. Facilitators will explain how the Massachusetts PKAL Region Network was created and operates, describing results of network activities that have improved student learning and begun to create institutional change. Additionally, facilitators will briefly describe how the regional network has fostered critical faculty development and opportunities for leadership within structures that provide rewards for faculty at typical colleges and universities. *Participants will* learn the structure and benefits of PKAL Regional Networks, identify partners in their geographical region who are interested in forming a network, and develop common goals that a newly formed Network could address. They will share contact information and identify potential leadership team members in their geographical region. The goal will be for participants to return to their local institutions with the beginning of a vision statement for a Regional Network and a follow-up plan for creating a Regional Network within the next year.
Thomas Kling, *Professor of Physics—Bridgewater State University;* **Monica Joslin**, *Dean of Academic Affairs—Massachusetts College of Liberal Arts; and* **Margaret Carroll**, *Dean of Science, Technology, Engineering and Mathematics—Framingham State University*

ELIZABETHAN ROOM B, SECOND FLOOR
CS 19: Planning the Learning Spaces for Tomorrow
What questions should one ask when considering the physical environment for learning in the undergraduate setting? How does a campus community and/or those responsible for a particular learning space, reach consensus on questions that reflect their context and their collective vision of what they want their learners to become? Who needs to be at the planning table? Is there a process of questioning that links attention to spaces to broader institutional initiatives? Such questions are emerging on campuses as academics and architects today plan learning spaces for tomorrow. This workshop will introduce a pilot approach for integrating attention to physical spaces into ongoing institutional planning. It reflects lessons learned from regional roundtables orchestrated by the Learning Spaces Collaboratory (LSC) about the value of planning that focuses on the future for their learners and of their campus community. *Participants will* learn about planning driven by questions such as: What do we want our learners to become? What are the most audacious questions that should drive our planning? Working in teams, participants will prepare posters that present an audacious question to introduce at an early stage and iteratively throughout the planning process. The workshop will conclude with a review and critique of "take-home" ideas for broader institutional attention and consensus.
Jeanne L. Narum, Director—The Independent Colleges Office, and Principal—Learning Spaces Collaboratory and Pamela Scott-Johnson, Dean College of Natural and Social Sciences—California State University Los Angeles

COLONIAL ROOM, MEZZANINE
2:45 P.M. – 3:15 P.M.   REFRESHMENT BREAK

3:15 P.M. – 4:15 P.M.   CONCURRENT SESSIONS

THEME I: UNDERGRADUATE STEM TEACHING AND LEARNING: CONTEXTS, CONTENT, AND RELEVANCY

*NSF FEATURED SESSION | CALFIRONIA WEST, SECOND FLOOR
CS 20: National Science Foundation: Improving Undergraduate STEM Education: Some Institutional and Community Transformation Projects Funded by the NSF
The NSF IUSE program supports projects that use innovative approaches to increase substantially the propagation of highly effective methods of STEM teaching and learning in institutions of higher education. Its ICT track recognizes that efforts at institutional change will require commitments from within an institution's academic leadership and will typically require the efforts of teams of faculty and support from the department chairperson, college dean, or other appropriate individuals, including Provosts and Presidents. *Participants will* learn about multiple projects that either affect more than one discipline or focus on institutional change, or both.
Ron Buckmire, Program Director, Division of Undergraduate Education, Andrea Lisa Nixon, Program Director, Division of Undergraduate Education, and Alejandro Delapuente, AAAS Science and Technology Policy Fellow—all of National Science Foundation

CS 21: Introducing Experiential Research in the STEM Classroom: Tiered Community of Learners and Peer-Leaders

The PEERS (Peer Enhanced Experiential Research in STEM) workshop uses peer mentors to train STEM faculty in implementing hands-on research and computational activities in the introductory STEM curriculum. This session will mimic the successful implementation of these activities at Northeastern Illinois University (NEIU), an urban Hispanic Serving Institution (HSI) in Chicago. Participants will develop initial ideas for small research and/or computational activities that can be integrated into their introductory courses. By the end of this session, the participants will have created outlines for research activities that they can implement in their particular disciplines. The session will also address how this approach can be institutionalized and sustained. *Participants will* learn to leverage their expertise to develop PEERS-type modules to introduce research in the introductory STEM courses at their institutions; develop an interdisciplinary workshop course to train peer-leaders as effective facilitators for their PEERS-type courses; and learn how to implement the PEERS model to build a sustainable community of learners, peer-mentors, and STEM faculty at their institutions.

***Paulo Acioli**, Professor of Physics and Department Chair, **Rachel Trana**, Assistant Professor of Computer Science, **Elisabet Head**, Assistant Professor of Earth Science, and **Joseph Hibdon Jr.**, Assistant Professor of Mathematics—all of Northeastern Illinois University*

CS 22: Breaking Down the Silos: Using Microcircuit Technology and PBL to Promote STEM Learning Across Disciplines

Education has traditionally built silos around each discipline; isolating, instead of integrating subjects together. The use of microcircuits and sensor technology can help break down these independent silos and begin to help promote STEM education across the natural science curriculum. Participants will learn about the current state of microcircuits and sensor technology and the opportunities that exist for its implementation with Problem Based Learning (PBL) in areas such as physics, biomechanics, mathematics, and engineering. Several tested practices will be presented along with the "engineering" process inherent within them. There will be an opportunity for participants to gather, collect, and analyze data in a seamless fashion that will show its ability to promote excitement, engagement, and effective STEM learning in the undergraduate setting across disciplines. *Participants will* interrogate the idea that PBL promotes active engagement through inquiry within a Constructivist/Constructionist theory and discuss the advantages and disadvantages of PBL in the undergraduate classroom.

***Steve Pauls**, Associate Professor of Natural Science and **Don Diboll**, Associate Professor of Kinesiology—both of Fresno Pacific University*

CS 23: Decision Based Learning: Helping Students Connect Equations to Concepts

Session facilitator will discuss the notion that the sphere of knowledge comprises three types of understanding. Procedural knowledge deals with perceiving "how to do something". Conditional knowledge, which is not only understanding "when" or "under what conditions" procedural knowledge is applied, but also discerning the core conditions, laws, or foundational tenants upon which, procedural knowledge is based. Conceptual knowledge, is directed at "the why", and built upon the other two. Drawing on this model, the facilitator will introduce Decision-Based Learning (DBL), which provides students with a cognitive structure that focuses on helping them connect the conditional core ideas with the problem solving associated with procedural knowledge. *Participants will* see examples of STEM DBL course structures and discuss how to implement DBL along with student outcomes. They will understand the individual types of knowledge, how they are interrelated, and how to use these as a scaffold in

designing a course. Participants will learn that conceptual knowledge is incomplete and inadequate without conditional and procedural knowledge; it is not a factual statement of a concept. Based upon this understanding, participants will recognize how to design and incorporate Decision-Based Learning pedagogy in their courses to assist students in constructing their knowledge and developing their conceptual understanding.
Steven Wood, Teaching Professor—Brigham Young University

THEME II: SUPPORTING, REWARDING, AND BUILDING CAPACITY OF STEM FACULTY

TOWER SALON A, TOWER SALONS
CS 24: Engaging Faculty in Student Success Workshops Promoting Equity and Inclusion in STEM Classrooms

Session facilitators will present findings from a three-year study on the impact of an inclusivity intervention targeted at STEM faculty. They will provide an overview of the format and content presented at each faculty student success workshop and share assessment data gauging the effectiveness of this intervention at changing faculty attitudes, knowledge, level of awareness, and interest/ability to modify their teaching practices. The presentation of assessment results will focus on those issues facing underrepresented students as barriers to their college success. *Participants will* learn about faculty workshop topics covered, as well as the assessment results and impact of the workshop on faculty attitudes and teaching practices. They will discuss best practices for teaching faculty about inclusive classrooms and lessons learned over three years of workshops, including highlights on the strengths and weaknesses of three different formats and facilitators. Participants will have the opportunity to explore how inclusivity interventions might be adopted at their own institutions.
Erin Sanders, Director, Center for Education Innovation and Learning in the Sciences and Marc Levis-Fitzgerald, Director, Center for Educational Assessment—both of the University of California, Los Angeles

THEME IV: ASSESSMENT AND EVIDENCE FOR HIGH-QUALITY UNDERGRADUATE STEM LEARNING

ELIZABETHAN ROOM C, SECOND FLOOR
CS 25: Which Instrument Should We Use? Assessing Classroom Observation Protocols

After a brief overview of five different observation protocols (RTOP, COPUS, PORTAAL, EQUIP, and DART), participants will be divided into groups, each assigned to either COPUS or PORTAAL (since these two can be quickly learned). Any participants previously trained in EQUIP (which requires longer training), will join an EQUIP group. Participants will use their assigned instrument to observe two short teaching videos: one with high levels of active learning and another that is more lecture-based. After the observation, groups will share and compare data from observations and from RTOP and DART reports that will be prepared by the presenters prior to the session. Participants will attempt to answer research questions about the two classes and will discuss how well each helps them answer the questions in different contexts. Based on this experience, the group will develop a framework and set of criteria for selecting instruments that best suit their needs. *Participants will* become familiar with five different classroom observation protocols and have a good understanding of what kind of data it provides, have experience using at least one classroom observation protocol, and develop criteria for determining which classroom observation protocol is most suitable for a given context and research question.
Kathryn Plank, Director of Center for Teaching and Learning and Associate Professor of Education, Joan Esson, Associate Professor of Chemistry, and Paul Wendel, Associate Professor of Education—all of Otterbein University; and James McCargar, Associate Dean of Natural Sciences, Mathematics and Computing—Baldwin-Wallace University

ELIZABETHAN ROOM A, SECOND FLOOR

CS 26: From Institutional Leadership to the Classroom: Radically Changing Calculus or other Gateway Courses

How does one initiate change in a gateway course that is holding students back when the institutional culture and structures challenge such change? Session facilitators will help participants identify obstacles and stakeholders as they develop a plan to transform institutional culture in support of student learning and success. The session will draw from the experience at Binghamton University, where a campus-wide coalition was formed by university leadership to address student success challenges in the Calculus sequence. Through collaboration from key stakeholders, innovative approaches to these challenges resulted in significant improvements in learning outcomes and a culture focused on student success. *Participants will* identify a program or course at their campus that would benefit from this approach; define the obstacles to be overcome involved in such an approach; develop a strategy to identify key stakeholders who can foster institutional change; and articulate key steps in an action plan for implementing this approach.

*Lawrence Kazmierczak, Director of Calculus and **Donald Loewen**, Vice Provost for Undergraduate Studies—both of Binghamton University*

CALIFORNIA EAST, SECOND FLOOR

CS 27: What Are the Necessary Elements for Managing Change in STEM Education?

Loyola University Maryland is a Pathways to Innovation institution, an NSF supported program from Epicenter at Stanford University in collaboration with VentureWell. This initiative is a collaborative effort among the engineering, computer science, and physics departments and is garnering support from the Schools of Business, Education, and Arts and Sciences, the university library, University advancement, student life, alumni office, and alumni. It has enhanced students' interest and engagement in creative, innovative, and entrepreneurial minded courses and co-curricular work. The framework for change used is based on "strategic doing" as agile change management approach. *Participants will* explore the common elements and patterns associated with implementing changes related to STEM education.They will be introduced to the agile change management approach and reflect on lessons learned about change management in STEM that are applicable at various types of institutions.

Bahram Roughani, Associate Dean for Natural and Applied Sciences and Professor of Physics—Loyola University Maryland

ITALIAN/COLONIAL ROOM, MEZZANINE
4:30 P.M. – 6:00 P.M.   POSTERS AND RECEPTION

THEME I: UNDERGRADUATE STEM TEACHING AND LEARNING: CONTEXTS, CONTENT, AND RELEVANCY

POSTER 49: Chemistry for the Modern Age: Focusing Curriculum Redesign on Blended Learning.
This poster will examine a complete redesign of the chemistry curriculum from the ground up that integrates all disciplines and builds a foundation of core concepts on which students can build specialized advanced learning. *Participants will* learn about the process of reform, the model developed, and the proposed analysis of change including the challenges and opportunities of whole curriculum level redesign and the methods of analysis being employed to look at the large scale nature of change.

*Douglas Mulford, Senior Lecturer and **Filipp Frank**, Post Doctoral Fellow—both of Emory University*

POSTER 50: Improving Chemistry Education for Non-Science Majors
Engaging non-science majors in chemistry classes is challenging. This poster will examine how understanding particular aspects of student learning can enhance a one-semester survey of general, organic, and biochemistry. In particular, it will consider how attitudes of non-science majors toward chemistry, how students understand molecular structure and apply that to their understanding of the natural world, and how students connect the symbolic, microscopic, and macroscopic properties of substances in lecture and lab. *Participants will* learn about a novel approach to engaging non-science majors in thinking like scientists, wherein lecture and laboratory activities are integrated and each contribute to the theme "How does chemical structure affect function"? Participants will also learn how case studies can be used to teach medicinal chemistry topics in an introductory chemistry class.
***Annette Neuman**, Assistant Professor of Chemistry—Oxford College of Emory University*

POSTER 51: Engaging More Students in Doing Science Early in College: Multi-Department Reform
Developing the knowledge, skills, and confidence of young scientists, engineers and mathematicians is a critical and important challenge. It is also a very complex problem, with many factors impacting students' success. A promising strategy is a systems approach of simultaneously improving the matrix of courses that students take and providing multiple opportunities to work in authentic projects, both inside and outside courses. Participants will learn about a system map that describes where they can impact students' knowledge, skills and confidence in STEM and learn how to characterize those tasks by where they fit in a two-dimensional matrix. They will gain understanding about specific initiatives they can adapt on their campus including calculus reform, a cost-effective freshmen research initiative, and interdisciplinary projects for undeclared students.
***Jo Anne Powell-Coffman**, Chair, Department of Genetics, Development, and Cell Biology—Iowa State University*

POSTER 52: An Interdisciplinary Approach to Enhancing Student Learning in Quantitative and Scientific Reasoning
To develop students' quantitative and scientific reasoning skills, a modular laboratory course where students complete experiments from various STEM disciplines was created. Each experiment (biology, chemistry, environmental science, mechanical engineering, physics, and final project) has a common theme of measurement. Course learning objectives (LOs) involve developing and executing an experimental strategy, analyzing and interpreting data, synthesizing experimental conclusions, and reporting data in graphical form. This poster will examine whether the course LOs were attained through performance on course assessments (quizzes, lab reports, and final project), a validated quantitative reasoning test, and/or a learning gains survey. *Participants will* learn about the evaluation results of this approach and how to weigh curricular assessment data and formulate novel ideas for developing students' quantitative and/or scientific reasoning skills in an interdisciplinary STEM environment.
***Laura Ott**, Director of Science Education Research Unit and **Caitlin Kowalewski**, Research Coordinator—both of University of Maryland, Baltimore County*

POSTER 53: Deliberative Democracy Pedagogy: A Tool to Broaden and Engage
This poster will describe the model of Deliberative Democracy Pedagogy (DDP), an active learning strategy, based on deliberative democratic models of citizen engagement in science policymaking. This integrative pedagogical approach, revises the delivery of conventional introductory science content around modules that engage students with current science policy and research controversies. Essential to this model is the scaffolding of individual and collaborative student experiences with peer-reviewed research, media coverage, and personal and community connections, which is built into the course

structure. Through these experiences, students integrate both scientific and social and ethical content in the deliberative learning framework. *Participants will* have an understanding of this pedagogical model and its goals, as well as the both the ease and challenges of implementation. Additionally, participants will learn how to integrate the DDP modules into existing syllabi and strategies for facilitating student use of primary literature. The flexibility of the model allows for wide ranging topics to engage students with issues of local, regional and national significance. Participants will also learn about the summer development workshop structure and strategies for writing of DDP modules by graduate student and faculty teams. Ideas piloted for in-class presentation and worksheets will also be discussed.
Erin Shortlidge, Assistant Professor—Portland State University

POSTER 54: A 3D Intervention: Addressing Enzyme-Substrate Interactions Misconceptions
Many students enter biochemistry courses with enzyme-substrate interaction misconceptions stemming from prior biology and chemistry courses where this core concept is inadequately illustrated, explained, and/or assessed. Moreover, research has shown two-dimensional representations not only fail to effectively convey biochemical concepts, but also propagate misconceptions. Reported enzyme-substrate interaction misconceptions highlight the necessity for better, targeted instructional tools and assessments. As such, a series of active learning assessments, with corresponding learning objectives and physical models designed by a team of undergraduate students, were developed to address the identified misconceptions of space, electronic interactions, and stereochemistry in enzyme-substrate interactions. This poster will present the design and development of these assessments and corresponding 3D physical models along with the preliminary results of this study. Further development and results of this study set the stage for curriculum wide development of enzyme-substrate interaction targeted assessments. *Participants will* learn about the impact of 3D physical models on student misconceptions; consider the role of misconceptions in biochemistry courses; and examine the measurement of misconceptions and student learning. They will have the opportunity to discuss the use of models and modeling to address misconceptions.
Cassidy Terrell, Assistant Professor—University of Minnesota, Rochester

POSTER 55: Analysis of Impact of Supplemental Instruction in Upper-Division Course
Undergraduate student enrollment in the biological sciences continues to grow annually leading to higher enrollment in both lower and upper-division biology courses. Supplemental instruction has been studied in the context of introductory courses but there is little to no evidence of the impact of supplemental instruction at the upper-division course level. As upper-division biology courses are the first courses that community college transfer students experience when they arrive at four-year institutions, and yet many upper-division courses do not offer supplemental instruction. This poster till analyze the impact that an optional discussion section has in a high-enrollment upper-division genetics course. *Participants will* learn of challenges that transfer students experience upon entering upper-division courses; what resources are offered at the upper-division level to promote learning and retention in STEM; and discuss the most effective practice of providing supplemental instruction at the upper-division level.
Marina Crowder, Lecturer with Potential Security of Employment, Molecular and Cellular Biology Department—University of California Davis

POSTER 56: An Inclusive and Innovative Inquiry-Based STEM Education: The Grand Challenges Initiative
This poster will describe the Grand Challenges Initiative, an inquiry-based program designed to empower undergraduate students working in small teams to use STEM as a means of solving society's most pressing challenges. Over the course of four semesters, students develop a foundation in critical thinking and interdisciplinary problem solving, while also learning how to effectively collaborate and communicate with one another. By engaging every student from day one, the initiative seeks to foster an inclusive, diverse and supportive STEM community that improves student retention. Students are mentored by postdoctoral fellows trained in evidence-based teaching approaches, as well as by experts from a number of different fields who support students in addressing their particular challenge. *Participants will* learn about a unique college-wide initiative to transform undergraduate STEM education. In particular, they will discuss: 1) strategically building a theory-driven program that leads to inclusive excellence in STEM through high-impact educational practices; 2) developing a postdoctoral teaching fellows program to support that program; and 3) scaling that program to an entire college.
***Gregory Goldsmith**, Director of Grand Challenges Initiative and Assistant Professor of Biology and*
***L. Andrew Lyon**, Dean of Schmid College of Science and Technology and Professor of Chemistry—both of Chapman University*

POSTER 57: Building Student Success Through Inclusive and Collaborative STEM Course Redesign
This poster will highlight work on the redesign of introductory biology and chemistry courses currently underway at City University of New York's Queens College and Queensborough Community College. Each redesigned course will feature a new syllabus, a refined set of learning outcomes, a new set of in- and out-of-class linked activities to the learning outcomes, and a set of resources for engaging students in self-directed inquiry learning. The impact of the course redesign will be assessed through ongoing structured observations, collection of course artifacts, and examination of additional measures of student achievement. *Participants will* learn about the: 1) processes and steps involved in the redesign of STEM introductory lecture and laboratory courses in biology and chemistry; 2) similarities and differences in course redesigns recently completed; and 3) interact with project staff regarding issues that arose during the implementation.
***Sabrina Hussain Avila**, Project Coordinator, STEM Bridges Across Eastern Queens and **Patrick Johnson**, Project Coordinator, STEM Bridges Across Eastern Queens—both of Queens College, City University of New York*

POSTER 58: Integrative Education Mentoring in Higher Education
Integrative education fosters opportunities for students to grow intellectually and emotionally, through the inclusion of cognitive, affective, physical, and intuitive interdisciplinary activities. The cognitive and affective domains are of particular interest here, due to the well-documented evidence linking these to enhanced academic performance. This poster will propose that an integral aspect of emotional intelligence is self-awareness and self-advocacy, qualities that lend themselves to competent leadership. It will outline an approach to mentoring students on the role of developing emotional intelligence and meta-affective practices, with the specific aims of promoting motivation, persistence, and resilience. Moreover, the presenters will suggest that meta-awareness is independent but intertwined with metacognition; both being essential for students' aptitude for learning. *Participants will:* 1) learn about the interrelationship between stress, emotional intelligence and metacognition; 2) appreciate that an integral aspect of emotional intelligence is self-awareness and self-advocacy; 3) identify specific strategies to develop emotional intelligence and meta-affective practices; and 4) examine ways to incorporate these ideas into STEM courses.
***Mays Imad**, Professor of Physiology and Neuroscience—Pima Community College and University of Arizona*

POSTER 59: Summer Program: Enhancing Success of Underrepresented Students Entering College
This poster will present data from work done as part of the NIH supported, ReBUILD Detroit Summer Experience Program. The goal of the summer program is to build relationships in the unique cohort of students as well as help prepare incoming freshman from under-represented populations to succeed during the often challenging transition from high school to undergraduate education. *Participants will* 1) see a model for pre-freshmen intervention in different STEM disciplines; 2) engage in discussions of how to design and implement short modules to address different learning objectives for STEM disciplines; and 3) gain feedback on data of the effectiveness of different modules on achieving stated learning objectives. They will learn about plans for future improvements of these modules and see how cross disciplinary modules can include scientific material spanning multiple subjects.
*Jacob Kagey, Associate Professor of Biology and **Stephanie Conant**, Associate Professor of Biology—both of the University of Detroit, Mercy*

POSTER 60: Inclusivity Through Broad Recruitment for a Major Undergraduate Research Program
The University of Maryland (UMD) initiated a new program in 2014-15 to provide authentic faculty-led research experiences, mentorship, and accelerated opportunity for first year freshmen from a wide range of academic backgrounds. The UMD First Year Innovation and Research Experience (FIRE) provides broad mentorship and institutional connections that impact academic success, personal resilience, and professional development. This poster will present how the FIRE mission focuses attention on undeclared, non-honors, and transfer student populations in order to increase academic success, expose students to less traditionally considered academic units, and accelerate student professional development. Annually, FIRE offers involvement in the institutional missions of innovation and research, a supportive peer community, and a more academically immersive first year experience to a broad demographic range of nearly 500 students. *Participants will* learn recruitment techniques proven to reach underserved and minority student populations; understand the importance of undergraduate research experiences on underserved and minority student populations and the short, medium and long term impacts of undergraduate research experiences that lead to higher levels of student academic success, engagement and professional development. They will understand a proven method by which faculty led undergraduate research experiences can be scaled at both colleges and universities in a manner that is discipline-adaptive, productive for faculty, and sustainable over time.
Patrick Killion, Director of First Year Research Programs—University of Maryland

THEME II: SUPPORTING, REWARDING, AND BUILDING CAPACITY OF STEM FACULTY

Poster 61: The Process by Which Faculty Members Adopt Innovative Teaching Practices: A Case Study
This poster will examine a case study approach to obtaining an in-depth understanding of the process that two instructors took in redesigning a biology course from teacher-centered teaching towards learner-centered teaching. Using the innovation-decision model for change, this case study explores the motivation, decision-making, and reflective processes of the two instructors through two consecutive, large-enrollment biology course offerings. Data reveal that the change process is somewhat unpredictable, requiring patience and persistence during inevitable challenges that arise for instructors and students. *Participants will* learn about the process by which faculty members adopt innovative teaching approaches including instructors' motivation for change, attitudes towards change, and challenges related to implementing active learning approaches. Participants will also learn about different administrative support that could aid the transformation process.
Gili Marbach-Ad, Director, Teaching and Learning Center—University of Maryland

POSTER 62: Should I Stay or Should I Go? Member Retention in an Online Professional Learning Community

Professional development (PD) is effective in addressing STEM educators' content and pedagogical goals, if it is conducted long-term. Given budget, geographic, and time constraints, one method for delivering ongoing PD is online professional learning communities (PLCs), which also encourage member collaboration. However, many members rarely return, a situation strikingly similar to student departure from higher education institutions. Since education professionals have different capacities and expectations when utilizing online PD, one possible explanation is some members' characteristics matched well with the PLC (goodness-of-fit) while others did not. This poster will examine this hypothesis using member information and usage data obtained from a national PLC for STEM education professionals. *Participants will* be able to understand one basic challenge that managers of online professional learning communities (PLCs) face and its similarity to the problem of traditional student departure from higher education institutions. They will consider how application of the goodness-of-fit theoretical model may help in gaining a deeper understanding of potential members' capacities and motivations for using online PLCs, and what these findings suggest for the future design and implementation of online PLCs that aim to improve student learning outcomes.

Anne Weiss, *Adjunct Professor of Science and Former Faculty Professional Development Manager—Tidewater Community College*

POSTER 63: Transforming Engineering Culture to Advance Inclusion and Diversity

Although there is clear and compelling need for greater diversity and inclusion in engineering, it is unlikely that greater diversity and inclusion will occur without a significant culture shift in engineering. This poster will describe how teams of 5-6 department leaders, faculty, and staff participated in workshops to prepare these teams, using evidence-based strategies, to lead change efforts that facilitate diversity, equity, and inclusion within their departmental cultures. Longitudinal analysis documented participant growth and improvement in three areas: 1) confidence and knowledge in fostering change; 2) knowledge and comfort in diversity and inclusion concepts; and 3) creating and implementing plans to address diversity and inclusion. Resources such as workshop agendas, key sample activities from the workshops with be shared, along with the resulting change model. *Participants will* learn about the change process and become familiar with the resources found to facilitate change teams' capacity to engage in diversity, equity, and inclusion.

Gretalyn Leibnitz, *Co-Principal Investigator and Project Director for Transforming Engineering Culture to Advance Inclusion and Diversity Project—Women in Engineering ProActive Network*

THEME III: INCLUSIVE EXCELLENCE/BROADENING PARTICIPATION IN STEM HIGHER EDUCATION

*LEAP FEATURED SESSION

POSTER 64: Enhancing Success in STEM for Diverse Students via a Summer Bridge Program

This poster will describe a short bridge program that combines a two-and-a-half-week residential summer program with a fall semester component to improve the retention and success of students. Building on AAC&U LEAP Essential Learning Outcomes, this program engages students in modular lectures and labs which combine skill development with applied topics like Forensic Biology and Environmental Chemistry. During the fall semester, students also engage in a community engagement project with local schools and are mentored via formal mentoring relationships with faculty members. *Participants will* learn about the challenges and benefits of a summer bridge program focused on women in science for encouraging retention and persistence of underrepresented STEM students.

Helen Walter, *Visiting Assistant Professor—Mills College*

POSTER 65: Empowering Peer Leaders to Create Inclusive Academic Support Environments
The Peer-Assisted Learning (PAL) program at Sacramento State University has over five years of data showing improved student performance (20% bump in course grade) and a closing or narrowing of the achievement gap across a number of STEM courses. This poster will showcase the role of recruitment, selection, and equity-minded training of undergraduate facilitators in achieving these outcomes with examples that may be transferred to a variety of settings in higher education. *Participants will* be able to understand how to bring equity-minded practice to successfully address some of the common challenges to STEM student success (e.g. wide range of academic preparation, diverse cultural and socioeconomic backgrounds, etc.). They will learn how collaborative partnerships with peer leaders may provide a new "lens" through which program success may be optimized and consider how some of these approaches may be used on their own campuses via synergism, rather than duplication, of efforts.
Jennifer Lundmark*, Professor, Biological Sciences and Director, Peer-Assisted Learning Program and* ***Corey Shanbrom****, Assistant Professor, Mathematics and Statistics—both of California State University, Sacramento*

POSTER 66: Effects of Presentation Methods and Spatial Abilities on Learning Geographic Information Systems
This poster will present results from an intervention study in an introductory course on geographic information systems. Over two semesters, faculty compared two methods for presenting lecture content and the effects of spatial ability on learning: traditional lectures presented on the chalkboard to a live audience versus video presentations. Learning outcomes from the video-recorded presentations were significantly greater than live presentations and results suggest the segmenting principle of multimedia learning can help erase the advantage of spatial abilities in introductory STEM courses. *Participants will* learn about the relationships between spatial abilities and learning in STEM fields, particularly those that bring together spatial thinking and diagrammatic reasoning. In addition, they will understand the cognitive theory of multimedia learning and examine best practices for designing multimedia instruction for online learning. This session will be especially valuable to STEM instructors that seek to better integrate lecture content with computer-based laboratories.
Jeff Howarth*, Associate Professor—Middlebury College*

POSTER 67: A Math and Science Scholars Program: A Bridge Program and Beyond
This poster will describe a pilot program designed to improve the retention of underrepresented students in STEM fields. The program uses several different strategies to promote student success including: an on-line bridge program, teaching students academic and metacognitive study skills, training advisors and mentors in fostering the growth mindset, and providing students with early exposure to research experiences. The program has been effective in improving retention, creating a STEM community and generating corollary activities such as formation of a science and math student-faculty coalition to address issues of equity and diversity, and creation of a science teaching and learning center. *Participants will* learn of an academic program to support underrepresented groups in science and math and about high-impact practices and other activities that were deemed unsuccessful.
Ishita Mukerji*, Fisk Professor of Natural Science and Co-Director, Wesleyan Math and Science Scholars Program and* ***Teshia Levy-Grant****, Dean for Equity and Inclusion and Associate Director of Wesleyan Math and Science Scholars Program—both of Wesleyan University*

POSTER 68: The Metric is the Message: Analyzing Methods and Outcomes of the Arts in STEM to STEAM
Traditionally, STEM fields have promised strong earnings potential and career security. As career trajectories grow more complex, fields of science and technology will increasingly require humanity, experimentation, and innovation. Moreover, as industries and labor become more automated, the study of art—as an experimental processes, a proxy for independent thinking, and a hub for interdisciplinary inquiry—may lead to more pivotal outcomes, especially given trends towards the automation of labor and the restructuring of jobs into the gig economy. This poster will offer an innovative and important new taxonomy of methods of art in learning—whether observation and connoisseurship, or question-driven experimentation and trial and error. The rubric holistically encompasses both the incremental and transformational gains of studying art, and translates these characteristics for use in STEM contexts. *Participants will* gain a more granular understanding of the different methods of inserting "A" for "art" into STEM, and will be able to connect methods within the resulting "STEAM" framework for evaluating outcomes. STEAM has come to include visual and performing arts, studio art and art history, and both outcome- and process-based definitions of art. Wolniak and Whitaker's work models key differences and commonalities across those methods, and maps them to learning outcomes. *Participants will* receive a uniquely hybrid perspective drawing on Wolniak's research on higher education outcomes and Whitaker's MBA-MFA study of arts in a business context.
Amy Whitaker, Assistant Professor, Visual Arts Administration, Steinhardt School—New York University

POSTER 69: A Better Way to Assess Lab Notebooks: There's an App for That!
This poster will examine the importance of general chemistry students developing lab notebook keeping skills. Until recently, student notebooks were quickly graded as they left the lab. This didn't allow time to make constructive comments and led to inconsistencies in grading that depended upon lab section and how quickly they finished the lab. In 2015, a scanning app for phones was introduced to enable students to scan their notebook at the end of each lab creating a .pdf file which is submitted or grading. This process allows faculty to annotate notebooks with comments and provide timely feedback that is consistent. *Participants will* become acquainted with a simple idea to improve laboratory notebook assessment. The combination of a scanning app, Blackboard submission, and grading rubric will be demonstrated as a way to improve and develop student laboratory notebook keeping skills.
*Anne Ryter, Professor of Chemistry and **Dale Orth**, Professor of Chemistry—all of Western State Colorado University*

POSTER 70: Undergraduate STEM Students Learn More and Fail Less With Active Learning Strategies
A study of thousands of students in an introductory physics course found that compared to traditional instructors, all faculty using active learning – even those lacking pedagogy training – have students exhibiting significantly higher conceptual learning gains, lower fail rates, and decreased achievement gaps. The poster will provide an overview of the varying and effective implementations of high-impact practices and highlight institutional data dashboards tracking student performance at the course and instructor levels. The poster will summarize the rigorous analysis used to demonstrate the effectiveness of active learning, even by untrained faculty. *Participants will* explore various ways that an institutional data dashboard can be designed to identify courses of concern, assess active learning interventions, and inform detailed studies that control for other student characteristics. They will discuss how to use concept inventories and course performance to compare learning across various instructional styles.
*Shanna Shaked, Senior Associate Director of Center for Education Innovation and Learning in the Sciences (CEILS) for Physical Sciences Initiatives and **Brit Toven-Lindsey**, Research Analyst, Center for Educational Assessment—both of the University of California, Los Angeles*

POSTER 71: Assessing Service Learning in STEM: A System-Wide Study
Service Learning (SL) courses partner students with community organizations providing students with hands-on experience connecting course concepts with real-world issues (Kuh & O'Donnell, 2013). Although many institutions implement SL courses, little research has systematically assessed the impact of these courses on a variety of student outcomes. This poster will outline a study assessing SL in STEM courses across the California State University system. The research aims to: 1) uncover the essential elements of high-quality SL; 2) determine if SL in STEM disciplines has a positive impact on student academic achievement, career development, and civic engagement; and 3) determine if student outcomes differ depending on the quality of the course experience. *Participants will:* 1) learn about the context of SL courses in STEM and the findings from the research study conducted at 11 CSU campuses; 2) understand what factors are included in a high-quality SL experience for undergraduates; and 3) understand how students' participation in STEM SL courses relates to key outcomes of interest.
Judy Botelho, Director, Center for Community Engagement and Cathy Avila-Linn, Consultant to the Center for Community Engagement—both of California State University, Office of the Chancellor

POSTER 72: Using Evidence to Refine STEM Initiatives: Lessons Learned from the Dana Center Mathematics Pathways
This poster will highlight the successes and challenges of implementing classroom, institutional, and state policy reforms to support the development of multiple math pathways. The poster will provide information on the Dana Center Mathematics Pathways (DCMP) and their work to support college faculty, institutions, and states in implementing math pathways at scale. It will also include MDRC's beginning implementation and impact findings from a random assignment study of these pathways at four Texas colleges. *Participants will* be able to explain the rationale for multiple math pathways to another participant; understand the DCMP principles for accelerated mathematics pathways; interpret early findings as they apply to multiple math pathways; create a list of questions to evaluate their college and state's readiness/need for accelerated mathematics pathways; and make a preliminary list of the evidence that they have available to them at their colleges and universities.
Jennifer Dorsey, Senior Evaluation Analyst—Charles A. Dana Center; and Evan Weissman, Senior Operations Associate—MDRC

THEME V: UNDERSTANDING EFFECTIVE STRATEGIES FOR TRANSFORMING INSTITUTIONAL CULTURES FOR UNDERGRADUATE STEM REFORM

POSTER 73: Supplemental Instruction and a STEM Success Academy
This poster will represent a STEM Success Academy design graphically, with inputs, program components, and student outcomes to be emphasized. New Jersey City University (NJCU) will employ a colorful, data-rich and low-text design to convey the background, structure, implementation plan, and results of its supplimental instruction (SI) program and STEM Success Academy. The poster will share several years' experience with SI and results that provide formative assessment feedback that informs our ongoing revision of the program. Modifications have increased availability and participation and reduced costs. *Participants will:* 1) be able to implement several strategies that increase participation and financial efficiency of Supplemental Instruction programs at their institutions; 2) become familiar with the student-success outcomes of the NJCU model of SI; and 3) be able to develop an academic, personal, and career development program for rising sophomores.
John Grew, Professor and Chairman of Biology and Alberto Pinkas, Professor and Chairman of Physics—all of New Jersey City University

POSTER 74: Biology Curriculum Revision to Promote Coherence and Scaffolded Learning
The Virginia Wesleyan College (VWC) Biology department reformed the major to promote curricular coherence and scaffolded learning leading toward three high impact practices. Departmental assessment indicated a need to reform the introductory sequence and maintain two upper level classes in genetics/molecular biology. The 2-course introductory sequence was split into three courses, and upper-level requirements adjusted to allow an additional departmental elective. The lab in the first course presented a serious challenge to many students, so it was expanded and converted into the new 3rd introductory class. The lecture of the first course was converted to an active learning technology enhanced non-lab course, which added structured low-stakes assignments demonstrated to improve academic success. This will engage underprepared first year students and prepare them for success in later biology courses. The poster will compare historic persistence rates with those through the midterm of fall 2017, and ultimately will compare DFW rates before versus after curricular modification.
Participants will examine possible ways to revise the major curriculum to promote coherence; consider the benefits of a scaffolded approach that guides students along a path toward the high impact practices; and consider the relative merits of a 2-course vs. 3-course introductory biology sequence. They will learn about a structured active-learning approach to promote student success; reflect on the data used to drive curricular reform; and discuss the necessary departmental negotiations needed to allow curricular reform to proceed. They will have the opportunity to discuss methods that allow students to discern whether a major is their best academic and/or career path without resorting to a "weed out course" approach.
Maynard Schaus, Associate Provost and Professor of Biology—Virginia Wesleyan College

POSTER 75: Developing a Shared Vision for STEM General Education Reform at a Liberal Arts College
This poster will share a model for STEM general education reform used at a small liberal arts college that is grounded in literature. This "grass roots" approach was initiated by two faculty members (Chemistry/Biochemistry and Psychology) and supported by the administration. The effort provided a context for reaching consensus across the university's eight science and math departments on learning outcomes for STEM general education courses. While the path has been more uncertain and the pace slower than anticipated, the project demonstrates that faculty, staff, and administrations can work together to develop a shared vision and align institutional priorities to generate institutional change.
Participants will leave with ideas for initiating general education reform at their institution; strategies for creating transparency and communication with faculty colleagues in STEM and other divisions; and strategies for fostering collaboration between faculty, staff, and administration. They will gain suggestions for utilizing existing institutional resources; greater awareness of factors contributing to successes and challenges in implementing change; and a "scientific literacy skills" instrument.
Jacqueline Roberts, Professor of Biochemistry and Pamela Propsom, Professor of Psychology—both of DePauw University

POSTER 76: Exploring Faculty and Administrator Perceptions and Behaviors Toward Accreditation
Over the past century, accreditation has evolved as the prevalent system in American higher education to monitor the quality of college and university educational services for continuous improvement. According to the U.S. Department of Education, more than 5,000 Title IV postsecondary institutions are accredited by regional, national, or programmatic accreditation agencies. Despite its longstanding permeation into all levels of colleges and universities, little research has been conducted about the effect of accreditation systems on perceptions, attitudes, and behaviors of faculty and administrators. To address the gap, this poster will explore the following research questions. What perceptions do faculty and administrators have toward accreditation systems? What factors influence their perceptions? How do accreditation systems shape behaviors of faculty and administrators in their

professional roles? Findings will offer insights that could contribute to better understanding of individual perceptions and behaviors in response to accreditation systems. *Participants will* learn about faculty and administrators' perceptions of accreditation systems, and identify factors influencing their perceptions regarding the institutional/and or the departmental culture of data use. Based on an understanding of similarities or differences in the data use processes of three institutions, participants will learn how accreditation systems contribute to/and or militate against building a culture of data use on campus to improve STEM education.
Hyoung Joon Park, *Ph.D. Student—University of Wisconsin-Madison*

SATURDAY, NOVEMBER 4, 2017

COLONIAL ROOM, MEZZANINE
8:00 A.M. – 8:45 A.M.   CONTINENTAL BREAKFAST

9:00 A.M. – 10:15 A.M.   CONCURRENT SESSIONS

THEME I: UNDERGRADUATE STEM TEACHING AND LEARNING: CONTEXTS, CONTENT, AND RELEVANCY

GEORGIAN, MEZZANINE
CS 28: In the Fishbowl: Strategies for Conversations on Mathematics in the Partner Disciplines
Mathematics is used throughout the partner disciplines and introductory mathematics courses would benefit from input from the partner disciplines. Yet, how often do faculty from mathematics and the partner disciplines engage in meaningful conversation about the mathematics taught and used in the undergraduate curriculum? In the Curriculum Foundations Project (CFP), the Mathematical Association of America conducted a series of 22 workshops to facilitate such discussions. The CFP used a "Fishbowl" discussion structure where partner discipline faculty responded to prompts while mathematics faculty listened. In the new SUMMIT-P project, ten institutions are revising their introductory mathematics curriculum by building partnerships with the partner disciplines using CFP findings and replicating the "Fishbowl" discussions. *Participants will* learn about the findings of the Curriculum Foundations Project, either as it pertains to their own discipline or as it pertains to the use of mathematics in other disciplines. They will experience holding a "Fishbowl" discussion with faculty from the partner disciplines and mathematics and develop a strategy for using these findings and facilitating similar cross-disciplinary conversations on their campus.
Suzanne Dorée, *Professor of Mathematics and Statistics and **Stella Hofrenning**, Associate Professor of Economics—both of Augsburg University; and **Rosalyn Hargraves**, Associate Professor of Teaching and Learning—Virginia Commonwealth University*

TOWER SALON A, TOWER SALONS
CS 29: Preparing STEM Students for 21st Century Careers
Session facilitators will explore data about the career paths of undergraduate STEM students and how those paths differ from what faculty imagine. Using the Phys21 and Vision and Change reports, the participants will discuss the critical skills which, according to the NAS Board on Workforce and Higher Education's report and the research for the Phys21 report, are common to most STEM careers. The group will also discuss recommendations for enhancing those skills in undergraduate programs and how those recommendations can be adapted to other STEM disciplines. The facilitators will lead a planning exercise in which the partcipants will evaluate the integration of some of these skills in their departments' programs. The session will include discussions about how career information and the development of professional skills enhances recruitment and retention in STEM programs.

Participants will learn about academic, professional, and career outcomes in STEM. They will prepare to consider how the career paths of STEM graduates inform undergraduate curricula, and how to convey that information to other faculty, students, and the students' families. Participants will identify professional skills most highly valued by employers, the evidence for that list of skills, and how to enhance those skills in an undergraduate STEM program. Finally, they will begin to develop plans for enhancing one or more of those skills in their home departments.

Beth Cunningham, *Executive Officer—American Association of Physics Teachers;* ***Cynthia Bauerle****, Dean of the College of Science and Mathematics and Professor of Biology—James Madison University; and* ***Sharon Gusky****, Professor of Biology and PULSE Fellow—Northwestern Connecticut Community College*

ELIZABETHAN ROOM A, SECOND FLOOR
CS 30: Supplemental Instruction: A Catalyst for STEM Course Success Across the California State University System

Supplemental Instruction (SI) is an empirically proven student success model that has been offered at over 1,500 institutions during the last 40 years. This voluntary, non-remedial, student near-peer-led program is open to all students enrolled in targeted high-challenge courses, and is grounded in active learning strategies considered effective for STEM disciplines. While SI outcomes are positive (e.g., narrowing achievement gaps, improving grades, increasing retention and graduation rates), institutions can struggle to formulate, sustain, and scale the program. *Participants will* engage in facilitated discussions around the development and optimization of SI interventions. They will identify the common components of successful, scalable, and sustainable SI programs and how active learning strategies translate to underrepresented students in high challenge STEM courses. Participants will develop actionable strategies to initiate and/or strengthen an SI program and evaluate the effects of SI participation on the course population and sub-populations.

Maureen Guarcello, *Instructional Designer and* ***Stephen Schellenberg****, Associate Dean, Division of Undergraduate Studies—both of San Diego State University;* ***Sean Walker****, Professor and Chair, Biological Science—California State University, Fullerton; and* ***Mai Kou Vang****, Supplemental Instruction Coordinator, Learning Center—California State University, Fresno*

THEME II: SUPPORTING, REWARDING, AND BUILDING CAPACITY OF STEM FACULTY

ELIZABETHAN ROOM D, SECOND FLOOR
CS 31: Making Faculty Development Matter: Rewarding, Long-Term Faculty Development in STEM

Faculty are key players in transforming STEM student outcomes, particularly in first year undergraduate STEM courses. Higher education research on minority student persistence shows that what happens in classroom spaces during the first year can either create or discourage their engagement with college (Kuh et al. 2008; Ibarra 1996; Treisman 1988). Faculty training in student engagement and learning practices should therefore be a top priority for colleges with high STEM attrition, yet multiple barriers prevent them from taking part in faculty development, and implementing changes to their teaching. Session facilitators will outline disconnects they have seen emerge as well as the specific ways minority serving institutions have created conditions for faculty to embrace their role as change agents within the classroom, and increase student success in STEM. *Participants will* be able to list key components to professional development necessary for faculty to apply, implement, and sustain changes to their instruction; explain why faculty development is particularly important for increasing minority student success in STEM; and use a culturally responsive STEM teaching rubric to determine areas of strength.

Melissa Salazar, *Math Faculty and Faculty Professional Developer—University of New Mexico Taos and ESCALA Educational Services LLC; and* ***Melissa McAlexander****, Professor of Chemistry—Notre Dame de Namur University*

CS 32: Institutional Transformation: A Summer Seminar for University Administrators and STEM Faculty

Session facilitators will provide an overview of OREGON STATE ADVANCE's 60-hour summer seminar for university administrators and STEM faculty. Drawing from theories of sense-making and systems of oppression, facilitators will encourage participants to apply these theories to their own institutional contexts and envision effective educational opportunities for institutional transformation on their own campuses. *Participants will* be able to: 1) describe Oregon State University's ADVANCE summer seminar; 2) apply theories of sense-making to and understand systems of oppression in their institution; and 3) envision opportunities for effective institutional transformation on their campus.

***Susan Shaw**, Professor of Women, Gender, and Sexuality Studies and Co-PI for OREGON STATE ADVANCE, **Rebecca Warner**, Professor of Sociology and PI for OREGON STATE ADVANCE, **Michelle Bothwell**, Associate Professor of Chemical, Biological, and Environmental Engineering and Co-PI for OREGON STATE ADVANCE and **Kali Furman**, Graduate Research Assistant for OREGON STATE ADVANCE—all of Oregon State University*

THEME IV: ASSESSMENT AND EVIDENCE FOR HIGH-QUALITY UNDERGRADUATE STEM LEARNING

CS 33: Experiential Learning and Evidence-Based Teaching: Powerful Tools in Assessing STEM Competencies

This workshop will focus on the value of integrative and innovative teaching, competency and student-centered education, and assessment tools that extend beyond the traditional, for increasing student success in STEM. Participants will actively engage in sharing their project goals, research designs, strategies for formative and summative assessments, and effective use of data obtained for further improving courses, instruction and/or student learning. As important as success stories are, learning about each other's institutions, their existing resources, extent of faculty buy-in, faculty development opportunities, administrative support, and time or financial constraints is equally helpful. New knowledge can offer fresher perspectives with respect to attending to the needs of all students, particularly the URMs. This session will spur new ideas, adoption of validated teaching and assessment tools, and/or initiation of new collaborations among participants to bring about lasting and meaningful reforms in STEM education. *Participants will* examine current trends in STEM scholarship of pedagogy; discuss issues in broadening participation in STEM to underrepresented or underprepared students; and list the challenges in transitioning to data-driven, competency-based STEM teaching and learning. They will use available software to demonstrate hands-on activities that engage students; define ways that data is used to further improve teaching and learning; practice ways to introduce scientific competencies and measure their attainment; and describe research design and approaches used for maximum faculty buy-in. Finally, they will discuss strategies for encouraging faculty collaborations and administrative support and analyze formative and summative assessment techniques.

***Shubha Ireland**, Professor of Biology and P.D. HHMI supported Project Scicomp—Xavier University of Louisiana*

CS 34: Using Writing Support and Assessment to Scaffold Quantitative Reasoning Communication
When students struggle to communicate in written form, instructors cannot easily assess the reasoning the student is trying to convey. In seeking to support student written communication of quantitative information, 4C coding was developed. This simple assessment/inter-vention tool supports writing of a specific type of statement frequently used as evidence in scientific writing—the quantitative and comparative (QC) statement. Supporting students in writing clear comparisons resulted in improved written communication of quantitative information. In addition, the 4C writing framework is used as a platform to scaffold higher order writing and reasoning skills. *Participants will* practice and discuss how to use the 4C coding framework. They will discuss how to help students organize their reasoning in lab reports; be able to score quantitative comparison statements; and be able to assess instructor prompts for lab reports to help students develop better quantitative reasoning and communication skills.
Christelle Sabatier, *Lecturer of Biology and* ***Tracy Ruscetti***, *Lecturer of Biology—both of Santa Clara University*

THEME V: UNDERSTANDING EFFECTIVE STRATEGIES FOR TRANSFORMING INSTITUTIONAL CULTURES FOR UNDERGRADUATE STEM REFORM

CS 35: Supporting Early Career Preparedness and Decision-Making
As graduates prepare to enter the workforce, effectively communicating the value of their education to employers is hampered by a complex process of knowing where and how to look for a job and how to get hired. To address these concerns, the NSF-funded Professional Engineering Pathways Study (PEPS) conducted surveys and interviews with engineering students focusing on their decision-making process and the resources they draw upon as they seek their first post-undergraduate job. *Participants will* acquire a framework for understanding the ecosystem in which engineering undergraduates prepare for their chosen careers; review research findings from the PEPS study; and collectively brainstorm ideas for how research can inform practice in the form of curriculum, resources, and co-curricular activities. They will identify strategies for engaging stakeholders in supporting students in their employment pathways.
Helen Chen, *Director of ePortfolio Initiatives, Office of the Registrar and Research Scientist, Department of Mechanical Engineering—Stanford University*

10:15 A.M. – 10:30 A.M. REFRESHMENT BREAK

10:30 A.M. – 11:30 A.M. PLENARY
STEM Education: The Road Ahead
Kumar Garg, *Senior Fellow, Society for Science and the Public and Former Assistant Director for Learning and Innovation—White House Office of Science and Technology Policy*

Kumar Garg helped shape science and technology policy for the Obama Administration for nearly eight years, serving in a variety of roles in the White House Office of Science and Technology Policy (OSTP). Garg helped develop a range of STEM initiatives over that time, working closely with Governors, Mayors, philanthropists, higher education, entrepreneurs, and non-profits. Garg will offer his thoughts on lessons learned from the Obama Administration's "all hands on deck" approach, from the current policy landscape, and regarding how to build high-impact partnerships going forward.