



PROJECT KALEIDOSCOPE
Advancing What Works in STEM Education

**TRANSFORMING UNDERGRADUATE STEM EDUCATION:
*Implications for 21st Century Society***

**November 3-5, 2016
Boston Park Plaza | Boston, Massachusetts**

Dear Colleagues,

Thank you for joining us for the *2016 Transforming Undergraduate STEM Education: Implications for 21st Century Society* conference. 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.

Each year, the Association of American Colleges and Universities (AAC&U) and Project Kaleidoscope (PKAL) host a Network for Academic Renewal Conference that focuses on deep exploration and examination of evidence-based models, strategies, and practices that will empower us to: 1) produce more competitively trained, liberally educated STEM graduates and, ultimately, 2) guarantee a scientifically literate citizenry. *Transforming Undergraduate STEM Education* is built upon our legacy of defining not only “what works” in STEM higher education reform, but also on understanding how it works, for whom it works best, and under what institutional conditions can the work be adapted and sustained.

Our conference agenda features two dynamic plenary presentations – bookending concurrent sessions, facilitated discussions, and poster presentations. Eric Mazur, physicist and educator of Harvard University, will deliver an opening plenary focusing on best practices for implementing interactive teaching strategies that promote innovation as a core learning outcome of undergraduate STEM curricula. Our closing plenary will feature Tyrone Hayes, American biologist and professor of integrative biology at the University of California Berkeley. Dr. Hayes will fully articulate the urgent need and most effective strategies for STEM faculty to connect their research and undergraduate teaching interests to national advocacy platforms that significantly improve quality of life for all in the 21st century.

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.

Again, thank you for choosing our conference.

Kelly Mack

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

Karen Ann Kalla

Director, Network for Academic Renewal

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SCHEDULE AT A GLANCE

Thursday, November 3, 2016

10:00 a.m. – 7:00 p.m.	Conference Registration and Membership Information
2:00 – 5:00 p.m.	Pre-Conference Workshops (separate registration and fee required)
7:00 – 8:15 p.m.	Keynote Address: Eric Mazur, Harvard University
8:15 – 9:00 p.m.	Welcome Reception: Meet Lynn Pasquerella, AAC&U President

Friday, November 4, 2016

7:30 a.m. – 5:30 p.m.	Conference Registration and Membership Information
9:15 – 10:00 a.m.	Newcomers' Welcome and Introduction to LEAP
8:30 – 10:00 a.m.	Continental Breakfast and Poster Sessions
10:30 – 11:30 a.m.	Concurrent Sessions
11:30 a.m. – 1:00 p.m.	Lunch on your Own
1:15 – 2:30 p.m.	Concurrent Sessions
3:00 – 4:00 p.m.	Concurrent Sessions
4:15 – 5:30 p.m.	Poster Sessions and Reception

Saturday, November 5, 2016

8:00 – 9:00 a.m.	Continental Breakfast
9:15 – 10:30 a.m.	Concurrent Sessions
10:45 – 11:45 a.m.	Plenary: Tyrone Hayes, University of California, Berkeley

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 are designed 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 **#aacustem16**

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 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 improvement efforts. For information about LEAP visit www.aacu.org/LEAP.

PROGRAM OF EVENTS

THURSDAY, NOVEMBER 3, 2016

VALET ENTRANCE, LOBBY LEVEL

10:00 A.M. – 7:00 P.M. CONFERENCE REGISTRATION AND MEMBERSHIP INFORMATION

2:00 – 5:00 P.M. PRE-CONFERENCE WORKSHOPS

Separate registration and fee required (\$125 members; \$195 non-members) *Check in at conference registration desk for more information about available workshop tickets.*

TERRACE, LOWER LOBBY

WK 1: Achieving 21st Century Skills for STEM Success

Based on a growing body of literature in science education, the academic community knows “what works” in the STEM classroom---what works to help our students better understand the content of a discipline and gain the 21st century skills necessary to conduct investigations in different areas of science. 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, systems modeling, critical thinking, quantitative reasoning, communication, and experimental design, among several others. While we know what works and, while faculty have knowledge of evidence-based methods, the problem in gaining widespread use of these improved pedagogies seems to be in the actual implementation of active learning into the classroom. This workshop will focus on providing faculty with the tools they need to help students develop the skills necessary to be successful in today’s technology and science-driven world. During this workshop, we will provide examples of evidence-based methods and engage participants in activities that can be immediately implemented in their classrooms or adapted for use in other learning environments. Participants will also learn how to work with colleagues to implement these methods across their programs and departments.

Susan Elrod, Provost and Executive Vice Chancellor for Academic Affairs—University of Wisconsin – Whitewater; and Gordon Uno, Chair, Professor of Plant Biology and David Ross Boyd Professor of Botany—University of Oklahoma Norman

BEACON HILL, FOURTH FLOOR

WK 2: Pre-Service STEM Teacher Education

Traditional, lecture-style STEM teaching has been shown to diminish student learning outcomes, retention, and interest in STEM fields. This potentially poses a major threat to U.S. global preeminence in science and technology. Critical to addressing the need for better STEM teaching practices is the development of K–12 teachers who are competitively trained in STEM disciplines, culturally responsive, and liberally educated. This pre-conference workshop will explore a next generation (2030) vision for K-12 STEM teacher preparation based on work currently being done in Washington State. Participants will have the opportunity to examine how collaboration and leveraging of existing resources within and between institutions can support systemic changes in STEM teacher preparation that benefit all students and support K-12 schools in the implementation of the Next Generation Science Standards and Common Core State Standards in Mathematics and Language Arts.

Ed Geary, Director of Science, Mathematics, and Technology Education—Western Washington University; and Paul Kuerbis, Professor of Education Emeritus—Colorado College

ARLINGTON, SECOND FLOOR

WK 3: Accelerating Systemic Change Network (ASCN)

ASCN is a newly formed network intended to serve as an intellectual home for individuals and groups who are engaged in creating or studying institution-wide change in undergraduate STEM education in the full range of institutional settings. Development of a coherent, interdisciplinary professional network will help capture what is known and emerging about leading and evaluating change efforts on campuses around the country. This new network will also afford participants opportunities for synergistic exchange and collaboration among the variety of campus and state system efforts now in progress.

ASCN is structured around a flexible set of topical working groups, at present:

- Working Group 1: What theories and models should be used to guide change efforts?
- Working Group 2: What are the costs and benefits of change?
- Working Group 3: Who leads change and how?
- Working Group 4: How can measurement and communication be used to promote change?

This workshop invites participants to join the conversation in one of these working groups, and/or suggest and develop other themes. Faculty, staff and administrators who are involved in other STEM networks focused on institutional change or who are leading campus wide change projects or looking to begin such work are invited to join this workshop to meet, share and learn from others who are so engaged. Participants will leave with a better understanding of how to lead change efforts on their own campuses and an opportunity to join this new network.

Charles Henderson, Professor, Physics Department and Mallinson Institute for Science Education—Western Michigan University; and **Linda Slakey**, Senior Fellow—AAC&U

CAMBRIDGE, FOURTH FLOOR

WK 4: 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 Summer 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. This highly-interactive workshop will serve two purposes. First, it will introduce participants to the underlying theory that supports Project Kaleidoscope's unique approach to leadership development. Second, it will 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, College of Science and Mathematics and **Sylvia Nadler**, Affiliate, College of Science and Mathematics—both of James Madison University; **Mary Majerus**, Professor, Mathematical Sciences—Westminster College; and **Brandon Schwab**, Associate Professor, Academic Affairs—Western Carolina University

GRAND BALLROOM, SECOND FLOOR

7:00 – 8:15 P.M. **WELCOME REMARKS AND KEYNOTE ADDRESS**

Welcome Remarks

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

Carlos E. Santiago, Commissioner—Massachusetts Department of Higher Education

Lynn Pasquerella, President—AAC&U

Keynote

Educating the Innovators of the 21st Century

Eric Mazur, Balkanski Professor of Physics and Applied Physics and Area Dean of Applied Physics—Harvard University

Can we teach innovation? Innovation requires whole-brain thinking — right-brain thinking for creativity and imagination, and left-brain thinking for planning and execution. The prevalent approach to education in science and technology focuses on the transfer of information, developing mostly left-brain thinking by stressing copying and reproducing existing ideas rather than generating new ones. Dr. Mazur will show how focusing in class on questioning and promoting social interaction leads to deeper learning and independent thinking. He also will present a new approach to getting every student to prepare for every class using a new social learning platform that uses a combination of intrinsic and extrinsic motivation factors.

GEORGIAN, SECOND FLOOR

8:15 – 9:00 P.M. MEET ACC&U PRESIDENT PASQUERELLA RECEPTION

Join in this opportunity to meet Lynn Pasquerella, AAC&U President, visit with colleagues, and begin to plan your schedule for the conference.

FRIDAY, NOVEMBER 4, 2016

EXETER FOYER, SECOND FLOOR

7:30 A.M. – 5:30 P.M. CONFERENCE REGISTRATION AND MEMBERSHIP INFORMATION

GRAND BALLROOM, SECOND FLOOR

8:30 – 10:00 A.M. POSTERS AND CONTINENTAL BREAKFAST

Please join in this opportunity to learn about some of the latest research findings and promising approaches for advancing pedagogy; high-impact practices; STEM faculty professional development; assessment and evaluation; and strategies for change taking place on campuses across the country. Posters will include evidence of success and provide resources for participants.

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

POSTER 1: Flipping Calculus: Impact on Student Learning and Challenges of Effective Implementation

The flipped classroom has received much attention, but questions have been raised about effective implementation and the impact on student learning. As part of an initiative to improve calculus courses, in-class active learning was promoted. Of fourteen instructors, five implemented a fully flipped classroom while the others used a variety of approaches from semi-flipped to full lecturing. A study was conducted to determine the impact of these approaches on student learning. Modest results indicate the importance of engaging students in all elements of the course, particularly outside-of-class activities. The research design, assessments, and study outcomes will be shared. *Participants will* more deeply examine the flipped classroom method of teaching and possible challenges for its impact on student learning. Participants will gain a better understanding for how to design and conduct a research study which assesses the impact of different instructional methods on student learning. Although this study is situated in introductory calculus courses, it should be transferable to other courses. As part of the presentation, participants will be introduced to a variety of data gathering tools including classroom observation tools, as well as those assessing student learning and levels of engagement within a course.

Kathleen Koenig, Associate Professor of Physics—University of Cincinnati

POSTER 2: The Future of STEM Education: Outcomes and Implications from Two Programs

This poster will present a brief history of, as well as ongoing assessment data from, a highly successful duo of grant-funded programs at Virginia Tech: The Summer Bridge Program and the Curie Living-Learning Community. The focus of the poster will be two-fold. First, evidence will be presented as to the effectiveness of innovative practice in these programs, intended to enhance undergraduate students' academic experiences. Second, the poster will suggest strategies to sustain and enhance successful practice in STEM education as a result of the two programs' successes. *Participants will* discuss the implications of the evidence presented; generate ideas for future strategies that will enhance undergraduate STEM education; and provide insight into effective, institution-specific strategies to enhance STEM education currently in the practice or planning stages.

Matthew Grimes, Assessment Coordinator, Virginia Tech NSF STEP Grant, ***Stephanie Lewis***, Postdoctoral Fellow, Office of Undergraduate Academic Affairs, and ***Courtney Vengrin***, Postdoctoral Associate, Office of Undergraduate Academic Affairs—all of Virginia Tech

POSTER 3: Greater Than the Sum of Parts: Team-Taught, Modular, Interdisciplinary STEM General Education Courses

This poster will describe DePauw University's model for a team-taught, modular, interdisciplinary general education course in which faculty members from a variety of STEM departments teach modules on important scientific advances of their own choosing. It will feature a structure for sequencing and building off of the modules so that students master key learning goals in multiple disciplinary contexts and are guided in comparing and contrasting disciplinary approaches for conducting science. The presenter will describe a short workshop process for coordinating instructors' modules, developing "synthesis days," and calibrating expectations and student workload across modules. He will provide concrete examples of course material, review the effectiveness of this approach, and discuss benefits for interdisciplinary faculty development. *Participants will* learn a model for an effective team-taught, interdisciplinary STEM course that teaches science literacy skills from multiple disciplinary perspectives and discuss ideas for assessing the short-term and long-term effectiveness of this type of course.

Michael Roberts, Associate Professor of Psychology and Neuroscience—DePauw University

POSTER 4: Liberal Studies in Engineering: An Interdisciplinary Pathway into Engineering

This poster will outline a Liberal Studies in Engineering program structure and the pathway to its implementation will be described. *Participants will* see how this new program will fit into the current slate of available academic programs, with a specific focus on implementation at the community college level. Participants will also see how the community college represents an increasingly common entry point for the higher education experience and how the mission, programs, and faculty are part of a flexible and highly collaborative network where new programs can be quickly implemented and assessed.

Louis Bucciarelli, Professor of Engineering and Technology Studies—Massachusetts Institute of Technology; and **Laura Vosejka**, Professor of Physical Science—Mid Michigan Community College

POSTER 5: Cultivating a Community of STEM Polymaths through Transdisciplinary Laboratory Experiences

To increase student persistence in STEM and foster scientific understanding while also inspiring passion for scientific engagement, UNG STEM faculty from biology, chemistry, mathematics, and physics designed and developed an integrative and transdisciplinary laboratory curriculum. The transdisciplinary lab course was piloted in Spring 2016 with 24 STEM majors enrolled. This poster will present narratives of the experiments and some examples of the students' research papers and oral presentations. It will focus on the design and implementation of the lab, as well as initial assessment results, which capture how the students' quantitative reasoning skills improved through their engagement in this transdisciplinary lab. *Participants will* recognize the impact that a transdisciplinary laboratory experience has on improving students' quantitative reasoning, retention, and interest in STEM. They will learn about potential interdisciplinary topics to implement at their institution as well as how to design and implement a transdisciplinary lab course at a predominantly undergraduate liberal arts institution.

Sarah Formica, Fuller E. Callaway Professorial Chair and Associate Professor of Physics, **Royce Dansby-Sparks**, Associate Professor of Chemistry, and **Margaret Smith**, Assistant Professor of Biology—all of University of North Georgia

POSTER 6: Using Hops as a Tool to Integrate Research into the Introductory Biology Classroom

This poster will address a new paradigm by which an introductory biology laboratory can be taught using a cohesive inquiry-based model that thematically fits with a biological survey lecture course. This model is effective in giving introductory students the mental tools that they will need to succeed both in more advanced coursework and in preparing for potential careers in the STEM disciplines. It also introduces Hops as an emerging model system that is relatively inexpensive, easy to use, and an excellent source for developing projects of scientific and commercial applicability to students. *Participants will* come to an improved understanding of the efficacy of Hops as a vehicle for introducing prospective STEM undergraduates to the scientific process. They will see how an analysis of Hops and its fungal pathogens can dovetail with the gamut of topics commonly found in an introductory biology course, including ecology, physiology, genetics, molecular biology, and bioinformatics.

Michael Wolyniak, Associate Professor of Biology and Director of Undergraduate Research—Hampden-Sydney College

POSTER 7: Using Science in the Media as a Gateway to the Primary Literature

This poster will report on a controlled study, looking at learning outcomes for introductory level biology students when asked to read and answer questions about a primary literature article, with or without a preceding discussion of a mainstream media report on the same topic. The addition of the media article was intended to increase student comprehension and engagement with the primary literature article by introducing the topic in lay terms, anchoring the assignment in something familiar, giving students a sense of "real world implications" for the science, and prompting students to think critically about the differences between lay press and scientific journals. Quantitative and qualitative outcome measures will be reported. *Participants will* gain new ideas for how to effectively integrate and teach primary literature in their science courses.

Heather Rhodes, Associate Professor of Biology and Neuroscience—Denison University

POSTER 8: Gwynedd Mercy University E-STEM Program: Ethics and STEM Capacity Building

The Gwynedd Mercy University Ethics in STEM (E-STEM) program is an NSF grant-supported scholarship program that offers a modular approach for capacity development. The evidence-based modules incorporate ethics, study skills, peer mentoring, and social events to support the recruitment, retention, and academic success of students in STEM majors. In addition, the E-STEM program aims to encourage students to become part of the STEM workforce and improve for students the professional skills and ethical decision-making desired by employers. This ongoing program is prospectively evaluated with a systems mixed methods approach. The format of the program and the methods for analysis will be presented, along with the evidence base for each of the modules that include STEM and non-STEM content. *Participants will* learn how to effectively implement a modular based program for scholarship or as an extracurricular offering to STEM major students, as well as methods for identifying participant, program, and institutional capacity development. Participants will also have access to an adaptable implementation plan to be put into practice at their own institutions.

Michelle McEliece, Natural and Computational Sciences Division Chair, Associate Professor of Biology, **Tara White**, Academic Coach, Lecturer of Biology, and **Christian Hellings**, Mathematics Program Coordinator, Associate Professor of Mathematics—all of Gwynedd Mercy University

POSTER 9: Integrated Sciences First-year Program: Engaging Students in Collaborative Inquiry and Research

The Integrated Sciences First-year Program was piloted and designed to teach systems thinking, improve quantitative skills, make connections among fields of science, foster peer-to-peer mentoring, and create a vibrant science community. In the fall semester of 2015-2016, 34 students took a class in hydrology, applied math or microbiology and completed joint collaborative laboratory projects each week centered around water use/reuse in a living building on campus. Students were assessed throughout the program using rubrics, self-evaluations, and focus group interviews. Preliminary data show this program increased students' understanding of complex systems and their ability to generate testable research hypotheses and complete collaborative independent research. *Participants will* learn methods for collaborative teaching and research that can be implemented at multiple scales including one- and two-semester long courses, modules/units and one-off activities. Methods used to assess student learning focusing on process; an approach for scaffolding student research in the first-year; and methods for creating research communities centered around a common theme will be described.

Christina Cianfrani, Associate Professor of Hydrology and **Sarah Hews**, Assistant Professor of Mathematics—both of Hampshire College

THEME II: SUPPORTING, REWARDING, AND BUILDING CAPACITY OF STEM FACULTY**POSTER 10: Instructor Mentorship Networks as a Tool to Sustainably Improve STEM Student Engagement and Learning Outcomes**

This session will address the need for sustainable reform to STEM teaching practices that will allow a more experiential-based paradigm to develop across all types of American educational institutions. It will describe a pair of mentorship networks developed by the American Society for Cell Biology Education Committee to meet this pedagogical challenge. The Promoting Active Learning and Mentoring (PALM) Network and Mentoring in Active Learning and Teaching (MALT) Program promote long-term mentorships that can lead to developing sustainable STEM lecture and laboratory teaching models, respectively, that conform to recognized best STEM teaching practices. *Participants will* learn about long-term mentorship networks as a potential effective strategy for

enacting strong and sustainable reform to STEM teaching practices at their institutions. They will also understand the potential role that professional societies can play in developing inter-institutional educational collaborations that facilitate such reform.

Michael Wolyniak, Associate Professor of Biology—Hampden-Sydney College

POSTER 11: Seeding Change: Non-Tenure-Track Faculty Transforming Undergraduate Teaching

The faculty model is increasingly differentiated in many modern academic institutions. Ehrenberg (J. Econ. Perspect., 2012) reports that non-tenure-track (NTT) faculty increased between 1995 and 2007 from 24% to 35% at public doctoral institutions and from 18% to 46% at private non-profit doctoral institutions. For many large institutions, therefore, student retention and progression depends on the abilities and dedication of the NTT faculty. Resources to enhance the effectiveness of NTT faculty include opportunities for faculty learning communities, exposure to innovative teaching strategies, and opportunities for faculty to develop their own scientific ideas in course-based undergraduate research settings. Mini-grants have proved to be especially effective; requirements for quantitative data encourage effective use of scarce resources. *Participants will* learn of the teaching effectiveness of NTT faculty; and see how mini-grant projects lead to changes in course outcomes, including progress in high stakes STEM courses. The role of faculty learning communities will be highlighted.

Dabney Dixon, Coordinator of STEM Education Initiatives and Professor of Chemistry—Georgia State University

POSTER 12: Using Faculty Learning Communities to Develop and Sustain Interdisciplinary STEM Initiatives

Two year-long STEM Faculty Learning Communities (FLCs) at Miami University are focused on creating a culture of collaborations across STEM departments to enhance research, education and outreach. FLC membership varies from 10-12 participants per group, drawn from the College of Arts and Sciences, School of Education and the School of Engineering. FLC members are engaged in activities that intend to 1) develop awareness of national efforts in STEM education and research; 2) collaborate in developing instructional pedagogies that improve retention in STEM and especially the success of underrepresented student groups; and 3) enable pathways for faculty to develop educational outreach activities that stem from their research, extend the impact of to the K-12 level, and serve the recruitment of undergraduates to Miami University. The FLCs are helping shape a vision for a Center for Excellence in STEM that currently does not exist at Miami. *Participants will* learn how institutional needs which guided the establishment of the STEM Faculty Learning Communities (FLCs) were identified; how the goals for the FLCs were set up; how meetings and projects were structured through the year; and how the goals were assessed. *Participants will* also learn how FLC members worked toward benefitting their own research and teaching practices, the opportunities presented by such forums to facilitate learning and professional development, and how to develop and establish collaborative instructional strategies.

Joyce Fernandes, Professor of Biology—Miami University

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

POSTER 13: Broadening System-Wide STEM Success for Students throughout Massachusetts

Massachusetts is in the midst of an innovative, full-scale initiative to transform its community college STEM education pathway. The STEM Starter Academy (SSA) program has engaged over 10,000 students in the past two years—many who come from underrepresented minority backgrounds or low-income backgrounds—to focus on improving student recruitment, readiness, retention, and completion. The primary goal of this program is to graduate more community college students with STEM degrees and certificates so they can either successfully transfer to a four-year institution or enter the workforce. The secondary goal is to recruit more students into the STEM pipeline at the community colleges. *Participants will* learn about the design and evolution of the SSA program, successful strategies undertaken and many still in development, formative evaluation data and outcomes, and challenges still ahead. They will see evidence based strategies for recruiting, retaining, and supporting enrolled community college STEM students through to academic completion or job attainment. Many of these lessons and best practices might also be implemented at four-year institutions.

Allison Little, Executive Director of Science, Technology, Engineering, and Mathematics and **David Cedrone**, Associate Commissioner—both of Massachusetts Department of Higher Education

POSTER 14: Increasing Retention and Persistence in STEM: Challenges of Transferring a Successful Model to Other Disciplines

When a model has been shown to be successful in increasing persistence and retention in a science discipline, especially for students from historically underrepresented groups, how do other disciplines implement it? The Chemistry Department at Duke University has created a successful model that improves persistence and retention in STEM. The department uses high school background information and an assessment quiz to place students into one of four initial courses, tailored for various levels of experience. The department also works closely with advisors to ensure students are placed correctly into classes. The success of the chemistry model has inspired the Biology Department to implement similar curricular changes. However, the requirements of the biology major have made it challenging to follow the successful chemistry model. *Participants will* be able to 1) describe successful models for increasing persistence and retention in science disciplines, especially for historically underrepresented minority students; 2) identify challenges of transferring a successful model in one discipline to another; 3) identify aspects of models that could move across disciplines within a college or between institutions; and 4) discuss approaches in advising that complement these models for increased retention in STEM.

Dorian Canelas, Assistant Professor of the Practice, Chemistry and Lee Willard, Associate Vice Provost for Undergraduate Education—both of Duke University

POSTER 15: Broadening Participation of Underrepresented Students in STEM: a First-Year Research Program

Early research experiences can be effective at increasing participation and persistence of underrepresented students in STEM. Research also suggests that community building among students can be critical to persistence of vulnerable students in STEM. This poster will describe a model program for increasing persistence in STEM centered on first-year research in an undergraduate college. Topics will include student recruitment, program details, and assessment strategies. *Participants will* learn about the development, assessment, and cost-effective institutional transportation of a model to increase persistence of underrepresented students in STEM through student-mentored research experiences. Assessment of this program included a pre- and post- program assessment (written, as well as focus groups) to identify the level of science self-identification among incoming program participants. Participants will discuss cost-effectiveness of the program and the ability of students to participate in research labs as first-year students.

Julia Paxson, Assistant Professor and Ken Mills, Professor—both of College of the Holy Cross

POSTER 16: The Summer Bridge Experience: Providing Connections from Community College to the Four-Year Institution

The SCCORE program assists community college students in STEM with transition/acclimation to university culture and research. Participants reside on a university campus, attend a credit-bearing seminar, participate in faculty-mentored research, receive year-round advising, and gain a network of support. Of the 167 participants, 69% have transferred to four-year degree programs, with 13% currently enrolled in pre-transfer programs. Of those who have transferred, 82% have either earned or remain on track to earn STEM B.S. degrees. This poster will describe goals and objectives; program components; best practices/strategies; assessment methodology; and outcomes. *Participants will* learn about the benefits of a summer program that helps students bridge the gap between community college and university and a best-practices model for faculty and/or administration/staff who are interested in setting up their own research-focused program. Participants will learn about the successful components of the program and the impressive outcomes of the program, including transfer and graduation data and graduate school entrance and completion. Assessment methods will also be addressed, including formative and summative evaluation data that are used to improve and to assess the impact and success of the program.

Jeanne Garland, Alliance Senior Program Manager and Assistant Director and Gabriella Cisneros, Staff Engineer and Assistant Director—both of New Mexico Alliance for Minority Participation, New Mexico State University

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

POSTER 17: Assessment and Evidence for High-Quality Biology Teaching and Learning

This poster will describe how assessments are conducted at three points in a biology major's time at the University of Minnesota. Slightly modified versions of these assessments are given at the beginning and end of each non-majors course in the college. The science process skills assessment measures critical scientific thinking skills

without relying on self-report, which has been shown to correlate poorly with actual skills. The second survey, the Pathways Survey, measures critical psychosocial and affective attributes that may be associated with retention of students in STEM disciplines. Other assessments are given once, at key junctures in the undergraduate experience. During the three-day summer orientation experience that all students in the major attend, students are given a formative assessment whose primary function is in helping students adjust their understanding of what college expectations of them will be and what high quality learning looks like at the U of M. *Participants will* explore how a diverse set of courses and programs are assessed, learn about some of the findings, and how a multi-dimensional, multi-level assessment strategy can examine not only knowledge students have gained but also ways in which they have been transformed.

David Matthes, Professor, Teaching—University of Minnesota

POSTER 18: Enculturating Peer and Instructor Critique in a Transdisciplinary Technology Studio Environment

This poster will explore undergraduate STEM students' perceptions and ability to engage in critique in studio learning experiences during their first four semesters in college. Participants were enrolled in an experimental undergraduate program focused on competency-based learning. Students were provided frequent opportunities for exposure to peer and instructor feedback through formal and informal critiques, which encouraged students to modify their design approach. Enrolled students engaged in transdisciplinary experiences spanning multiple domains within technology and the humanities, while gaining both technical and non-technical competencies. Students worked in a studio environment, engaging in design activity with their peers, mentors, and instructors through studio critiques, a primary form of both assessment and instruction in the studio environment. Their experiences in providing formative feedback through critique may inform educators working in STEM fields. *Participants will* learn of the potential impact of critique in STEM education and see examples of the use of critique within a competency-based, transdisciplinary, studio setting which will inform them in designing formative feedback structures for students in similar environments. These students' perceptions could inform instructional developers who are considering using or are currently using critique to better understand how students in STEM disciplines perceive and accept feedback and use it to further their design ability.

Denise Wilder, Doctoral Candidate, Building Construction Management and **Colin Gray**, Assistant Professor, Computer Graphics Technology—both of Purdue University

POSTER 19: A Theoretical Framework to Assess Self-Management, Task Management, and Team Management

This poster will describe the Framework for Professional Responsibilities and discuss how it can be used to assess the identified skills and dispositions within self-management, task management, and team management in formal and informal environments. It will also explore whether and how the framework can be applied across STEM disciplines to support learning, as well as, to assess students' skills and dispositions, and to potentially provide evidence for program assessment, if applicable. This framework will be discussed within an underlying theory of change. *Participants will* have an opportunity to 1) understand the theoretical framework components and how they are related; 2) situate the work within formal and informal settings across STEM disciplines; and 3) understand the role of competitions to support broader student learning of professional responsibilities.

Lori Bland, Associate Professor—George Mason University

POSTER 20: Innovative Teaching Approach Increases Student Engagement, Course Performance, and Persistence

This poster will present an innovative new teaching approach that utilizes technology to help instructors monitor every students' concept mastery and empowers students through self-assessment and to discover their own erroneous thinking about a concept. It will offer practical strategies for using various assessment tools, including existing data sources, classroom observations, and content analysis, to effectively evaluate student-centered pedagogical practices in STEM courses. In courses with high enrollment, instructors may struggle to figure out how each student is approaching a concept and students can face challenges to ensure that their thinking is correct. Utilizing data from ten years of an introductory bioinformatics course, the presenters analyzed student course records, registrar data, instructor communications and records, classroom observations, recorded lectures, and course exams, to consider this shift towards more student-centered pedagogical practices. *Participants will* be introduced to Open Response Concept Testing (ORCT) and results of the comprehensive assessment efforts used to test the effectiveness of ORCT in an introductory STEM course (research methodology, analyses, and findings).

Christopher Lee, Professor, Chemistry and Biochemistry—University of California, Los Angeles

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

LEAP FEATURED SESSION*

POSTER 21: Strategic Planning Grounded in Best Practices as a Driver of Change Within and Beyond STEM

Strategic planning within and across units at academic institutions can help to reaffirm mission, articulate values, and create a vision for the future. Yet, launching and implementing a strategic plan can be challenging. The sciences at Smith College recently undertook such a plan informed by local perspectives, assessment data, and cutting-edge principles and practices of STEM education, including those articulated by AAC&U's LEAP initiative. This process propelled meaningful change by impacting campus-wide strategic planning, increasing faculty interest in best-practices pedagogy, and providing clarity about, and emerging success in, funding efforts within and beyond the institution. This poster will discuss strategic planning approaches that tie local conversations with broader thinking about STEM education. It will feature challenges, underlying principles, and relevant assessments that influence and define strategic planning. *Participants will* learn how to lead strategic planning conversations that articulate meaningful and well-received strategic directions tied to authentic priorities and principles of an academic unit or institution. They will learn about the successes, challenges, and principles of shepherding and implementing a collaborative and well-grounded strategic plan that leverages local conversations with broader thinking about best-practices in STEM, including the principles and practices articulated by AAC&U's LEAP initiative. Finally, participants will learn how strategic planning goals within a unit can help influence planning and priorities across the broader institution.

Patricia DiBartolo, Faculty Director of the Sciences and Professor of Psychology, **Kevin Shea**, Professor of Chemistry, and **Minh Ly**, Associate Director for Assessment—all of Smith College

POSTER 22: First in the World: Developing A STEM Faculty Learning Community Across Three California State Campuses

This poster will examine the challenges of structuring a multi-campus, multi-disciplinary faculty learning community as part of the First in the World grant at San Jose State University, California State University, Los Angeles, and California State Polytechnic University, Pomona. It will describe the content, activities, and guided inquiries utilized to assist faculty in developing curriculum and course content, along with supporting them to be agents of change on campus and across the California State University system. *Participants will* take away ideas that can be utilized to bring support to faculty across diverse institutions through a Faculty Learning Community that have the common goal of evolving teaching pedagogy on their campuses and becoming agents of change.

Laura Sullivan-Green, Associate Professor of Civil Engineering and **Patricia Backer**, Professor—both of San Jose State University

POSTER 23: Implementation of Interdisciplinary Student Research Semester: Design Phase

New initiatives for undergraduate research typically result in many unforeseen pitfalls but also many unforeseen rewards. This poster will describe how to acquire support for a program, both externally and institutionally. It will outline an undergraduate research initiative including discussion of proposed ideas, project selection criteria, faculty responsibilities, student selection processes, and outcomes from the research project. *Participants will* engage in a discussion of the benefits and drawbacks of an interdisciplinary research project; learn about the barriers and identify possible barriers at their own institutions; and consider how to overcome such obstacles.

Daron Barnard, Director of Center for STEM Research and Education and Associate Professor of Biology, **Linda Larrivee**, Dean, School of Education, Health, and Natural Sciences, and **Jeremy Andreatta**, Assistant Professor Department of Chemistry—all of Worcester State University

POSTER 24: Sustainable Models of STEM Education Reform: A Survey of Institutional Factors

The use of best practices in STEM education can increase learning and retention of science students. While many STEM faculty have been exposed to evidence-based models of instruction, widespread adoption and assessment of these techniques are still limited. Departmental and institutional practices can encourage, or unintentionally discourage, the adoption of evidence-based teaching. With this in mind, this poster will examine institutional infrastructure and practices, such as curricular and staffing decision-making, faculty review procedures, course

evaluations, and administrative and technological support of teaching. *Participants will* take away a list of best practices for implementation and institutionalization of evidence-based STEM teaching at their institution suggested by the analysis of this faculty survey of institutions with advanced efforts in this area. They will gain context for these questions in light of research on faculty development and institution reform.

Rachelle Spell, Senior Lecturer—Emory University; **Lawrence Blumer**, Professor—Morehouse College; and **Gordon Uno**, David Ross Boyd Professor—University of Oklahoma

GEORGIAN, SECOND FLOOR

9:15 – 10:00 A.M. AAC&U NEWCOMERS' WELCOME AND INTRODUCTION TO LEAP

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—AAC&U

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

BERKELEY/CLARENDON, SECOND FLOOR | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Facilitated Discussion*

CS 1: Scientific Decisions for Everyday Life: Engaging Teams of Scholars for Interdisciplinary Learning

How can educators work together to design high-impact practices that enhance student learning? Team-teaching and undergraduate peer mentoring were used by faculty to design and implement novel courses for STEM and non-STEM majors. In the majors course, learning gains of students enrolled in research-infused labs were compared to those in traditional labs. Data demonstrated a positive correlation between research infusion and self-reported learning gains. *Participants will* be able to plan, design, and implement a real-world example of a novel course for STEM or non-STEM majors, by incorporating interdisciplinary team teaching and/or peer mentoring. Implementation of this intervention will develop a framework for inclusion of a STEM course-based research experience and a STEM interdisciplinary course redesign. Long-term outcomes include satisfaction of student's learning and mentoring experiences and increased retention and persistence of STEM majors.

Mohammad Ahmed, Associate Professor, Department of Mathematics and Physics and **Porche' Spence**, Postdoctoral Fellow, Center for Science, Math, and Technology Education—both of North Carolina Central University

TERRACE, LOBBY LEVEL | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Facilitated Discussion*

CS 2: A Comparison of STEM Students' Expectations for Engagement and Faculty Teaching Practices

A misalignment of first-year student engagement expectations and the teaching practices of STEM faculty can undermine first-year students' engagement in effective educational practices. Facilitators and participants will examine the results from 68 institutions who have participated in two large-scale national surveys to compare the engagement expectations of first-year STEM students and the teaching practices of lower-division STEM faculty. *Participants will* learn about ways to collect information about STEM students' engagement in a variety of effective educational practices; students' engagement expectations and faculty practice; and discuss what it means to align faculty-teaching practices with student expectations.

Allison BrckaLorenz, Project Manager and Research Analyst and **Jim Cole**, Project Manager and Research Analyst—both of Indiana University Bloomington

STATLER, SECOND FLOOR | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Facilitated Discussion*

CS 3: Deliberate Investment: Strategies for Sustaining Inclusive STEM Classrooms for First-Generation Students

Deliberate investments are necessary for sustaining inclusive classrooms for first-generation college students pursuing STEM fields, particularly in the first semester. Effective strategies include embedded scaffolding for problem-solving, peer mentoring, and intentional connection with students to promote trust. Participants will be

asked to discuss three challenges that threaten sustainability and scalability: 1) increasing science enrollments and stagnant budgets; 2) faculty ambivalence or lack of information about working holistically with students; and 3) lack of faculty access to classroom strategies to improve scaffolding and transparency of learning strategies. Facilitators offer strategies and invite additional strategies to be generated. *Participants will* learn about strategies at three different institutions and within the research literature more broadly. They will also identify key barriers and strategies for addressing those barriers including ways to engage with faculty, staff, and administrator colleagues. Research is known and shared, but without strategies to enlist support including budget and infrastructure, important strategies are not likely to be sustained over time.

Mary Hatcher-Skeers, *Professor of Chemistry, Keck Science—Claremont McKenna, Pitzer and Scripps Colleges;*
Darryl Yong, *Professor of Mathematics—Harvey Mudd College;* and **Becky Packard**, *Professor of Psychology and Education—Mount Holyoke College*

WHITTIER, FOURTH FLOOR | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Facilitated Discussion*

CS 4: The Global Bridge at VCU: Closing Academic and Cultural Spans in First-Year Math Courses

VCU's Global Bridge was designed to develop in faculty "culturally competent pedagogical strategies on how to respond in culturally sensitive ways" and in students "the ability to successfully communicate and work with learners from other cultures" Gopal (2011). The program took as its foundation Deardorff's (2009) intercultural competence model, seeking to develop attitudes, knowledge and comprehension, and skills, through a deliberate focus on academic content and a highly intentional discursive approach to pedagogy and assessment. This session will set the context for conversation by sharing the theory behind the Global Bridge as it relates to faculty development and the instructional strategies and techniques that Math faculty at VCU found most useful in teaching Algebra to international students and non-native English speakers. Topics for discussion will include scaffolded Math instruction; language acquisition in the Math classroom; student development of intercultural competence in the STEM context; and inclusive pedagogical practices in the STEM classroom. *Participants will* gain a greater sense of and ability to respond to the particular challenges faced by international students and non-native English speakers in the U.S. STEM classroom and by the faculty teaching them. They will learn about scaffolding, inclusive syllabus and assignment construction, and intercultural modeling; helpful ideas about content, skills, language acquisition, and inclusive communication; and the basics of assessing intercultural competencies among students and faculty and of content skills and knowledge development among students.

Amber Hill, *Director of International Student and Scholar Program and English Language Program,* **Terry Franson**, *Academic Advisor and Instructor, Department of Teaching and Learning,* and **Hilary Cassil**, *Instructor, Department of Mathematics—all of Virginia Commonwealth University*

CAMBRIDGE, FOURTH FLOOR | *Supporting, Rewarding, and Building Capacity of STEM Faculty I Facilitated Discussion*

CS 5: Situating Undergraduate STEM Reform within Teaching Development and Inquiry Groups: The SIMPLE Principles for Enacting Change

Session facilitators will describe the SIMPLE principles for teaching development groups and discuss the underlying theory of change, including the affordances for and barriers to change; the institutional need and context in which the project has operated; how the principles were enacted to support development of faculty leaders as change agents, to engage faculty development in interactive teaching strategies, and to develop faculty interest in STEM pedagogical research; and to consider how to identify and examine outcomes related to implementation of faculty processes, including sample components in design artifacts. *Participants will* have an opportunity to understand the broad project in a large group setting, examine and review artifacts from the teaching development groups, and examine barriers and affordances related to sustaining teaching development groups.

Lori Bland, *Associate Professor* and **Jill Nelson**, *Associate Professor—both of George Mason University*

ARLINGTON, SECOND FLOOR | *Inclusive Excellence/Broadening Participation in STEM Higher Education I Facilitated Discussion*

CS 6: Building Community to Broaden Participation in the STEM Pipeline: A Multi-Tiered Approach

Session facilitators will provide evidence of why 'belonging' is critical for students to persist in STEM and outline evidence-based initiatives that work for building community and enhancing the recruitment and retention of underrepresented groups in the STEM pipeline. They will also briefly discuss typical barriers to building community. Activities will allow participants to identify barriers in their own discipline and institution, brainstorm

on how to break down those barriers, and form partnerships of practice for long term engagement in community building. These partnerships will help support cultural change and long term impact at the participants' departments and institutions. Session facilitators will present a short panel on best practices and the Simmons model for building communities for STEM inclusion. They will seat participants at round tables where they have at most one disciplinary colleague and at most one institutional colleague and move to facilitated discussions around the central theme using the following discussion prompts. What are the barriers – both disciplinary and institutional – which you face in building community for STEM? What can you do and whom can you partner with to break down those barriers? Each table will then report out to the group their three main barriers and three best approaches to overcoming those barriers. *Participants will* be able to assemble a toolkit of “best-practices” for establishing a community of scholars across diverse groups; identify members of their discipline and of their institution who could form communities of practice; identify novel opportunities for inter-disciplinary collaborations to engage students in the STEM communities; and create a work plan to develop these initiatives. **Jennifer Canfield**, Professor of Chemistry and Physics, **Margaret Costello**, Assistant Professor of Nursing and Health Sciences, **Amanda Carey**, Assistant Professor of Psychology, and **Anna Aguilera**, Assistant Professor of Biology—all of Simmons College

BEACON HILL, FOURTH FLOOR | *Assessment and Evidence for High-Quality Undergraduate STEM Learning I Facilitated Discussion*

CS 7: Assessment Alignment: Including Undergraduates in A Process for Program Evaluation

This session will address the need for processes to collect learning outcome assessment data in established programs. A Learning Outcomes Framework that aligns learning outcomes at the course, major, program, and university levels will be presented. Senior undergraduate students analyzed almost 1,600 pre-existing questions from assessments in core courses required for all Molecular and Cellular Biology (MCB) majors at the University of Guelph using this Learning Outcomes Framework. Students assigned a Bloom's Taxonomy level to all questions using a calibrated method. The students presented analyses of their data with instructors and curriculum committees at an annual meeting to inform improvement of course learning outcome alignment with assessment. *Participants will* engage in discussion of the framework and student findings and share thoughts regarding the challenges and opportunities of engaging our students in the development and assessment of learning outcomes. Participants will be able to apply a learning outcome framework to their own institutional and program context; analyze Learning Outcome Framework data to identify strengths and weaknesses in courses and programs; and learn the value of the undergraduate student voice in discussions around learning outcomes development.

John Dawson, Director, College of Biological Science Office of Educational Scholarship and Practice—University of Guelph

WHITE HILL, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Facilitated Discussion*

CS 8: Rewarding What We Value: The Role of Promotion and Tenure Guidelines

Reform and change can be stymied by a variety of factors. One of these factors is aligning values with reward systems. In most departments and colleges, an important document is the tenure and promotion guidelines. This codifies the institutional value system, but often escapes scrutiny or change. Session facilitator and participants will explore the challenges and pitfalls of these documents for STEM programs and investigate different ways to match beliefs and expectations for faculty work. *Participants will* be able to articulate key issues in revising promotion and tenure documents; reflect on aligning promotion and tenure documents with unit and institutional mission and goals; develop a plan to revise promotion and tenure documents for their unit; and appreciate the challenges that comes with rethinking promotion and tenure guidelines.

Robert “Bob” Kolvoord, Dean, College of Integrated Science and Engineering—James Madison University

NEWBURY, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Facilitated Discussion*

CS 9: STEM-Led Institutional Change through Technology-Mediated Advising Reform at a Two-Year Institution.

STEM programs can be challenging, especially for underrepresented two-year students. Career confusion, time constraints, developmental needs, and correct course sequencing can all pose barriers to two-year students. Colleges and universities across the country are increasingly looking to technology to support institution reform of advising services. Leveraging technology to create career and academic plans helps creates a cohesive experience

for students as they progress through their STEM programs. This type of technology-mediated advising reform is known as Integrated Planning and Advising for Student Success (iPASS). Session facilitators will examine how STEM departments can lead the institution in iPASS reform through attention to technology, data, and organizational change strategies. Utilizing a two-year technical college's institutional data and experience pursuing transformative change through iPASS, this session will explore new strategies for implementing effective STEM student support practices. Participants will gain knowledge about iPASS and technology-mediated advising; understand the definition and components of Kemplin and Karp's (2015) definition of transformation institutional change through iPASS; and examine strategies for STEM-led transformative institutional change which include technology assessments, change management training, action plans, and comprehensive communication plans. **Laurie Fladd**, Associate Dean of Science and Mathematics—Trident Technical College; and **Mei-Yen Ireland**, Associate Director of Data and Technology for Students Success—Achieving the Dream

GEORGIAN, SECOND FLOOR | *Innovation/Ideation Session*

CS 10: Measuring Change; Improving Persistence in STEM Majors; and New Paradigm in Physics Pedagogy

This session will include three distinct presentations as described below.

Moderator: Karen Kalla, Director, Network for Academic Renewal—AAC&U

Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform

A New Scale to Measure the Likelihood of Adopting Evidence-Based Instructional Practices

Change is difficult for many, including changing the way college professors teach. Theories of change may be useful in understanding the process by which STEM faculty adopt evidence-based instructional practices, but the predictors of change must be keyed to the specific situation. Although there are models of corporate change (e.g., Dormant, 2011) and theories from health psychology (e.g., the transtheoretical theory of change, Prochaska & DiClemente, 1982), the stages of change in these models must be specifically mapped to the increased adoption of evidence-based instructional practices. Presenters will report results from an initial test of 514 college faculty completing the adoption scale. The specific psychometric performance of the scale items will be shared and the implications for campus-wide efforts and the goals of transformational change discussed. *Participants will* learn about the utility of measuring where faculty members reside regarding their use of evidence-based practices.

R. Eric Landrum, Professor of Psychology and **Karen Viskupic**, Research Professor of Geosciences—both of Boise State University

Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy

The STEM Zone: A Coordinated Effort to Foster Community and Improve Persistence in STEM Majors

Campuses seeking to increase the persistence of their STEM majors face several challenges, including supporting students who arrive underprepared. Evidence demonstrates that one way to support students is to create STEM learning communities that help students both learn science and identify as scientists (Graham et al., 2013). With this in mind, a STEM Zone Program was created to provide a comprehensive approach to support students, both directly through a peer-staffed STEM learning center, and indirectly through faculty development and cultural initiatives. This approach over the past two years has improved student achievement and course persistence. In addition, faculty have become more engaged with students and across disciplines, leading to increased campus-wide dialogues. Presenters will discuss the implementation of the STEM Zone Program, evidence for its successes, and challenges that lie ahead. *Participants will* learn about an inclusive program to promote an introductory STEM learning community that integrates students at all levels with faculty and staff to better support student success and persistence at a small liberal arts school.

Melissa Schen, Director of Educational Assessment, **Katie Boes**, Instructor and Laboratory Coordinator, **Jennifer Bowen**, Associate Professor of Mathematics, and **Kara Melrose**, STEM Zone Coordinator—all of The College of Wooster

Assessment and Evidence for High-Quality Undergraduate STEM Learning

Introductory Competency-Based Cross Disciplinary Physics Curriculum for Non-Physics Majors

The discipline of physics requires strong conceptual cohesion—firm insights into basic practices and definitions are essential for student success. Standard college physics instruction assumes a level of prior physics and mathematical preparation, however, this expectation is often unrealistic. Presenters will compare and contrast

traditional physics pedagogy with a novel curriculum developed for and being tested on students majoring in technical disciplines other than physics. This curriculum will be compared to others in the physics community, identifying ways to improve student reasoning and acknowledgement of conceptual cohesiveness in different situations. Preliminary results of concept inventory assessments will be presented and discussed. *Participants will* explore new paradigms in physics pedagogy intended to focus more on conceptual knowledge, application, and the integration and transfer across disciplines (the notion of competency). Participants should be able to identify the characteristics of pedagogical elements that foster student understanding of essential elemental concepts; integrate practices with a strong focus on applications; maintain clear connections between concepts; and assess student reasoning and acknowledgement of conceptual cohesiveness in different situations.

Ajith Rajapaksha, Assistant Professor and **Jeffrey Evans**, Associate Professor and Associate Dean for Undergraduate Programs—both of Purdue University

1:15 – 2:30 P.M. CONCURRENT SESSIONS

STATLER, SECOND FLOOR | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Workshop-Theory to Practice*

CS 11: Why and How to Design a Sequence of Research Courses for First-Year STEM Students

Research on the Freshman Research Initiative (FRI) at the University of Texas at Austin (UT) has shown that a sequence of faculty-lead research-based courses can successfully engage undergraduates, leading to scientific publications and more graduates in STEM (Rodenbusch et al., in review). The FRI program is a three-course sequence in which students work on faculty-lead research, guided by PhD-level research educators and trained undergraduate peer mentors. FRI-like programs have clear benefits for faculty and students; however, establishing such programs requires considerable planning. Facilitators will share lessons learned and offer guidance for developing a three-research-course sequence for early college students, tailored to participants' institutional objectives and resources. *Participants will* be able to 1) identify advantages of establishing research-course sequences for first-year students; 2) identify what their students and academic units would gain by implementing a first-year research program; 3) identify what institutional issues and priorities can be leveraged to develop support for such a program; 4) evaluate existing courses for potential as part of a research-course sequence; and 5) articulate initial action items relative to their institution.

Stacia Rodenbusch, Director of Freshman Research Immersion—University of Texas-Austin; **Patrick Killion**, Director, First Year Research Programs—University of Maryland, College Park; and **Nancy Stamp**, Director, Freshman Research Immersion (FRI) and Professor of Biological Sciences—Binghamton University

CAMBRIDGE, FOURTH FLOOR | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Workshop-Theory to Practice*

CS 12: Guiding Students to Construct Understanding and Develop Process Skills with POGIL

In a POGIL classroom, teams of 3-5 learners work on activities with active facilitation by the teacher. Through scripted inquiry and investigation, learners discover concepts and construct their own knowledge. Using assigned team roles and other scaffolding, learners develop process skills and individual responsibility. The teacher is not a lecturer, but a facilitator who helps to ensure that all students are engaged and able to achieve the learning objectives. POGIL activities are research-based and have a particular structure based on learning cycles.

Participants will work through meta-activities that are designed specifically for teachers to learn core POGIL concepts, practices, and benefits. They will be able to name crucial elements of POGIL pedagogy and philosophy, list desirable student learning outcomes, and create strategies to begin implementing POGIL in their classrooms.

Clifton Kussmaul, Associate Professor of Computer Science—Muhlenberg College; **Timothy Herzog**, Associate Professor of Chemistry—Weber State University; and **Helen Hu**, Professor of Computer Science—Westminster College

GEORGIAN, SECOND FLOOR | *Supporting, Rewarding, and Building Capacity of STEM Faculty I Workshop-Theory to Practice*

CS 13: Expanding and Promoting Curricular Innovation and Collaboration

Sustaining and expanding curricular innovations from the enthusiastic early adopters to a broader segment of faculty is a major challenge in achieving lasting and significant curricular change. Facilitators and participants will explore several mechanisms for promoting innovation, collaboration, and the sharing of successful practices,

including faculty learning communities and communities of practice, co-teaching, summer sharing sessions, seed grants, and teaching resource collections. Workshop attendees will identify opportunities on their own campuses where similar mechanisms could play a role in advancing curricular change.

Chrysanthe Demetry, Director, Center for Educational Development and Assessment, **Kristin Wobbe**, Associate Professor of Chemistry and Associate Dean of Undergraduate Studies, **Richard Vaz**, Director, Center for Project-Based Learning, and **Paula Quinn**, Associate Director, Center for Project-Based Learning—all of Worcester Polytechnic Institute

WHITE HILL, FOURTH FLOOR | *Supporting, Rewarding, and Building Capacity of STEM Faculty I Workshop-Theory to Practice*

CS 14: Lead On: Successful Techniques for Building Leadership Capacity in Individuals and Institutions

Whether your interest is teaching and learning, supporting faculty, advocating for inclusive excellence, promoting evidence-based assessment, or transforming institutional cultures, leadership skills are essential to your success. For the past two decades, Project Kaleidoscope has provided leadership development for hundreds of early- and mid-career STEM faculty through its Summer Leadership Institute. This hands-on workshop will introduce Project Kaleidoscope's unique approach to leadership development that strategically utilizes a combination of deep introspection and experiential learning. The presenters, all leaders of PKAL's Summer Leadership Institute, will demonstrate how to use Experiential Learning Exercises (ELEs), such as those used at the SLIs, to build teams, teach leadership concepts, and explore sensitive or controversial issues in a low-risk, low-stakes environment. The ELEs utilize Kolb's Experiential Learning Cycle and parallel the learning environments utilized and recommended by PKAL: hands-on, experiential, personally meaningful, and collaborative. *Participants will* be able to describe the Kolb Experiential Learning Cycle; understand how Experiential Learning Exercises (ELEs) may be used to develop leadership skills and to build teams that can achieve a desired end result; experience how ELEs, that use all domains of learning (cognitive, affective, and psychomotor), provide a low-risk, low-stakes environment for exploring attitudes and behaviors that enhance or inhibit achievement of a desired end result; and understand how ELEs and the Kolb Experiential Learning Cycle can be used in other learning and life situations.

Judith Dilts, Professor Emerita, College of Science and Mathematics and **Sylvia Nadler**, Affiliate, College of Science and Mathematics—both of James Madison University; **Mary Majerus**, Professor, Mathematical Sciences—Westminster College; and **Brandon Schwab**, Associate Professor, Academic Affairs—Western Carolina University

BERKELEY/CLARENDON, SECOND FLOOR | *Inclusive Excellence/Broadening Participation in STEM Higher Education I Workshop-Theory to Practice*

CS 15: Moving Beyond Access: Using Critical Race Theory to Improve Retention and Inclusion of All Students in STEM Courses

This workshop will begin with a brief introduction to critical race theory (CRT) and how it can be used to inform and change teaching and advising practices. The facilitators will discuss how increased communication across departments and offices can advance these changes and examine with participants two cases that illustrate observed challenges and solutions. *Participants will* become familiar with the tenets of critical race theory; be able to navigate resources related to critical race theory in education; and consider where the lens of CRT could reveal problems and inform solutions in introductory STEM courses at their institutions.

Emily Braley, Assistant Professor of the Practice in Mathematics and **Alyssa Perz**, Assistant Dean of Trinity College—both of Duke University

TERRACE, LOBBY LEVEL | *Assessment and Evidence for High-Quality Undergraduate STEM Learning I Workshop-Theory to Practice*

CS 16: Designing Effective Assessment Plans and Engaging Faculty in Institutional Transformation

This workshop will provide an introduction to educational assessment theory and practice. Facilitators will share their experience in using assessment data to promote faculty engagement and discuss how similar assessment data might be used to foster changes in pedagogy at a scale necessary to achieve institutional transformation. *Participants will* be introduced to a range of instruments including concept inventories for measuring student learning and surveys for measuring affective gains in areas such as motivation and self-efficacy; learn what it means for an instrument to be "validated" and why this is important for effective assessment. They will use this workshop to identify an assessment need at their home institution and begin creating an individualized assessment plan that they can use as a starting point after the conference. After this workshop, participants will be able to describe different assessment instruments; evaluate the strengths and weaknesses of different assessment

strategies; and recognize ways in which their assessment data could be used to transform their teaching practices. **Liz Roth-Johnson**, *Discipline-Based Education Research Fellow, Department of Life Sciences Core Education and Debra Pires*, *Academic Administrator, Department of Life Sciences Core Education—both of University of California, Los Angeles*

WHITTIER, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Workshop-Theory to Practice*

CS 17: Improving Outcomes through a STEM Community of Practice: Grassroots Strategies for Shifting Departmental Culture

Most faculty and chairs can identify common weaknesses in learning shared by recent graduates of their programs. Too few students are able to solve problems creatively; students admit they haven't learned the communication skills they need; or assessment findings show they have trouble with the field's more quantitative dimensions. These are big problems, beyond what can be effectively addressed in a single course. Finding a strategy to address them across a program curriculum is daunting. *Participants will* recognize the potential impact of engaging with colleagues to enact meaningful improvements in student learning; consider the role of institutional supports in facilitating programmatic change; and be able to identify strategies for engaging colleagues in changes that will promote learning beyond what can occur in an individual course. Data will establish the impact that change has made on their teaching and student learning at the course and program level.

Anne Kelsch, *Director of Instructional Development*, **Joan Hawthorne**, *Director of Assessment and Regional Accreditation*, and **Brett Goodwin**, *Associate Professor of Biology—all of University of North Dakota*

NEWBURY, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Workshop-Theory to Practice*

CS 18: Technology for Good: Building Sustainable Service Learning Projects in High-Tech Fields

This workshop will examine Computing for Good (C4G) as one of the background experiences for Serve-Learn-Sustain. Facilitators will outline student-oriented, partner-oriented, and project-oriented risks to achieving service learning and discuss some important challenges in each of these three categories including mitigation strategies. Facilitators will address assessment and how the institutionalization of projects like C4G can become programs to be emulated by a full range of disciplines and to which an entire campus can become committed. *Participants will* learn about some of the challenges in introducing community partnership projects for STEM learning and strategies for overcoming them including student attitudes towards technical problems; building community partnerships that endure; and assessing student learning.

Colin Potts, *Vice Provost for Undergraduate Education* and **Ellen Zegura**, *Stephen Fleming Professor of Computer Science—both of Georgia Institute of Technology*

BEACON HILL, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Workshop-Theory to Practice*

CS 19: Instructors and Learning Spaces: How Social Cognitive Theory Informs Space Development, Policy, and Faculty Training

As the number of active-learning spaces on campuses increases, administrators are challenged to develop policies and resources for the strategic use of these spaces. Current research suggests that active-learning spaces empower instructors' use of teaching best practices. This session will examine how research using social-cognitive theory can endorse a more nuanced association, where instructors' use of teaching best practices is contingent on faculty's self-efficacy in a learning space. Findings suggest that instructors who are effective in traditional-learning spaces are likely to be less effective in active-learning spaces. The workshop will enable participants to apply these findings to their institution and identify opportunities for change in institutional policies, practices, and resources. *Participants will* research considering evidence for learning-space dependent self-efficacy and consider self-efficacy as a mechanism of faculty ability to support student learning across learning spaces. They will be able to frame their perspective of learning spaces at their institution in social-cognitive theory and current research and identify potential areas for change in their practices, policies, and resources.

Lindley McDavid, *Post-doctoral Research Associate, Discovery Learning Research Center*, **Loran Carleton Parker**, *Assessment Specialist, Discovery Learning Research Center*, and **Wilella Burgess**, *Managing Director, Discovery Learning Research Center—all of Purdue University*

ARLINGTON, SECOND FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Workshop-Theory to Practice*

CS 20: Using PULSE Vision & Change Rubrics to Stimulate Transforming STEM Education at the Department Level

This workshop will introduce participants to the PULSE Vision & Change Rubric, Recognition Program, and Ambassadors Program as mechanisms stimulating STEM education transformation. Facilitators will share findings from pilots of these programs. Workshop participants will utilize the PULSE Snapshot Rubric, an abbreviated form of the PULSE Vision & Change Rubrics, to assess areas where their departments/institutions are making progress, and where additional attention is required. The session will include time for participants to discuss major barriers to change that are revealed by the rubrics. *Participants will* gain an understanding of the utility of the PULSE Vision & Change Rubrics for assessment of the current state of their STEM department's alignment with current best practices and learn how both the PULSE Vision & Change Recognition Program and the PULSE Ambassadors Program can serve to transform institutional cultures to stimulate undergraduate STEM education reform.

Thomas Jack, Professor of Biological Sciences—Dartmouth College; **Loretta Brancaccio-Taras**, Professor and Chair Department of Biological Science—Kingsborough Community College; **Michael Kelrick**, Professor of Biology Emeritus—Truman State University; and **Sara Lindsay**, Associate Professor of Marine Sciences—University of Maine

3:00 – 4:00 P.M. CONCURRENT SESSIONS

BEACON HILL, FOURTH FLOOR | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Facilitated Discussion*

CS 21: Opportunities and Challenges in Designing and Delivering Online and Alternative Science Laboratories

Many breakthroughs have emerged in developing and teaching asynchronous science laboratories including online labs, simulation software, distributed lab kits, field and case studies. However, challenges remain. *Participants will* explore developing and delivering alternative labs, including 1) factors to consider when developing alternative learning modes and activities; 2) discussing accessibility requirements in alternative lab delivery; 3) addressing issues of safety, materials access, specialized equipment, and techniques, and 4) developing recommendations for online and alternative laboratories that will engage students in the processes and application of science.

Audeliz Matias, Assistant Professor, **Mary Mawn**, Associate Professor, and **Brian Hagenbuch**, Associate Dean of Science, Math, and Technology—all of SUNY Empire State College

GEORGIAN, SECOND FLOOR | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Facilitated Discussion*

CS 22: A Kaleidoscope of STEM Teaching Innovations: Reforms Inspired by the Summer Leadership Institute

Well-established active learning strategies increase student engagement, content comprehension, persistence, and identity as scientists. When implemented in introductory courses, pedagogical strategies such as early research experiences, implementation of guided inquiry learning curricula, and use of primary literature can help faculty change the culture of introductory courses that have previously contributed to student attrition from STEM. Participants will examine evidence of support for these introductory course approaches across STEM disciplines and institution types. A cohort of PKAL Leadership Institute Alumni (2013) will assist participants in discovering how to implement these methods and help inspire colleagues to innovate their own teaching and change the culture of introductory STEM courses on campus and across the country. *Participants will* 1) evaluate the appropriate application of active learning strategies for application to their own courses; 2) develop an experimental design to test the efficacy of the method in their classes; and 3) brainstorm the next generation of advancement in STEM pedagogy that will inform research and teaching paradigms for the coming two decades.

Carrie Hall, Assistant Professor of Ecology and Biology Education—University of New Hampshire; **Gwen Shusterman**, Professor of Chemistry—Portland State University; **Mike Wolyniak**, Associate Professor of Biology, Director of Undergraduate Research—Hampden-Sydney College; and **Scott Paulson**, Associate Professor of Physics and Astronomy—James Madison University

TERRACE, LOBBY LEVEL | *Inclusive Excellence/Broadening Participation in STEM Higher Education I Facilitated Discussion*

CS 23: Speaking to All Students: Integrating Culturally Relevant Pedagogy into the Computer Science Classroom

This discussion will introduce Culturally Responsive Pedagogy (CRP) as a multipronged approach implementing a delicate balance to address culture, motivation, self-efficacy, effort, resilience, and success. Participants will be introduced to evidence-based implicit bias data to demonstrate that implicit bias is pervasive and guides how individuals process information and make decisions. Through a series of exercises, participants will recognize that while all individuals have cultural backgrounds that are different; there exist implicit associations that are not evidence-based. *Participants will* 1) develop an understanding of Culturally Relevant Pedagogy (CRP) and models for implementation in the computer classroom; 2) learn approaches to maximize faculty engagement and development as part of that process; 3) gain a perspective of the challenges faced in the implementation and transformation of both curricular and teaching components and build solutions through a developmental and inclusionary process; and 4) learn about successfully implemented and ready to use approaches, strategies and activities to implement CRP.

Kiron Sharma, Professor of Computer Science, Laila Khreisat, Chair of Mathematics, Computer Science and Physics Department, and Diana Cvitan, Director of Global Learning and Partnerships—all of Fairleigh Dickinson University

ST. JAMES, FOURTH FLOOR | *Inclusive Excellence/Broadening Participation in STEM Higher Education I Facilitated Discussion*

CS 24: Mentoring and Metacognition: Designing a Holistic Learning Community Model for Inclusive STEM Gateway Courses

This discussion will focus on learning communities, one of the high-impact educational practices with potential to transform outcomes for students from communities traditionally underserved by higher education. Participants will discuss a multi-variant approach to introductory STEM courses that integrates inquiry-based learning, peer learning assistants, and instruction in metacognition within a comprehensive multicultural learning community. The overarching question of this session will be “How can we build understanding of best learning practices and structure relationships among students, staff, and faculty within gateway courses to build the broadest acquisition of cognitive and social capital in STEM learning communities?” *Participants will* be given tools to identify gaps in student learning and how to address these gaps with a relationship framework for STEM learning at their institutions as a means to improve persistence and learning outcomes in STEM fields.

Rebecca Ciancanelli, STEM Coordinator for the Student Academic Success Center—University of Colorado at Boulder

BERKELEY/CLARENDON, SECOND FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Facilitated Discussion*

CS 25: Measuring Institutional Change Over Time: Beneficial Effects and Continuing Challenges

For the past three years, researchers at Boise State University have worked to transform the institutional culture of STEM teaching through an NSF WIDER grant (#1347830) by encouraging faculty to adopt evidence-based instructional practices that focus on active learning strategies. The major strategy to affecting change was the use of a grassroots, departmentally-centered, bottom-up approach emphasizing peer-to-peer influence. Each year an annual assessment survey is administered campus-wide; the two key measurement instruments are the Post-Secondary Instructional Practices Survey (PIPS; Beach, et al., Western Michigan University) and the Current Instructional Climate Scale (CICS), developed and validated locally. The PIPS provides indicators about specific teaching strategies and the CICS measures the climate regarding institutional culture, personal teaching practices, and institutional support. Over three years and examining both between-groups and within-subjects data has provided statistically significant evidence of change over time. *Participants will* learn about an NSF WIDER effort to transform STEM education practices to increase the adoption of evidence-based instructional practices and discuss the survey methodology and challenges in capturing institutional change over time with an annual assessment approach. The measurement instruments, data analytic strategies, and current results will be shared.

R. Eric Landrum, Professor of Psychology and Karen Viskupic, Research Professor of Geosciences—both of Boise State University

ARLINGTON, SECOND FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Facilitated Discussion*

CS 26: Community Engaged Strategic Planning for Building Institutional STEM Innovation and Capacity

This discussion will address research-based techniques for community engaged STEM strategic planning that have been a catalyst to STEM educational pathway development and shared STEM initiatives for workforce development. The session will include “rapid fire” mini-activities to showcase various STEM related strategies, such as building a STEM leadership team, undertaking SWOT analyses (strengths-weaknesses-opportunities-threats), undertaking program logic modeling, building mission statements, setting objectives, and conducting annual reporting. *Participants will* 1) become familiar with a process for community engaged and interdisciplinary STEM strategic planning; 2) learn about a community chair model, as well as how such a position can support a campus and community-based STEM leadership team; 3) examine several indicators and assessments for monitoring the progress of an organizational STEM priority; and 4) receive access to an electronic folder of document templates.

Neal Grandgenett, *Haddix Community Chair of STEM Education*, **Robert Shuster**, *Chair, Department of Geography/Geology*, and **Nancy Edick**, *Dean, College of Education*—all of *University of Nebraska at Omaha*

CAMBRIDGE, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Facilitated Discussion*

CS 27: Scaling Effective Teaching Practices

Within every institution there are pockets of excellence that use innovative teaching strategies that could be adapted in other parts of the institution, or even more widely. Scaling effective teaching practices, though, does not commonly happen. This discussion will explore a set of tools to help change agents apply system-level thinking to the problem of scaling effective teaching practices. *Participants will* consider the difference between dissemination and propagation and identify effective strategies to support adoption of educational innovations. Emphasis will be placed on understanding potential innovation users and the four levels of the instructional system that influence use (individual, department, institution, extra-institution). *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) develop an effective change plan. *Participants will* also be exposed to the Increase the Impact resources that can be used to support planning for effective change.

Charles Henderson, *Professor of Physics and Science Education*—*Western Michigan University*; and **Renee Cole**, *Associate Professor of Chemistry*—*University of Iowa*

WHITE HILL, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Facilitated Discussion*

CS 28: Improving Student Access and Success through Educational Equity: Two Models for Change

Through two research-based cultural transformation models, the National Alliance for Partnerships in Equity (NAPE) builds educators’ capacity to implement effective solutions for increasing student access, educational equity, and workforce diversity. These two models address and eliminate barriers to implementing effective pedagogies and equitable practices. *Participants will* explore two comprehensive educational equity programs that lead to institutional, individual, and ultimately organizational change and evaluate the two models as solutions for educational equity concerns at their institution. The topics will include NAPE’s theoretical framework, modes and methods of implementation, specific case studies, and samples of program outcomes for improving educational equity for every undergraduate STEM student.

Meagan Pollock, *Director of Professional Development*—*National Alliance for Partnerships in Equity*

STATLER, SECOND FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Facilitated Discussion*

CS 29: Using a Dialectical Perspective to Frame Teaching Transformation by Faculty and Institutions

This discussion will explore frameworks for examining institutional change at the faculty level. Using data collected as part of a large, institutional level course transformation effort at a research intensive university, the discussion will focus on the use of a dialectical perspective to examine the interplay among institutional contradictions, praxis, and institutional change at the faculty level. This work will serve as the foundation for examining the potential for this type of model in understanding and predicting mediators and barriers related to institutional change. *Participants will* become familiar with the dialectical perspective as it applies to a university context and

be able to do identify institutional contradictions, including inefficiencies, nonadaptability, incompatibilities and misaligned interests and the likelihood and scope of praxis for institutional change at their university.

Loran Parker, *Assessment Specialist*, **Wilella Burgess**, *Managing Director*, and **Lindley McDavid**, *Postdoctoral Research Associate*—all of *Purdue University*

NEWBURY, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform | Facilitated Discussion*

CS 30: Experiential Learning Environments – Making Transformative Change

How can colleges and universities support and advance their most innovative faculty in the classroom? This session will explore how colleges and universities are tuning and transforming their learning environments to encourage applied learning and deep personal connections. Insights and best practices will be shared on design, implementation, faculty engagement, technology, and assessment strategies. There will be a “deep dive” into Bryant University’s Academic Innovation Center. The University has been playing in a series of “sand box” learning environments over the last five years, creating learning spaces “tuned” to their institutional culture. This new facility features interior design concepts that advance these models of experiential and experimental study and spark creativity and innovation. *Participants will engage in a series of think-pair-share exchanges to take back strategies for creating, implementing, and evaluating active learning environments on their own campus.*

Leslie Sims, *Senior Science Expert* and **Michael Collard**, *Project Director*—both of *EYP Architecture & Engineering*; and **Jane McKay-Nesbitt**, *Associate Professor of Marketing* and **Ed Kairiss**, *Director of Faculty Development and Innovation*—both of *Bryant University*

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WHITTIER, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform | Workshop-Theory to Practice*

CS 31: National Science Foundation: Review of Funding Mechanisms for Broadening Participation in STEM - Part I

In line with its Congressional mandate, the National Science Foundation has made significant investments in broadening participation in STEM. However, persistent societal disparities continue to challenge the efficacy of these efforts. As a result, national STEM higher education reform efforts, now more than ever before, require a more sophisticated effort in ensuring that theories, pedagogies, and practices are responsive to the ever changing demographic landscape of higher education. To that end, this session will feature a detailed overview of the representation index for all underrepresented groups, as well as new and emerging directions of STEM broadening participation. Participants will also gain insight in the often misunderstood processes of grant submission and negotiation. Participants will explore the entire funding portfolio of NSF that is related to broadening the participation of historically underrepresented groups in STEM, as well as emerging funding priorities.

Andrea Johnson, *Program Officer* and **Claudia Rankins**, *Program Officer*—both of *the National Science Foundation*

GRAND BALLROOM | SECOND FLOOR

4:15 – 5:30 P.M. POSTERS AND RECEPTION

Please join in this opportunity to learn about some of the latest research findings and promising approaches for advancing pedagogy; high-impact practices; STEM faculty professional development; assessment and evaluation; and strategies for change on campuses across the country. *Light hors d'oeuvres and cash bar available.*

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

POSTER 25: Transforming the Biology Major Through Course-Based Research

This poster will examine the revision of a program in biology that gives all major students skills in research. The revision includes the Research Process (BIOL 260) followed by a course-based research experience. The poster will feature the set of outcomes and common features for these courses which incorporate research as part of the curriculum. *Participants will obtain information on how to design and implement changes in the curriculum to provide students with research skills; learn how to design upper level STEM classes which incorporate research experiences; and learn what works and what doesn't, when implementing course-based research.*

Deborah O'Dell, *Associate Professor of Biology* and **April Wynn**, *Assistant Professor*—both of *University of Mary Washington*

POSTER 26: Impact of Course-Embedded Undergraduate Research Experiences on Student Engagement and Performance: A Five-Year Study

Course-Embedded Undergraduate Research Experiences (CUREs) are a key component of GGC's STEM Initiative for enhancing student engagement and learning in STEM disciplines. This poster will describe the results of a five year project that utilizes a discipline-specific CURE model that scaffolds multiple research and creative experiences for all STEM majors during all four years of matriculation. To date, 54 courses include CUREs and over 3,000 students are impacted annually. Presenters will discuss key components of the project, institutional strategies, longitudinal program-level assessment (student performance, student attitudinal, and faculty attitudinal data), and how the model can be adapted to other institutions. *Participants will* consider how GGC's Four-year Undergraduate Research and Creative Experience model can be adapted at their own institutions. Participants will also discuss challenges/obstacles that prevent implementation of such a program at their institution; learn institutional strategies that can be used to incentivize faculty; and see how to develop assessment tools and plans.

Judy Awong-Taylor, Professor of Biology, **Allison D'Costa**, Associate Professor of Biology, and **Clay Runck**, Assistant Professor of Biology—all of Georgia Gwinnett College

POSTER 27: Course-Based Research in Organic Chemistry: Addressing a Real Problem/Measuring Student Learning

This poster will highlight a pilot project from research-based lab sections in Organic Chemistry II at Smith College. The semester of lab time was devoted to addressing the real world problem of developing a drug to treat the neglected tropical disease lymphatic filariasis. Students isolated neurolepin D, a natural product lead compound, and then spent the majority of the semester synthesizing analogs for subsequent biological testing. Their results were presented at a research poster session and in writing as a journal-type article. Student performance and perceptions were compared to traditional lab sections and showed positive gains on nearly all measures. *Participants will* learn about a successful example of a course-based research experience encompassing the entire semester of lab time in an intermediate-level chemistry course. They will gain insight into the challenges of project selection and implementation in a standard course that is the third semester of a traditional four-semester chemistry sequence. Participants will see examples of qualitative and quantitative student feedback, including comparison data with traditional lab sections and consider how to adapt these designs to their own work.

Kevin Shea, Professor of Chemistry—Smith College

POSTER 28: Design and Assessment of Inquiry Laboratory Experiences in Biochemistry Laboratory Courses

Many biochemistry laboratory courses expose students to laboratory techniques through pre-canned experiments in which students follow stepwise protocols provided by the instructor. This approach does not provide students sufficient opportunities to practice experimental design, critical thinking, and laboratory math. Ten inquiry modules were created for a one-semester undergraduate biochemistry laboratory course. A validated and published tool, the Experimental Design Ability Test (EDAT), was used to assess the impact of inquiry-based learning on student experimental design ability in four experimental (inquiry) and four control (cookbook) sections. The results, measured by pre- and post-tests, consistently showed a significant positive impact on the experimental design ability of students in sections that employed the inquiry approach, when compared to those in control sections that employed the cookbook approach. *Participants will* learn 1) how to convert existing "cookbook" labs to inquiry labs; 2) typical barriers to converting a traditional biochemistry laboratory curriculum to inquiry experiences; 3) best practices in implementing inquiry style laboratory modules; and 4) approaches to assessing inquiry learning and comparing its effectiveness to traditional laboratory experiences

Nina Goodey, Associate Professor of Pharmaceutical Biochemistry—Montclair State University

POSTER 29: Statistical Analysis of Student Learning in an Introductory Statistics Course: Traditional vs Flipped Teaching

In recent years, there has been a debate in the education field regarding the success of using "flipped" classrooms as a new teaching pedagogy. Flipped learning is defined by flippedlearning.org to be, "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment..." This poster will present a study designed to investigate the effectiveness of flipped teaching compared to traditional teaching in undergraduate introductory statistics courses. The data is from seven Elementary Statistics classes at Slippery Rock University of

Pennsylvania, where some classes were traditional and the others flipped. Appropriate statistical analysis has been conducted to compare the two teaching pedagogies. The results, limitations, and steps to expand the study will be discussed. *Participants will* learn how student learning differs between traditional classroom pedagogy and flipped classroom pedagogy in an introductory statistics course—what worked and what did not in the flipped pedagogy and see the statistical analysis and results comparing the student learning in the two pedagogies.

Dilrukshika Singhabahu, Assistant Professor—Slippery Rock University

POSTER 30: It's Elementary! Removing Barriers From STEM Learning at the College and Elementary School Levels

This poster will show how to engage predominantly first year students taking core curriculum courses in Pre K-5 STEM project-based learning activities offered in public schools. The service-learning partnership between New York Institute of Technology (NYIT) and three schools in Queens has helped excite elementary students about STEM careers and higher education; public school teachers improve upon teaching strategies through enhanced use of technology with NYIT student assistance; and NYIT students integrate classroom theory with practical experience while developing skills that will help them advance as professionals and citizens. The poster will provide an overview to integrating the development of learning and civic education approaches by theorists like Lev Vygotsky, Harry Boyte, John Holland, and John Dewey. *Participants will* 1) learn about the pilot program that garnered over \$300,000 in grant support; 2) discuss effective assessment mechanisms; 3) discover the impact this project has made on the college's 2030 plan for institutionalizing opportunities like these for NYIT students; and 4) identify three technologies that can be used to start, refine, and assess service-learning projects in the STEM fields.

Amy Bravo, Assistant Dean of Career Services and Director of Experiential Education, **Jim Martinez**, Assistant Professor of Instructional Technology, and **Lauren Rigney**, Adjunct Instructor Foundations of Scientific Process—all of New York Institute of Technology

POSTER 31: Frameworks for Communicating Science: A Merging of Liberal Arts and STEM Learning Outcomes

Public discourse about science indicates a need for scientists to communicate effectively with non-science audiences. Teaching undergraduate STEM majors communication strategies and techniques can equip them with skills valued by employers and necessary to enhance public science literacy. This poster will provide an example of an integrative and interdisciplinary approach used in a learning community (Biology course paired with a Science Communication course) that combined Frameworks Institute research, communication analysis, and improvisational communication techniques to develop students' science communication skills. *Participants will* receive a theoretical framework and pedagogical resources for using an integrative and interdisciplinary approach to teaching STEM students how to communicate science to a general audience; and learn how the framework and pedagogies enhance both STEM and liberal arts learning outcomes.

Darlene Panvini, Professor of Biology and **Jimmy Davis**, Professor of Communication Studies—both of Belmont University

POSTER 32: Student-Centered Active Learning Effects on Engineering Students' Motivation and Achievement

What motivational components predict positive learning outcomes in undergraduate STEM courses? How do different instructional strategies impact student performance? This poster will review answers provided by a research study of concurrently taught student-centered and lecture-based versions of a required introductory engineering course including empirical relations between student-centered learning, students' motivation and achievement; and course design elements and instructional technologies that contributed to these effects. The potential transferability of these design elements and supported technologies, and the challenges of making such transformations sustainable will be described. *Participants will* learn the key motivational constructs that predicted course performance and how two different teaching approaches impacted students' performance.

Jae-Eun Russell, Instructional and Research Specialist—University of Iowa

POSTER 33: Transforming the Undergraduate Experience for STEM Majors: The iCons Program at UMass Amherst

This poster will describe the learning environment of an iCons course and the learning experience from the point of view of both instructor and student. The objective is to demonstrate how participants can design their own courses based on the educational outcomes they seek. Crucial elements of the iCons Program include Inception, Engagement, Research, Creativity, and Reflection. *Participants will* learn how to reverse-design lesson content for a case study in the context of a real-world problem; and how to construct appropriate assignments and

assessments that allow students to develop target skills and cultivate desired learning attitudes. Participants will also learn how to construct course expectations by formulating learning goals in the context of an assignment.
Shubha Tewari, Lecturer of Physics—University of Massachusetts, Amherst

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

POSTER 34: Impact of Small Group Peer Mentoring of Female STEM Faculty on Career Progression, Institutional Culture, and the STEM Community

This poster will describe the outcomes of a five-year NSF ADVANCE project. *Participants will* learn how inter-organizational, peer mentoring of female STEM faculty from predominately undergraduate institutions impacts the career progression of the protégés, the culture of the protégés' universities, and the broader STEM community. Preliminary results indicate this mentoring strategy provides psychosocial benefits such as self-esteem enhancement, support for risk-taking, and increased career resilience as well as direct career benefits such as increased grant writing and scholarship activity. Data also suggests the peer-mentoring activities empowered many of the protégés to work within their institutions and the broader STEM community to improve the environment for women working in STEM disciplines.

Joanne Smieja, Professor of Chemistry and Biochemistry—Gonzaga University

POSTER 35: Cultivating Your Talent Pool: How to Maximize the Teaching Effectiveness of Adjunct Faculty

Building professional development and departmental engagement activities into adjunct training can maximize the effectiveness of all instructors and improve the learning experience for students. This poster will describe best practices in and a model of adjunct faculty development. *Participants will* identify the professional and emotional needs of adjunct faculty working at their institutions; identify opportunities for positive change; see how to plan for including adjunct faculty in departmental and institutional professional development and SoTL opportunities; and learn how to communicate institutional expectations and student outcomes to adjunct faculty.

Kristen Przyborski, Course Director and Rosemary Whelan, Coordinator, Biology and Genetics and Biotechnology Programs—both of University of New Haven

POSTER 36: Faculty Learning Program: Professional Learning Experience for STEM Faculty to Improve Teaching Practice

Educational trends like flipping the class, clickers, and peer instruction are popular for making valuable in-person class time active and engaging so that students learn more effectively. However, the larger challenge remains helping STEM faculty integrate active learning methods into their practice so that they can use them consistently, confidently, and effectively. This poster will describe a faculty development program designed for STEM faculty to improve their teaching. *Participants will* deepen their understanding about how learning happens; discuss how to teach more effectively to support learning; and learn about a faculty development program to improve STEM faculty teaching practices.

Lynn Tran, Research Director—University of California, Berkeley

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

POSTER 37: Broadening Participation for STEM Students through Co-Curricular Programming

With the recent merger between Georgia State University (GSU) and Georgia Perimeter College in 2016, GSU now serves over 50,000 students and has one of the most diverse populations in the nation. At its Perimeter College (PC) campuses in fall 2015, there were over 3,900 STEM students and 56% were from groups historically underrepresented in STEM. Since its inception in 2012, the PC STEM Initiatives Office has worked to increase STEM student retention and transfer/graduation rates, especially among first-generation, at-risk, and underrepresented populations. As a part of these efforts, four grant-funded student programs emerged. Program participants benefit from Academic Excellence Workshops; intrusive academic advising; and, research experiences. Successes include a 15% increase each year in student participation; and, for the FY 2013 cohort, 96% of program participants were retained at the institution compared to 69.5% of non-participants and the 3-year graduation rate was 12.5% compared to 6.3% of non-participants. *Participants will* learn strategies for developing student support programs that are designed to broaden participation. The discussion will also include how to use data to effectively design

and sustain these programs. Successes, lessons learned and challenges will be shared. Participants will also learn how the development of a STEM Office has helped grow STEM programming at the institution.

Cynthia Lester, Executive Director of STEM Initiatives—Georgia State University Perimeter College

POSTER 38: Designing Course-Based Undergraduate Research Experiences (CUREs) for Underserved Students: A Recipe for Success 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 and serves as a role model for other institutions with similarly diverse enrollments. However, ULV students face many of the same obstacles as their counterparts at other schools, including high attrition in STEM. The goal of the ULV Biology CURE project was to embed and assess effectiveness of budget- and resource-sensitive authentic research experiences in two courses to broaden participation, model inclusive excellence, and enhance equity of research experiences offered to undergraduates. The approach incorporated writing, critiquing, Design Your Own Experiment (DYOE) pedagogy, and modern research techniques into laboratory learning modules of a sophomore level course. Data collected from the CURE project suggest that underserved students in an HSI benefit from the DYOE/CURE approach. *Participants will* learn about a course-based undergraduate research experience model to enhance inclusive excellence in STEM, broaden participation in high impact practices, and improve STEM student outcomes.

Christine Broussard, Professor of Biology, **Pablo Weaver**, Instructor of Biology, and **Kathleen Weaver**, Associate Professor of Biology—all of University of La Verne

POSTER 39: Scaffolding the Two-Year/Four-Year Transition in STEM

Mount Holyoke College is a small research liberal arts college for women with a history of strength in STEM disciplines. Over one-fourth of its traditional students major in science or mathematics and the campus supports a lively research culture. This poster will describe three program elements: 1) faculty transfer advisors support for students mapping of pathway through a STEM major; 2) an orientation just for STEM community college transfers; and 3) a one-semester course for STEM transfers to support them in researching internships, and introducing them to the expectations of upper-level STEM courses. *Participants will* learn about the multiple transitions that students face when transferring from community college to a four-year institution, and consider the kinds of supports that might work to help students at their own institution effectively make this transition.

Sarah Bacon, Associate Professor Biological Sciences—Mount Holyoke College

POSTER 40: Institutionalizing Successful Pilot Projects: Expanding and Deepening the Reach of the SAGE Program

The Science Advancement through Group Engagement (SAGE) Program has successfully supported multiple cohorts of diverse and underrepresented learners in gateway chemistry courses. Recent funding from an institution-wide HHMI grant, has allowed dedicated staff to systematically review the program, formally align learning and research objectives across academic units, and deepen collaborations with scholars programs and chemistry faculty. The reach of SAGE has expanded to include an integrated peer educator/mentor development component and professional development opportunities for graduate students. *Participants will* 1) explore an academic support program that is designed to support underrepresented chemistry learners; 2) discuss effective training, mentoring, and advising practices that are utilized in SAGE to develop peer educators, graduate student interns, and participating chemistry learners; and 3) identify processes, relationships, and mixed method measures that they might transfer and adapt to their efforts towards improving and sustaining successful projects.

Claire Parker Siburt, Assistant Director and STEM Learning Specialist in the Academic Resource Center and **Alyssa Perz**, Academic Dean and Director of the Cardea Fellows Program—both of Duke University

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

POSTER 41: Effectiveness of Using a Computational Laboratory Exercise to Enhance Student Spatial Visualization Ability and Abstract Thinking

This poster will examine the role of computational visualization on chemistry learning in a physical chemistry laboratory course and present a module to enhance the spatial visualization abilities of students. The model employed computational tools to overcome limitations in teaching abstract chemistry concept of hydrogen bonding. The spatial skills of chemistry majors in developing a model system to interpret experimental

observations were evaluated. The Purdue Spatial Visualization Test on Rotations (PSVT: R) was used to assess students' spatial visualization before and after the activity. *Participants will* see results of both pre- and post-surveys to evaluate the effectiveness of the module and learn how students acquire understanding in predicted properties that are consistent with experimental observations. This laboratory module allows students to explore multiple physical chemistry concepts in two laboratory sections around one theme. The module also allows teaching the abstract thinking of microscopic interactions that are important for understanding the macroscopic experimental observations.

Yassin Jeilani, Assistant Professor—Spelman College

POSTER 42: Flipping Anatomy Content with the Aid of Interactive 3D Modeling Software

Student learning and measures of student satisfaction were compared among offerings of an anatomy and physiology course where anatomy content was flipped using interactive 3D modeling software, versus traditional lecture delivery. Students demonstrated similar learning in both formats, but reported increased satisfaction with the flipped course despite a significant increase in reported time spent working outside of class. Additional time gained in-class by flipping anatomy content was used to increase active learning opportunities. *Participants can* interact with the 3D software and assessment modules, and can take with them examples of case studies and templates for peer-evaluated in-class writing assignment. They will learn how software tools can facilitate independent student learning of lower Bloom's level content; gain fresh ideas for in-class active learning exercises that are easily translated across disciplines; and view, analyze and critique data related to the efficacy of flipped learning paradigms versus lecture delivery of content for student learning.

Natalie Farny, Assistant Teaching Professor, Department of Biology and Biotechnology—Worcester Polytechnic Institute

POSTER 43: Targeting Critical Thinking Skills in a First-Year Undergraduate Research Course Using Real-World Scenarios

TH!NK is a new initiative at North Carolina State University focused on enhancing students' higher-order cognitive skills. As part of this initiative, critical and creative thinking were emphasized in an existing bacteriophage discovery first-year research course. In addition to the typical activities associated with undergraduate research such as review of primary literature and writing research papers, another strategy that was employed to enhance students' critical thinking skills was the use of discipline-specific, real-world scenarios. This poster will outline a general "formula" for writing scenarios, as well as several specific scenarios created for the described course. It will also examine assessed student gains in critical thinking skills using a pre-/post- test model of the Critical Thinking Assessment Test (CAT), developed by Tennessee Technological University. The scenario strategy described here can be modified for use in biology and other STEM disciplines, as well as in diverse disciplines in the social sciences and humanities. *Participants will* learn to develop discipline-specific critical thinking scenarios based on primary literature, popular media and arguments, and visual representations of data.

Sue Carson, Associate Professor of Plant and Microbial Biology; Director of TH!NK; Interim Executive Director of Academic Enrichment Programs—North Carolina State University

POSTER 44: Exploring Student Use of On-Line Videos in a Flipped Introductory Biology Classroom

This poster will describe the results of a three-year study into the effectiveness of flipped classes, in which students watch lecture videos and answer comprehension questions prior to attending class. Because these videos and questions are available online, log files are generated tracking all student activity throughout the semester. This research centers on the analysis of these log files to gain a better understanding of how students learn in a flipped lecture setting. The log files include information on the specific student, video watched, time of day, etc. that reveal patterns of student use. It provided information to determine how many students watched each video at least once, how many times each student watched each video, and how many times students watched a video after its initial due date. These results will be correlated with student performance on exams. *Participants will* gain an increased understanding of students' use of on-line materials and the effectiveness of a flipped science classroom based on parameters such as how many students watched each video at least once, how many times students watched a video after its initial due date and how these correlate with exam performance.

Brian White, Associate Professor of Biology and Science Education—University of Massachusetts Boston

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

POSTER 45: Department-Wide Engagement Strategies for Biology Curriculum Reform

Revision of science curricula, to incorporate evidence-based pedagogies and learning goals aligned with national standards, is an essential but challenging goal for many academic departments. When a department has a long history of perceived student success, resistance to change can be a real barrier. The Department of Biology at The College of New Jersey has been a very strong program but could nevertheless benefit from curricular and pedagogical change. This poster will present a set of steps that engaged an entire department and led to major, ongoing reform of the curriculum to better align with the learning goals and pedagogies described in Vision & Change In Undergraduate Biology Education: A Call to Action. The first-semester biology course is now inquiry-based; the curriculum is now infused with evolution more intentionally; and the connection between biology and math/statistics has been enhanced. Continuing efforts are being informed by assessment of the changes.

Participants will increase their capacity to create curricular reform in their own departments; be able to adapt this process to create support for and implement curricular change; and develop contacts with TCNJ change agents.

Tracy Kress, Associate Professor of Biology, **Wendy Clement**, Assistant Professor of Biology, **Janet Morrison**, Professor of Biology, and **Luke Butler**, Associate Professor of Biology—all of The College of New Jersey

POSTER 46: Principles and Practices Fostering Inclusive Excellence: Lessons from the HHMI Capstone Institutions

This poster will describe the general principles of success across HHMI Capstone Institutions. Each institution directed activities towards persistence of STEM students, especially those from traditionally underrepresented groups, through a set of common elements: mentoring programs to build community; research experiences to strengthen scientific skill/identity; attention to quantitative skills; and outreach/bridge programs to broaden the student pool. It will also describe common assessment approaches that informed programming and created traction for stakeholder buy-in and demonstrated substantial improvement in performance in courses and persistence for members of groups under-represented in STEM. Presenters will discuss what was learned in the ex-post activity of looking across the individual institutional efforts, discovering common features and differences, and strategies that led to institutional transformation. *Participants will* learn about strategies for fostering inclusive excellence and resources that can provide support as they adapt and adopt these strategies. They will gain knowledge of the two decade-long developments at the HHMI Capstone institutions and how those might inform efforts to sustainably transform undergraduate science education at their institutions to improve learning of all students and retention in the sciences. They will also be introduced to a comprehensive Web site that includes details on the campus-based projects.

Jim Swartz, Dack Professor of Chemistry, Director, Center for Science and the Liberal Arts and **Leslie Gregg-Jolly**, Professor of Biology—both of Grinnell College; **Cathy Manduca**, Director, Science Education Resource Center—Carleton College; and **Patricia DiBartolo**, Caroline L. Wall '27 Professor of Psychology—Smith College

POSTER 47: Transforming a STEM Community—Taking Mentoring Across a College

A design, grounded in a 17-year program model (University of Houston-Downtown, Scholars Academy-UHD SA), provides evidence of factors forming critical student support infrastructure to positively impact the persistence and completion of minorities and women into STEM careers. Incorporating zero-cost features, great strides in supporting all STEM students can occur. Salient features include: 1) creating core discipline-based STEM communities through established student “clubs”/ organizations; 2) engaging discipline-based faculty members (tenure-track/tenured) with high interest as mentors; 3) using the Scholars Academy (SA) as the template for operationalizing the five most impactful retention actions; 4) use the UHD SA Peer Mentor Training Retreat as a model for training discipline-based club officers; and 5) providing academic support through tutoring for lower/upper division coursework using a peer-led team-learning approach to tutoring. *Participants will* learn how to identify and construct their own anticipated operational models of mentoring across a college or department and analyze through comparison and contrast those mentoring components.

Mary Jo Parker, Executive Director Scholars Academy / Natural Sciences Faculty—University of Houston-Downtown

POSTER 48: Transform Departmental STEM Programs Utilizing a Program (Re)Design Model

The department has been identified as the key unit for effecting change on a university campus. Academic developers in a center for teaching and learning have worked extensively with programs across several STEM departments in a research intensive university to optimize a Program (Re)Design process for designing or updating program curricula at the department level. The eight step process includes development of program learning outcomes based on current data, development of rubrics for each program outcome, curriculum mapping, teaching method discussions at the course level, and assessment and implementation plans. This poster will provide an overview of the process and participants will be able to discuss why it is an effective change model and potential pitfalls to implementation on their campus. *Participants will* be able to build awareness regarding a potential curricular change model at the program level, contemplate customizing the program redesign process to their campus, identify potential roadblocks, and access resources for potential customized adoption of the process. **Debra Fowler**, Associate Director of Center for Teaching Excellence and **Samantha Shields**, Ph.D. Student, Teacher Education and Technology—both of Texas A&M University

POSTER 49: Improving Student Success in our Science Cohort Living Learning Community: Redesign of

Mathematics Curriculum This poster will provide insight into the development and implementation of a Science Cohort Program in Fall 2013, to address retention and enhance student learning and success in the STEM disciplines. The program employed several proven best practices, peer-led team teaching, active and collaborative learning to enhance student learning and engagement. Initial assessment data indicated a strong correlation between student success and their math readiness. The poster will highlight key components on how to intentionally redesign designated sections of Developmental Math, College Algebra and Calculus I to support STEM student success in Introductory Chemistry and retention in the science cohort program. *Participants will* see how to assess the effectiveness of redesigning and developing problems in their mathematics courses to support STEM curricula.

Marie Turner, Associate Professor of Chemistry—Curry College

SATURDAY, NOVEMBER 5, 2016

8:00 – 9:00 A.M. CONTINENTAL BREAKFAST

GRAND BALLROOM | SECOND FLOOR

9:15 – 10:30 A.M. CONCURRENT SESSIONS

STUART, FOURTH FLOOR | *Undergraduate STEM Teaching and Learning: Contexts, Content, and Relevancy I Workshop-Theory to Practice*

CS 32: Connecting the Dots: Change Initiatives Focusing on How, What, When and Where Learning Happens

Campus-wide reform initiatives are mostly iterative and cyclical, particularly those focusing on student success, faculty careers, programs and pedagogies, and community outreach. Those focusing on facilities projects are more linear, time-constrained. Using a template drafted by the Learning Spaces Collaboratory, *participants will* explore how planning physical environments for learning can influence and is influenced by the broader institutional context and culture, and how connecting the dots can realize more creative, sustainable transformation of the undergraduate STEM learning environment.

Jeanne L. Narum, Director—The Independent Colleges Office and Principal—Learning Spaces Collaboratory; **Kimberely Frederick**, Professor and Chair, Department of Chemistry—Skidmore; and **Michael Palladino**, Vice Provost for Graduate Students, Professor of Biology—Monmouth University

TERRACE, LOBBY LEVEL | *Supporting, Rewarding, and Building Capacity of STEM Faculty I Workshop-Theory to Practice*

CS 33: Challenging STEM Faculty Perspectives on the Diversity Question

This workshop will engage faculty, faculty development staff, administrators, and interested stakeholders in developing and sustaining inclusive pedagogy activities, workshops, or events at their institutions. Reflective exercises and small group work will be intermingled with short presentations on a model developed at the University of Rhode Island to engage more STEM faculty in the practice of improving inclusive pedagogy. This

model focuses on three core components: 1) presenting student academic performance data across demographics; 2) modeling ways faculty can increase both diverse content and inclusive teaching practices; and 3) encouraging faculty to reflect on their own social positions relative to their students. Participants will reflect on practices and share ideas that focus on evidence-based practices towards more inclusive classrooms and student experiences.

Participants will be able to 1) design inclusive pedagogy workshops or activities within the context of their institution; 2) connect with colleagues to collectively generate ideas and share evidence-based practices; and 3) develop pathways to continue their own journey towards inclusive teaching practices.

Joshua Caulkins, Assistant Director for Faculty Development, Office for the Advancement of Teaching and Learning, and Bryan Dewsbury, Assistant Professor of Biology—both of University of Rhode Island; and Catalina Martinez, Regional Program Manager, Office of Exploration and Research—National Oceanographic and Atmospheric Administration

ARLINGTON, SECOND FLOOR | *Supporting, Rewarding, and Building Capacity of STEM Faculty I Workshop-Theory to Practice*

CS 34: Connecting Science to Societal Issues: Building Capacity for Interdisciplinary Education

Interdisciplinary problem solving that makes use of science knowledge and evidence is a critical 21st century skill that is central to the goals of higher education. This workshop will explore models for developing faculty capacity to teach this skill. Two critical barriers will be addressed: 1) materials and models for interdisciplinary teaching; and 2) strategies for increasing faculty comfort with interdisciplinary instruction. The discussion will draw from models developed by the InTeGrate STEP Center in the Geosciences which seeks to increase opportunities for students to study Earth sciences in the context of environmental issues—both within science courses and across the curriculum. The professional development opportunities implemented on individual campuses and in the national network shed light on mechanisms for promoting faculty growth and pedagogic change. *Participants will learn about successful strategies for increasing interdisciplinary teaching capacity, increase their familiarity with relevant theories of change, and reflect on the application of these ideas to their own programs.*

Cathryn Manduca, Director Science Education Resource Center—Carleton College; Rick Oches, Professor and Chair, Natural and Applied Sciences—Bentley University; and David McConnell, Professor, Marine, Earth and Atmospheric Sciences—North Carolina State University

LEAP FEATURED SESSION*

STATLER, SECOND FLOOR | *Inclusive Excellence/Broadening Participation in STEM Higher Education I Workshop-Theory to Practice*

CS 35: Becoming HIP: Embedding High-Impact Practices in Science Courses to Increase Equity, Inclusion, 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. Importantly, research has shown that traditionally underserved students show even higher gains from HIPs than their peers, thus fostering much-needed equity and inclusion in STEM. Participants will explore how this approach can maximize the number of ELOs in introductory science courses without removing essential content. Methods for student metacognitive reflection, so students become purposeful in building higher-order cognitive skills and the emotional resilience to overcome academic challenges will be shared. Not only does making STEM courses more “HIP” help students, it also increases instructor satisfaction and enjoyment. *Participants will be able to 1) articulate how ELOs and HIPs can be incorporated into introductory science courses; 2) assess how current practices may unintentionally place certain students at greater risk of attrition; 3) better comprehend the distinctive roles that writing and collaborative projects play in student learning and sense of belonging; and 4) envision (using provided tools) how to adopt these practices 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

BERKELEY/CLARENDON, SECOND FLOOR | *Inclusive Excellence/Broadening Participation in STEM Higher Education I Workshop-Theory to Practice*

CS 36: Implementation of Growth Mindset Strategies in Order to Create a More Inclusive STEM Classroom

This workshop will address the positive impact of growth mindset strategies for eliminating the achievement gap and creating a more inclusive environment in the STEM classroom. Practical ideas for implementing growth mindset strategies will be shared, and participants will analyze their own course materials in order to identify ways

to implement this powerful approach to addressing the affective domain of learning. *Participants will* learn how to identify growth mindset vs. fixed mindset messages and identify specific ways to implement growth mindset approaches in their classrooms and laboratories.

Angela Bauer, Professor and Chair of Biology and **V. McNeil Coffield**, Assistant Professor of Biology—both of High Point University

BEACON HILL, FOURTH FLOOR | *Inclusive Excellence/Broadening Participation in STEM Higher Education I Workshop-Theory to Practice*

CS 37: Creating a More Inclusive and Engaging STEM Classroom

Process Oriented Guided Inquiry Learning (POGIL) is a pedagogy that incorporates techniques that have been shown to retain students from underrepresented groups. Students collaborate in groups of 3-4 to work through carefully designed classroom activities. As part of the Westminster AAC&U TIDES project, five institutions adopted a set of culturally sensitive POGIL activities for a computer science course accessible to all students. Based on the five instructors' experiences, the presenters developed "Levels of Student Participation and Stages of Relevant Curriculum" to help all STEM faculty assess how to make their classrooms more inclusive and make their curriculum more relevant. *Participants will* learn about these activities and how they might be assessed to provide information to help advance student success.

Helen Hu, Professor of Computer Science—Westminster College; **Tricia Shepherd**, Professor and Chair of Chemistry—St. Edward's University; and **Clifton Kussmaul**, Associate Professor of Computer Science—Muhlenberg College

WHITTIER, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Workshop-Theory to Practice*

CS 38: PULSE Regional Networks as a Mechanism to Stimulate Departmental STEM Education Transformation

Participants will engage with members of their own institution and their PULSE Regional Network to develop Action Plans based on self-evaluation of their departmental practices and culture using tools developed by PULSE Regional Networks. Facilitators will also share findings from each of the six PULSE Regional Networks. *Participants will* use Systems Thinking to develop effective changes in departments and gain an understanding of PULSE Regional Networks as a support and resource to help STEM departments align with current best practices and to transform institutional cultures to stimulate undergraduate STEM reform.

Christopher Finelli, Professor and Chair, Department of Biology and Marine Biology—University of North Carolina Wilmington; **Loretta Brancaccio-Taras**, Professor and Chair, Department of Biological Sciences—Kingsborough Community College; **Thomas Jack**, Professor, Biological Science—Dartmouth College; and **David Ribble**, Professor, Biology—Trinity University

CAMBRIDGE, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform I Workshop-Theory to Practice*

CS 39: Career Navigation under Conditions of Stereotype Threat: Examining Strategies and Long-Term Response Patterns

Drawing on an exploratory study, this workshop will introduce participants to different ways women scientists respond to stereotype threat at work, and engage in an idea-generation process about implications. Whereas most solutions for career-advancement for women in STEM adopt an individual approach (i.e., train in negotiation skills, mentorship) or an institutional approach (i.e., hire more women, develop family-friendly policies), this work focuses on the interaction of individual differences with organizational contexts. *Participants will* 1) learn about ways women scientists strategically navigate careers in stereotype-threatening environments; 2) understand how and why strategies might differ between women working in the same organization; 3) understand the potential costs and benefits of employing specific strategies to more effectively mentor and support women scientists; and 4) share strategies for responding to stereotype-threatening cues and contribute ways to use this framework to create effective interventions in higher education.

Mateo Cruz, Visiting Lecturer, Organizational Behavior—Bentley University

WHITE HILL, FOURTH FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform | Workshop-Theory to Practice*

CS 40: STEM Education Transformation: Using Contextual Design Theory to Assist with Institutional Change

This session will address organizational change and STEM education transformation through the application of Contextual Design Theory. It will feature one university's partnership with industry leaders in technology certifications to create IT programs which are relevant and sustainable. Through the integration of Contextual Design Theory, this program is strategically being designed with a focus on accessibility of the system to end-users. This backwards design concept begins with core learning outcomes and new pedagogical learning strategies. The implementation of these innovative strategies within a B.S. in Information Technology competency-based education program has not only led to transformations in learning strategies within this program, but also within the traditional B.S. in Computer Technology program. *Participants will* learn strategies to implement cultural change in STEM curriculum based on the social science theory of contextual design; explore advanced STEM pedagogies and practices through the integration of Contextual Design Theory and partnerships with industry leaders; discuss barriers to implementing institutional change efforts and potential solutions; and apply the concepts of competency-based education to translate theory into practice when designing new STEM curriculum. **Monica Shukla**, Associate Dean, Curriculum, Assurance of Learning, and Tutorial Faculty Affairs, **Sheila Steinberg**, Professor, Social Sciences, and **Gerald Lege**, Tutorial Faculty, Competency Based Education—all of Brandman University

GEORGIAN, SECOND FLOOR | *Understanding Effective Strategies for Transforming Institutional Cultures for Undergraduate STEM Reform | Workshop-Theory to Practice*

CS 41: National Science Foundation: Interactive Technical Assistance for Funding Broadening Participation in STEM - Part II

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 workshop, NSF program officers will showcase specific proposal case studies as a tool for equipping potential principal investigators with cultural awareness and the relevant grantwriting skills that will likely yield better project efficacy. *Participants will* examine and explore proposal case studies relevant to STEM broadening participation.

Andrea Johnson, Program Officer and **Claudia Rankins**, Program Officer—both of the National Science Foundation

10:45 – 11:45 A.M. PLENARY

GRAND BALLROOM, SECOND FLOOR

Connecting STEM Research, Teaching, Learning, and National Advocacy to Real-World Challenges

Tyrone Hayes, Professor of Integrative Biology—University of California, Berkeley

How is STEM faculty helping students to connect their learning to solving complex real-world problems that are important to them and to society? Dr. Hayes will talk about the ways in which STEM educators can best prepare students not only to hypothesize, research, and develop solutions, but also to help educate the public, business, and civic sectors of society to make wise decisions that best serve the public good with understanding of its inextricable connections to the natural world.

Thank you for participating in and contributing to the program.

Please complete the online conference evaluation form to help us design the 2017 AAC&U/PKAL STEM conference.

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