



PROJECT KALEIDOSCOPE
Advancing What Works in STEM Education

NETWORK FOR ACADEMIC RENEWAL CONFERENCE

CROSSING BOUNDARIES: TRANSFORMING STEM EDUCATION

Westin Seattle | Seattle, Washington
November 12-14, 2015

Dear Colleagues,

The Association of American Colleges and Universities (AAC&U) and Project Kaleidoscope (PKAL) welcome you to the Network for Academic Renewal conference *Crossing Boundaries: Transforming STEM Education*. Over the next few days, we invite you to join with colleagues to examine strategies and practices for addressing the national imperative to produce more competitively trained, liberally educated STEM graduates and ensuring a scientifically literate citizenry. *Crossing Boundaries* provides an opportunity to share and discuss the kinds of integrative, inclusive, and engaging approaches to teaching and learning that all students need to address the pervasive and multifaceted issues of contemporary life. From public health; to climate change; to water, food, and personal security in the midst of geopolitical instability, the program encourages us to collaborate across disciplines, among all campus sectors, and with community and business partners to truly engage students with real-world issues from multiple perspectives.

Scott Page, Leonid Hurwicz Collegiate Professor of Complex Systems, Political Science and Economics at the University of Michigan will set the context for the conference by analyzing the ways in which diversity contributes to—indeed is essential for—a high-quality learning environment. Erika Camacho, Associate Professor of Mathematics and Natural Sciences at Arizona State University will share insights into the ways in which interdisciplinary and applied learning is helping educators and students cross boundaries to make the connections necessary to solve complex problems. And Nancy Cantor will provide strategies and practices for creating inclusive campus cultures that realize the assets that all students bring to college to increase the number of STEM baccalaureate degree earners who master complex STEM content and competencies, and for enhancing STEM literacy for all students. Campus-based research, models, and strategies for change contribute to concurrent sessions, facilitated discussions, and poster presentations, providing points of departure for critiquing the most promising practices in transforming STEM education.

Because this achievement is not possible without the commitment of STEM faculty, we thank you for exploring with us the inextricable links among STEM higher education, inclusive excellence, a competitive workforce, and a scientifically-literate citizenry.

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

Karen Ann Kalla
Director, Network for Academic Renewal

SPONSORS

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Contributing Sponsor

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LEAP FEATURED SESSIONS

Liberal Education and America's Promise

Throughout the conference program, sessions noted with the **Liberal Education and America's Promise (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; helps them to improve their efforts to ensure that all students achieve essential liberal education outcomes; and shines a spotlight on educational practices that work. 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.

FUTURE NETWORK FOR ACADEMIC RENEWAL CONFERENCES

February 18-20, 2016 | New Orleans, Louisiana

General Education and Assessment: From My Work to Our Work

March 17-19, 2016 | Philadelphia, Pennsylvania

Diversity, Learning, and Student Success: Shifting Paradigms and Challenging Mindsets

October 6-8, 2016 | Denver, Colorado

Global Learning in College

November 3-5, 2016 | Boston, Massachusetts

Transforming STEM Education

For information about Network for Academic Renewal conferences, please see www.aacu.org/meetings/network or contact Karen Kalla or Jacqueline Martin at 202.387.3760

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. Sign-up sheets for lunch and dinner groups, organized by areas of interest will be available in the registration area. You are also invited to join the conversation on Twitter at #aacustem15

CAMPUS CONTRIBUTORS

AAC&U extends a special note of appreciation to the individuals and campuses listed below for their many contributions to the conference program.

Bellevue College

M. Gita Bangera
Dean, Undergraduate Research

Jennie Mayer
Physical Sciences Program Chair/Chemistry Instructor

Eastern Washington University

Judd Case
Dean of the College of Science, Technology, Engineering, Math

Edmonds Community College

Jenny McFarland
Biology Instructor

Gonzaga University

Catherine Cronin
Project Coordinator

Joanne Smieja
Professor of Chemistry

Heritage University

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Title V STEM Grant Director

Lane Community College

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Joann Otto
Professor and Chair, Biology Department

Willamette University
Mark Stewart
Professor of Psychology

SCHEDULE AT A GLANCE

Thursday, November 12, 2015

- 10:00 a.m. – 7:00 p.m. **Conference Registration and Membership Information**
- 9:30 – 11:00 a.m. **Bullitt Center Tour** (*separate registration required*)
- 2:00 – 5:00 p.m. **Pre-conference Workshops** (*separate registration and fee required*)
- 2:30 – 4:00 p.m. **Bullitt Center Tour** (*separate registration required*)
- 7:00 – 8:15 p.m. **Keynote Address | Understanding Complexity: Diversity Matters**
Scott E. Page—University of Michigan
- 8:15 – 9:00 p.m. **Reception**

Friday, November 13, 2015

- 7:30 – 8:00 a.m. **Breakfast**
- 8:00 – 9:00 a.m. **Concurrent Sessions**
- 9:15 – 10:15 a.m. **Plenary | Meta-analysis Perspectives on Interdisciplinary and Applied Learning**
Erika T. Camacho—Arizona State University
- 10:45 – 11:45 a.m. **Concurrent Sessions**
- 11:45 a.m. – 1:45 p.m. **LEAP Challenge Forum Luncheon:
Preparing Students to Create Solutions for Our Future**
- 2:15 – 4:30 p.m. **Concurrent Sessions**
- 4:30 – 6:30 p.m. **Poster Sessions and Receptions**
- 4:30 – 6:00 p.m. **Bullitt Center Tour** (*separate registration required*)

Saturday, November 14, 2015

- 8:00 – 8:30 a.m. **Continental Breakfast**
- 8:30 – 10:45 a.m. **Concurrent Sessions**
- 11:00 a.m. – 12:00 p.m. **Closing Plenary | Examining the Intersections of Equity, Diversity, Community
Engagement, and STEM Education**
Nancy Cantor—Rutgers University-Newark

PROGRAM OF EVENTS

THURSDAY, NOVEMBER 12, 2015

10:00 a.m. – 7:00 p.m. Conference Registration and Membership Information

GRAND BALLROOM FOYER, GRAND LEVEL

Please visit the conference registration desk to pick-up your badge, conference materials, and membership information.

9:30 – 11:00 a.m./2:30 – 4:00 p.m. Bullitt Center Tour

Separate registration required. Tour is limited to 25 persons. Participants will meet AAC&U staff (Alex Belknap at 9:30 a.m. and Dan Singh at 2:30 p.m.) in hotel lobby to walk 1.4 miles to the Bullitt Center located at 1501 E. Madison Street.

The Bullitt Center, now recognized as “the greenest commercial building in the world” is recipient of the Living Building certification—the most challenging benchmark of sustainability in the built environment. In 2014, the Bullitt Center produced 60 percent more energy from solar panels on its roof than it used, largely due to efficiencies that exceeded expectations, making it the most energy efficient office building in the United States and possibly the world. We are pleased to offer tours of the Center thanks to Seattle University’s Center for Environmental Justice and Sustainability, which is housed at the Bullitt Center. The Center’s mission is to support interdisciplinary scholarship, teaching, and learning in environmental justice and sustainability. Visit their website at www.seattleu.edu/cejs.

2:00 – 5:00 p.m. Pre-conference Workshops

These workshops are ticketed events. For details and availability, please visit the conference registration desk.

PINE, WESTLAKE LEVEL

WORKSHOP 1: Committing to Equity, Diversity, and Inclusive Excellence: Transformational Cultural Change for Student Success in STEM

Committing to equity and diversity in STEM requires the creation of Inclusive Excellence goals that are campus-wide, valued, and assessed. The process is a long-term endeavor with the end goal of creating a culture that makes equity, diversity, and inclusiveness habits practiced throughout all aspects of the institution with emphasis on supporting and engaging faculty and all campus practitioners. Participants will gain a greater understanding of institutional change related to diversity and equity in STEM, as well as a blueprint for Making Excellence Inclusive.

Jesús Treviño, Associate Vice President for Diversity—University of South Dakota; and **Tia McNair**, Associate Vice President for Diversity, Equity, and Student Success—AAC&U

VASHON, SAN JUAN LEVEL

WORKSHOP 2: Improving the Climate for a Diverse STEM Faculty

This workshop will share institutional family-life-work policies and strategies that attract and support a diverse workforce. Examples from large research institutions as well as within a network of 28 predominantly undergraduate institutions will provide case studies and evidence of what works. Deans, administrators, and faculty leaders committed to improving the climate for a diverse faculty—with a focus on those historically underserved—are invited to consider how they might be adapted to their own campuses.

Donna Dean, Executive Consultant on Leadership and Talent Development—Association for Women in Science, and Career Consultant—American Chemical Society; and **Janice Voltzow**, Co-Principal Investigator of NSF-funded ASAP ADVANCE, and Professor of Biology—University of Scranton

FIFTH AVENUE, GRAND LEVEL

Workshop 3: Quantitative Reasoning Supporting STEM Success: Changing your Campus Culture and Curriculum

Participants will be introduced to Quantitative Reasoning (QR) and discuss the creation of QR centers and curriculum to support STEM students and faculty. The algebra dominated curriculum of developmental math is being questioned and QR courses and programs are replacing it. Workshop leaders will discuss creating and running a QR program that scaffolds STEM curriculum and changes the campus culture toward meaningful engagement with mathematics. Participants will engage in concrete QR activities.

Eric Gaze, Director of the Quantitative Reasoning Program—Bowdoin College, and President—National Numeracy Network; and **Margot Black**, Director of the Symbolic and Quantitative Resource Center—Lewis & Clark College

CASCADE BALLROOM II, MEZZANINE LEVEL

WORKSHOP 4: Transforming Institutions: 21st-Century Undergraduate STEM Education

Higher education is increasingly challenged to prepare students for life and work in the 21st-Century, particularly careers in STEM. Emerging models for transformation utilize best practices from diverse fields. This workshop will summarize the current state of higher education STEM reform efforts and engage the audience in suggesting next steps in the path toward transformation.

James Lehman, Director, and **Wilella Burgess**, Managing Director—both of the Discovery Learning Research Center—Purdue University; and **Gabriela Weaver**, Vice Provost for Faculty Development—University of Massachusetts–Amherst; and **Linda Slakey**, Professor Emeritus, and former Dean of the College of Natural Science and Mathematics—University of Massachusetts–Amherst, Senior Scholar—Bay View Alliance, and Senior Fellow—AAC&U/PKAL

CASCADE BALLROOM I, MEZZANINE LEVEL

WORKSHOP 5: 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 US 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 teachers. 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 and **Roxane Roca**, Instructor of Mathematics—both of Western Washington University; **Stamatis Vokos**, Professor of Physics—Seattle Pacific University; **Sara Julin**, Senior Physics Instructor—Whatcom Community College; and **Paul Kuerbis**, Professor of Education Emeritus—Colorado College

7:00 – 8:15 p.m.

Welcome and Keynote Address

GRAND BALLROOM II & III, GRAND LEVEL

Welcome and Opening Remarks

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

Keynote Address

Understanding Complexity: Diversity Matters

Scott E. Page, Leonid Hurwicz Collegiate Professor of Complex Systems Political Science and Economics—University of Michigan, and External Faculty—Santa Fe Institute

Diversity is essential to a quality learning environment and the cognitive- and identity-based diversity of students—and educators can and should influence the design of teaching and learning experiences. However, the multiple mechanisms through which these forms of diversity operate and what these mechanisms imply—for higher education in general and STEM in particular—raise interesting questions. Dr. Page will share insights from research and scholarship on complex systems and on the functional contributions of both forms of diversity within the academy. He will discuss the potential for more inclusive and equity-minded frameworks to transforming STEM education.

8:15 – 9:00 p.m.

Reception

GRAND BALLROOM I, GRAND LEVEL

FRIDAY, NOVEMBER 13, 2015

7:15 a.m. – 4:30 p.m.

Conference Registration and Membership Information

GRAND BALLROOM FOYER, GRAND LEVEL

Please visit the conference registration desk for your badge, conference materials, and membership information.

7:30 – 8:00 a.m.

Continental Breakfast

Breakfast will be available 7:30 – 8:00 a.m. Continental breakfast will be available in Lobby-, Westlake-, Mezzanine-, San Juan- and Grand-Level foyers. Please select the discussion in which you would like to participate then visit the breakfast buffet in the foyer area closest to that discussion room. Please enjoy your breakfast in the discussion room of your choice.

8:00 – 9:00 a.m.

Concurrent Sessions

FIFTH AVENUE, GRAND LEVEL | *Theme 1: Integrative Undergraduate STEM Teaching and Learning | Facilitated Discussion*

CS 1: From Theory to Practice: Retention Models that Engage Diverse Students in STEM Research.

Participants will understand the need for retention programs to offer mentored research opportunities for students in STEM; distinguish three distinct retention program models that provide mentored research opportunities for students in STEM; and identify promising practices for meaningful research experiences and collaboration with faculty mentors.

For underrepresented, first generation, and low socioeconomic students, STEM identity development is vital for academic persistence, success, and retention. Opportunities for career exposure and skill development can be obtained through meaningful research with faculty (Jones, M.T., Barlow, A.E.L. and Villarejo, M. (2010). Mentored research experiences provide an avenue to develop analytical and technical skills, writing abilities, a greater understanding of how academics and theory inform practice, as well as acquisition of scientific language (Lopatto, D. (2007). This panel of practitioners and university faculty will highlight three retention program models that focus on STEM identity development through meaningful research. Panelists will focus on strategies for developing research opportunities with meaningful impact with a focus on access, mentoring, and training. Participants will learn about and discuss how to adapt these programs which have resulted in students' successful completion of mentored research experiences and improved outcomes for supporting students underrepresented in STEM.

Stephanie Gardner, Director, Louis Stokes Alliance for Minority Participation, Teri Ward, Director, Health Sciences Center Minority Students Program, Todd Sperry, Assistant Director, EIP/McNair Scholars Program, and Catherine Canetti, Electrical Engineering Major, expected graduation Spring 2017—all of University of Washington

PUGET SOUND, LOBBY LEVEL | *Theme 1: Integrative Undergraduate STEM Teaching and Learning | Facilitated Discussion*

CS 2: Laboratory Algebra: Why Does This Challenge Students and What Can We Do to Help?

Participants will understand why many students find basic lab calculations so difficult and how we might alleviate the problem through more integrative laboratory experiences grounded in current cognitive theory.

Even some of our better STEM students struggle with laboratory algebra; calculating chemical dilutions, making unit conversions, using a standard curve to determine a solute concentration in a sample, etc. Transfer of these skills from course to course is also problematic since many students focus solely on the surface structure of these calculations. Especially when we are committed to teaching students through active, inquiry-based approaches, we recognize that students need to wrestle a bit with the problem to try to figure it out themselves. However, this can be counterproductive if students give up too quickly or become exasperated. Session facilitators will describe how they attempted to remedy this situation by employing LEAP-based laboratories designed by interdisciplinary teams, using simple analogies that help students to think about the deep structure of certain types of problems, and utilizing assessment data to further interdepartmental education reforms. Participants will share experiences and discuss how to develop strategies that work.

David Koetje, Professor of Biology and Herbert Fynewever, Associate Professor of Chemistry and Biochemistry—both of Calvin College

CASCADE BALLROOM I, MEZZANINE LEVEL | *Theme 1: Integrative Undergraduate STEM Teaching and Learning | Facilitated Discussion*

CS 3: Vibrant Interdisciplinary STEM Undergraduate Research Curricula Beginning at the Freshman Level

Participants will gain insights into curricular-design for interdisciplinary STEM learning; identify demonstrable goals for project-based experiential learning; and identify clear and specific assessment strategies for STEM experiential courses.

Through support from Delaware-EPSCoR (NSF-EPSCoR program), Delaware-INBRE (NIH-NIGMS IDeA program), NSF ARRA, Cannon Scholar (NSF S-STEM program) and the State, Wesley College established a successful partnership to bring undergraduates into the research enterprise beginning at the freshman level, with special emphasis on closely-mentored, well-designed STEM projects. Designed around the best practice of multi-tiered mentoring, the College is committed to effective practices that help to support and retain students. Participants will discuss how this particular focus on fostering success in populations underrepresented in the STEM fields equips students with the skills and credentials required to move forward toward a thriving career.

Malcolm J. D'Souza, Professor of Chemistry and Associate Dean of Interdisciplinary/Collaborative Sponsored Research, **Kathleen Curran**, Professor of Biology and Chair of Science, **Paul Olsen**, Associate Professor of Mathematics and Chair of Mathematics, **Agashi Nwogbaga**, Professor of Mathematics, and **Stephanie Stotts**, Assistant Professor of Environmental Studies—all of Wesley College

CASCADE BALLROOM II, MEZZANINE LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Facilitated Discussion

CS 4: Building Lifelong Learning Skills into Course Design

Participants will outline and apply backward course design; discuss and revise participant-created learning goals, outcomes, assessments, and learning experiences; practice teaching and learning techniques; and model group member roles.

Too often, courses focus purely on learning discipline-related content and not on lifelong learning skills that will serve students throughout their college career, getting—and keeping—a job, and becoming a responsible citizen. These skills can be integrated into any course as a vehicle to construct subject-specific knowledge. To accomplish such a task with intentionality and clear expectations, learning goals and outcomes and course assessments that focus on lifelong learning should be included. Participants will discuss such course attributes and create or redesign one learning goal, outcome, assessment, and learning experience for their chosen course.

Erin M. Hill, Physics Lecturer—University of Washington Bothell

ELLIOTT BAY, LOBBY LEVEL | Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education | Facilitated Discussion

CS 5: Learn by Example: Solving Classroom Challenges of Traditional and Active Learning Approaches with Culturally Responsive Teaching (CRT)

Participants will explore how CRT can enhance their instruction and apply CRT principles in a problem-solving process designed to address common course challenges.

Are your students not engaging in class discussions? Are they having trouble working with their classmates on a group project? Even the best laid active learning plans can run into unexpected problems, resulting in frustration for both professors and students. Participants will be guided through an interactive problem-solving process based on the principles of culturally responsive teaching (CRT). Participants will first discuss common problems they encounter in their teaching. They will then be exposed to core principles of CRT and discuss how they are relevant to the success of their students, especially those from groups underrepresented in STEM. They will then work in groups applying CRT strategies to produce multiple solutions to specific classroom challenges faced by professors. Finally, session facilitators will describe their experience implementing this process through a Teaching to Increase Diversity and Equity in STEM (TIDES) grant.

Alla Webb, Professor of Computer Science, **Raymond Gonzales**, Professor of English for Academic Purposes, and **Mark Alves**, Professor of English for Academic Purposes—all of Montgomery College (Maryland)

PIKE, WESTLAKE LEVEL | Theme 3: Supporting, Rewarding, and Building Capacity of STEM Faculty | Facilitated Discussion

CS 6: Non-tenure Track Faculty in STEM Education: Tapping the Resource

Participants will come away with new ways of supporting the NTT faculty on their campuses. Conversations will provide the opportunity to develop a clear view of the issues that face institutions with large number of NTT faculty. Successful strategies for providing technical, administrative, and social support will be shared.

For many academic institutions in the United States, the faculty model is increasingly differentiated, with different faculty members having different responsibilities and time commitments. Ehrenberg 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 (Ehrenberg, J. Econ. Perspect., 2012, 193-206). Supporting NTT STEM Faculty is therefore key to institutional success. The discussion will begin with an overview of a case study of Georgia State University; NTT faculty members in full-time, permanent positions now make up 31% of our STEM faculty. The facilitators will describe structural ways to provide resources to enhance NTT faculty personal development, professional advancement, research productivity, mentoring skills, and opportunities for innovation. Group discussions will allow participants the opportunity to share issues and begin to strategize change on their home campuses.

Dabney W. Dixon, Professor of Chemistry and Coordinator of STEM Education Initiatives and **Anu G. Bourgeois**, Associate Professor and Undergraduate Director, Computer Science—both of Georgia State University

CS 7: Preparing Critical Faculty for the Future: Agents of Change to Enhance Student Engagement and Learning in STEM

Participants will receive practical information, strategies, and guidelines to implement a faculty development program grounded in evidence-based, effective teaching strategies and mentoring.

Transforming STEM education practices requires effective faculty training in evidence-based teaching and implementation of these strategies as integral components of instruction. With the heavy teaching loads and commitments that exist at many institutions this remains an on-going challenge. Facilitators will discuss the establishment of the NSF funded Preparing Critical Faculty for the Future (PCFF) program to implement an effective faculty development program in this environment and gain momentum for institutional transformation. Ways that institutions can leverage resources to sustain professional development efforts, encourage and reward faculty, and increase faculty use of these strategies will also be discussed.

Louise Wrensford, Professor of Chemistry/Interim Associate Provost of Office of Research and Sponsored Programs and Graduate Dean, **Rhonda Porter**, Associate Professor of Mathematics Education, and **Janis Carthon**, Assistant Professor of Educational Leadership—all of Albany State University

CS 8: Evaluation, Validation and Use of PULSE Vision and Change Rubrics

Participants will gain an understanding of the utility of the rubrics for assessment of the current state of their STEM department alignment with the recommendations of Vision and Change (2011).

The PULSE Vision and Change Rubrics 1.0 have been published via the web and publicized as a Letter to the Editor in CBE Life Sciences. The rubrics were developed for departmental self-assessment and as the basis of a tiered certification program, with an underlying assumption that excellent/exemplar levels of achievement will lead to improved student learning outcomes. Complete data from 18 institutions, and data from specific rubric sections from approximately 50 schools has been collected and analyzed. A factor analysis has shown that the rubric sections have high internal reliability. As originally developed, the rubrics were meant to apply to all institution types, and additional statistical analysis has determined that the instrument shows no bias by institution type. An abbreviated form of the certification rubrics (PULSE Progress Snapshot Rubric) will be introduced to show how assessment data are being collected with interactive technology.

Pamela Pape-Lindstrom, Faculty and Co-Chair, Department of Biology—Everett Community College; and **Judy Awong-Taylor**, Associate Dean and Professor of Biology—Georgia Gwinnett College

CS 9: Fostering an Entrepreneurial Mindset in Engineering Students, Faculty, and Institutions

Participants will identify the characteristics and skills related to an entrepreneurial mindset and in particular, how they map to the LEAP outcomes. They will also evaluate different approaches to measure, demonstrate, and communicate evidence of entrepreneurial skills.

How might the goals of a 21st century liberal education, particularly those around the outcomes of creativity and innovation, be translated into the framework of entrepreneurship in engineering education? This discussion will explore the concept of an “entrepreneurial mindset” – defining its attributes, how it can be measured, and determining what kinds of evidence would effectively demonstrate entrepreneurial capabilities. Drawing upon the work of the Kern Entrepreneurial Education Network (KEEN) and its holistic approach to fostering the development of entrepreneurially minded engineers at the institutional level as well as research findings from the National Center for Engineering Pathways to Innovation, participants will brainstorm approaches for assessing and evaluating evidence of entrepreneurial thinking through the use of ePortfolios and the VALUE rubrics.

Helen L. Chen, Director of ePortfolio Initiatives and Research Scientist, Designing Education Lab, Department of Mechanical Engineering—Stanford University; **Doug Melton**, Kern Entrepreneurial Engineering Network (KEEN) Program Director—Kern Family Foundation; and **Terrel Rhodes**, Vice President, Office of Quality, Curriculum, and Assessment—AAC&U

CS 10: Making the Case: Space Matters in Enhancing the Learning Experience of All Students

Participants will explore evidence from research and practice on the impact of the quality of the physical space on the motivation, persistence, and success of underrepresented minorities in learning. They will also collaborate in identifying ‘take-home’ ideas for action.

Findings from a controlled research study at Morgan State University document the impact that integrated attention to how students learn, what students learn, and where students learn has profound impact on learners’ motivation, persistence, and success. Over a three-year period, a team including a design professional, senior administrator, and faculty collaborated in the arc of planning for assessing. Recognizing the increasing diversity of undergraduates in our nation’s

college and universities, their work, of particular import at Morgan State as an HBCU, offers lessons learned for all academic institutions. Our collective challenge—explicitly set forth in national reports such as PCAST and Crossroads, is to think about means by which all students develop the sense of self-confidence that is so critical to learning, and begin to see themselves as part of a community of practice beyond the campus.

Jeanne L. Narum, Principal – Learning Spaces Collaboratory; and James Determan, Principal-Hord Coplan Macht, Inc.

GRAND BALLROOM II & III, GRAND LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | LEAP Featured Session

CS 11: AAC&U Newcomers' Welcome and Introduction to LEAP

Participants will learn the who, what, why, and where of AAC&U, the Liberal Education and America's Promise (LEAP) initiative, and the Degree Qualifications Profile (DQP), exploring how the LEAP vision for learning serves as a useful overarching framework for undergraduate learning. The session will focus on AAC&U's centennial year themes of quality, equity, and inclusive excellence.

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 or intended career. In this session, participants will learn how AAC&U's four broad goals for student learning: 1) *LEAP: Liberal Education as a Global Necessity*; 2) *Quality: 21st-Century Markers for the Quality of U.S. Degrees*; 3) *Equity: Innovation, Inclusive Excellence, and Student Success*; and 4) *Social Responsibility: Integrative Liberal Learning and the Global Commons* and its LEAP initiative provide both context and framework for the undergraduate experience.

Susan Albertine, Vice President, Diversity, Equity, and Student Success—AAC&U

9:15 – 10:15 a.m.

Plenary

GRAND BALLROOM II & III, GRAND LEVEL

Introduction

Melissa Soto, Director, Undergraduate STEM Education—AAC&U

Plenary Address

Meta-analysis Perspectives on Interdisciplinary and Applied Learning

Erika T. Camacho, Associate Professor of Mathematics and Natural Sciences—Arizona State University

Preparing all students to address the social, environmental, health, and geopolitical issues of their time requires multifaceted understandings in STEM fields and their relationships with the humanities. One cannot address public health or climate change without deep knowledge in science, economics, social justice, geography, history, and current political structures. And addressing these issues also requires a STEM literate public able to make wise personal, professional, and civic-minded decisions with agency for the common good. Dr. Camacho will explore the ways in which interdisciplinary and applied learning are helping educators and students make the connections necessary to address complex problems, with particular emphasis on advancing STEM learning for underrepresented students.

10:45 – 11:45 a.m.

Concurrent Sessions

CASCADE BALLROOM I, MEZZANINE LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | LEAP Featured Session

CS 12: Civic Engagement Models to Foster Integrative Science Education

Participants will share their experiences of using civic engagement as tool to promote integrative learning and gather ideas and practices that they can take back to their home campuses.

Both the LEAP outcomes of civic responsibility and the high-impact practices promoted by AAC&U include civic engagement. Drawing from experiences over the past five years incorporating civic engagement into multiple STEM-related interdisciplinary programs (including public health and environmental studies), this discussion will explore using long-term, cross-disciplinary projects beyond the single course model. Participants will consider how to engage members of groups traditionally underrepresented in STEM and students from diverse academic backgrounds in addressing complex real-world problems. Community-based projects push students to integrate experiences from different disciplines and to cross the boundary between campus and community. Session facilitators and participants will discuss opportunities and challenges in working with community partners and designing assessment and reflection to foster student learning.

Deborah S. Gross, Professor of Chemistry, Debby R. Walser-Kuntz, Professor of Biology and Broom Faculty Fellow for Public Scholarship, and Melissa A. Eblen-Zayas, Associate Professor of Physics—all of Carleton College

CS 13: St. Olaf Center for Interdisciplinary Research: Building Interdisciplinary Student-faculty Research

Participants will better understand how to foster innovative, collaborative, interdisciplinary research that supports both students and faculty members.

The St. Olaf Center for Interdisciplinary Research (CIR) has fostered an environment of collaborative research between teams of 3-5 students from quantitative disciplines (primarily statistics but also mathematics and computer science) and faculty members at the college. These faculty members, called domain experts, come from a wide variety of disciplines such as economics, history, languages, and the natural sciences. The student teams provide quantitative expertise to faculty researchers; they fully engage in the project, reading primary literature and meeting regularly with the domain expert. An important benefit of this model is that the domain experts, often from fields outside of the sciences and mathematics, truly benefit from the students' expertise and participation in the research process. Participants will learn how the CIR has proven to be a viable method of supporting interdisciplinary undergraduate research during both the academic year and the summer in a manner that is beneficial to both faculty members and students.

Matthew Richey, Professor of Mathematics, Statistics, and Computer Science—St. Olaf College

CS 14: Inclusive Active Learning: Designing Active STEM Class Sessions for All Students

Participants will understand avenues of diversity in large classrooms; assess challenges in designing equitable activities; and initiate design processes for activities at their own institutions.

Direct experimentation into active learning in large STEM classrooms reveals that active learning works, but not equally for everyone. Data reveal avenues of diversity that force us to think critically about who we want active learning to serve, in what ways we need students to think, and about how activities can be best designed. Are men and women in your classrooms sharing equally in the opportunities to practice specific skills? Are cultural minorities all benefiting from the dynamic feedback in peer instruction and group work? Large classrooms are a particularly rich opportunity to improve the overall influence and outcomes of higher education, but starting this process requires a deeper understanding of the social cognition that goes on in these courses. Facilitators and participants will discuss how to use results from experiments in biology classrooms at UW to demonstrate important areas for faculty to consider when using active learning.

Benjamin Wiggins, Manager of Biology Instruction and **Alison Crowe**, Principal Lecturer—both of University of Washington; and **Sarah Eddy**, Post-doctoral Researcher—The University of Texas at Austin

CS 15: Impact of STEM Large Lecture Transformation: Fostering Critical Thinking and Problem Solving Skills

Participants will learn how two large lecture STEM courses were transformed and key research findings about the effectiveness of redesigned courses on students' engagement, performance, and satisfaction.

How can traditional large lecture STEM courses be transformed to increase student-centered learning? What are the core design elements that best fit undergraduate STEM education reform? What are the instructional strategies that foster students' critical thinking and problem solving skills? What types of support for instructors are critical in the transforming process? Participants will learn key details of research findings including the main design elements for transforming large lecture STEM courses to advance essential student learning outcomes. They will discuss transferable design elements, supporting technologies, and identify challenges to making such transformations sustainable.

Jae-eun Russell, Instructional Services Specialist of ITS Office of Teaching, Learning, and Technology—The University of Iowa

CS 16: Deeper STEM Learning through Metacognitive Conversation

Participants will learn how to initiate and support metacognitive conversations to build subject-area expertise in STEM courses by participating in metacognitive conversations led by community college STEM instructors.

What is the relationship among literacy, metacognition, and STEM content knowledge? And what can we do about it? Reading Apprenticeship is an instructional model which provides students with resources for approaching complex texts more confidently and strategically by engaging their instructors in a dynamic professional development process of making their thinking visible. STEM faculty leaders from the California statewide Reading Apprenticeship Community College STEM Network will engage participants in metacognitive conversations centered on complex disciplinary texts that defeat many students. By discovering and reflecting on their own ways of unlocking STEM graphs, charts, illustrations, and problems, and so forth, participants will experience ways the Reading Apprenticeship approach helps students master core concepts and helps instructors explicitly support academic literacy in their discipline. Session facilitators will share artifacts of student work as well as classroom data to demonstrate the efficacy of Reading Apprenticeship in their STEM classrooms.

Theresa Martin, Professor of Biology and Professional Development Coordinator—College of San Mateo; **Lilit Haroyan**, Physics Instructor—Los Angeles Mission College; **Linda Zarzana**, Professor of Chemistry—American River College; and **Denise Hum**, Math Instructor—Cañada College

PINE, WESTLAKE LEVEL | Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education | Workshop

CS 17: Promoting Persistence and Success: Adapting Promising Practices and Promoting Institutional Change

Participants will develop strategies for obtaining and interpreting data on STEM student persistence on their campuses; identify appropriate evidence based practices; and create an institutional plan.

Session facilitators will introduce a persistence framework model that focuses on developing student agency, confidence, and self-efficacy through learning and professional identification. Existing literature identifies the need for both academic and social integration through first year programs, research, peer mentoring, community service, improvement in institutional climate, and access to professional networks. After identifying challenges and opportunities for implementation at their specific institutions, participants will develop strategies for obtaining and interpreting data on student persistence on their campuses, identify appropriate evidence-based practices, and create an institutional plan.

Patricia A. Marsteller, Professor of Practice in Biology and Director of the Center for Science Education—Emory University; **Cynthia Bauerle**, Assistant Director Undergraduate and Graduate Programs in Science Education—Howard Hughes Medical Institute; and **Ashleigh Wright**, Coordinator, Outreach and Initiatives and Manager, HHMI Professors Program—Louisiana State University

GRAND BALLROOM II, GRAND LEVEL | Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education | Workshop

CS 18: Scientist Spotlights: Science Identity and Educational Innovation in Community Colleges and Beyond

Participants will articulate students' stereotypes of scientists; develop teaching strategies to foster science identity; and craft examples of pre/post evaluation of classroom interventions that foster inclusive STEM classroom environments.

National interest and investment in STEM education has recently emphasized community colleges as under-utilized gateways for the next generation of science professionals (President's Council of Advisors on Science and Technology, 2012). Workshop participants will be introduced to theory and research that addresses the effects of stereotypes on student learning, including an innovative intervention called "Scientist Spotlights." Small workgroups will craft plans for developing, implementing, and evaluating the effects of their own interventions. The goal of the workshop is to encourage interventions devoted to building evidence-based practices that enrich diverse students' science interests/learning and that emerge from within community college contexts.

Mary Wyer, Associate Professor, Psychology and **Heather Perkins**, PhD Candidate, Psychology—both of North Carolina State University; and **Jeff Schinske**, Instructor, Biology—De Anza Community College

GRAND BALLROOM III, GRAND LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Workshop

CS 19: Understanding Cultural Change: Frameworks and Tools for Documenting STEM Transformation

Participants will be able to create a "driver diagram" specifying aspects of departmental and academic culture that must be addressed in order to transform STEM education; generate a set of indicators and metrics for documenting cultural change; and identify the benefits and limits of different tools for tracking and assessing cultural change.

Drawing on the work of the Bay View Alliance (BVA), a network of nine universities in the U.S. and Canada, this workshop will engage participants in exploring a challenge faced by many STEM reform initiatives: how to document progress toward a transformed academic culture that supports excellent teaching and student learning. To meet this challenge, the BVA has employed a framework focused on primary "drivers" of the existing culture and worked to translate those drivers into indicators of cultural change. To facilitate this process, they developed tools and processes for generating both qualitative evidence (through case studies of STEM departments working together to change the teaching culture) and quantitative data (through a survey of faculty attitudes, practices, and perceptions) related to those indicators. Session facilitators will describe this process and invite participants to contribute and advance their own thinking about the challenge of documenting change in ways that shape and support further progress.

Pat A. Hutchings, Senior Scholar—Bay View Alliance; and **Linda Slakey**, Professor Emeritus, and former Dean of the College of Natural Science and Mathematics—University of Massachusetts-Amherst, Senior Scholar—Bay View Alliance, and Senior Fellow—AAC&U/PKAL

CS 20: Two Models of Institutional Transformation Starting with NSF Funding

Participants will gain a clear understanding of how Bellevue College and Tacoma Community College have implemented change and will outline their own goals and strategies for change at their institution.

Integration of research throughout the curriculum is one of the key recommendations of the 2011 NSF/AAAS report “Vision and Change in Undergraduate Biology Education.” For sustained long term implementation of this recommendation, especially for community colleges, it is essential that the culture of research be institutionalized. ComGen: The Community College Genomics Research Initiative (NSF # 0717470, 1225857) was developed to integrate authentic research experiences into the classroom and is impacting around 15 colleges in the Pacific Northwest. This discussion will provide participants with two examples of institutionalized cultures of research: Bellevue College and Tacoma Community College, and will help participants to identify their own goals for institutional change and develop strategies for implementation. The facilitators will share their experiences and resources such as training and networks (e.g. Comgen, PULSE, CURENET, NIBLSE) that are available to support the participants’ activities.

Gita Mahalaxmi Bangera, Dean of Undergraduate Research—Bellevue College; and **Kim Harrington**, Faculty—Tacoma Community College

CS 21: National Science Foundation Successful Grantwriting and Technical Assistance - Part I

Participants will explore the intricacies of the infrastructure of the National Science Foundation, as well as its peer review and decision making processes, and emerging funding priorities.

For decades, the National Science Foundation has made significant investments in the improvement of undergraduate STEM education through curricular and co-curricular development, institutional capacity building, and STEM faculty development. However, more recent national reports and higher education reform efforts now call for a more concentrated effort in examining relevant STEM education research theories that best explain the underlying mechanisms of advanced pedagogies at the undergraduate level - particularly as they relate to students historically underrepresented in STEM disciplines. To that end, this session will feature a detailed overview of new and emerging directions of STEM higher education reform. Participants will also gain insight in the often misunderstood processes of grant writing and submission.

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

CS 22: Quantitative Reasoning for Higher Education: What does the Research Say?

Participants will be introduced to the National Numeracy Network (NNN) and the collective research related to Quantitative Reasoning (QR) found in their journal, Numeracy: <http://scholarcommons.usf.edu/numeracy/>.

The National Numeracy Network (NNN) offers its members a network of individuals, institutions and corporations united by the common goal of quantitative literacy for all citizens. Through national meetings, faculty workshops, research initiatives, and information sharing, the NNN aims to strengthen the capacity of our country in the quantitative areas of business, industry, education, and research across all disciplines. The Network envisions a society in which all citizens possess the power and habit of mind to search out quantitative information, critique it, reflect upon it, and apply it in their public, personal and professional lives. The National Numeracy Network promotes education that integrates quantitative skills across all disciplines and at all levels. To this end the Network supports faculty development, curriculum design, assessment strategies, education research and systemic change. Two NSF supported research projects related to assessment of QR will be shared, with results related to STEM education.

Eric Gaze, Director of the QR Program—Bowdoin College Center for Learning and Teaching and President—National Numeracy Network; and **Kate Follette**, Postdoctoral Scholar, Kavli Institute for Particle Astrophysics and Cosmology—Stanford University

11:45 a.m. – 1:45 p.m. LEAP Challenge Forum Luncheon

Preparing Students to Create Solutions for Our Future

Separate registration and \$35 fee required.

This forum will examine both theory and practice of AAC&U’s LEAP Challenge—the next stage in AAC&U’s Liberal Education and America’s Promise initiative—designed to prepare students to do *Signature Work* integrating and applying their learning to the unscripted challenges of our fast-changing global society. Students’ will share stories about the kinds of learning in college that matter to them and faculty will examine how institutions can foster programmatic, integrative, and

scaffolded approaches to problem-based learning for all students. This forum is part of AAC&U's Centennial Year focusing on quality, equity, and inclusive excellence in American higher education.

Justin T. Fermann, Lecturer in Chemistry and iCons Program and **Erin Amato**, second year Master's student, Animal Biotechnology and Biomedical Sciences Graduate Program in the Veterinary and Animal Sciences Department, expected graduation Spring 2016—both of University of Massachusetts, Amherst; and **Kathleen F. Weaver**, Director, La Verne Experience and Associate Professor of Biology, **Kimberly Pineda**, Biology major, expected graduation Spring 2018, and **Vanessa Morales**, Title V STEM Post Baccalaureate Laboratory Assistant—all of University of La Verne
Moderator: **Susan Albertine**, Vice President, Office of Diversity, Equity, and Student Success—AAC&U

AAC&U gratefully acknowledges the foundations that have provided support for our Centennial Year dialogues about Liberal Education, Global Flourishing, and the Equity Imperative, and about The LEAP Challenge: Carnegie Corporation of New York, The Charles Engelhard Foundation, The Bill & Melinda Gates Foundation, The Kresge Foundation, Lumina Foundation, Alfred P. Sloan Foundation, and The Teagle Foundation.

2:00 – 3:00 p.m.

Concurrent Sessions

VASHON, SAN JUAN LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Innovation/Ideation Session

CS 23: Novel Model for Preparing Pre-service STEM Teachers

Participants will review different pre-service teacher STEM preparation models and evaluate short and long term merits in order to make recommendations to home institutions for possible alterations to existing programs.

Research has shown that attitudes about STEM are significantly influenced by teachers in elementary school and those teachers report overwhelmingly negative attitudes toward STEM. To address this problem, Cabrini College has developed and implemented a novel teacher STEM preparation model. This two semester course fully integrates science content with best practice STEM pedagogy. Graduates of the course, on both immediate and long term surveys, have consistently reported that this model has improved their attitude toward STEM and prepared them to implement inquiry based STEM education in their classroom. Details of this novel model and assessment data will be discussed.

Anne Coleman, Associate Professor of Life and Physical Sciences—Cabrini College

CASCADE BALLROOM I, MEZZANINE LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Innovation/Ideation Session

CS 24: Enhancing STEM Education through Written Communication and Narrative

This session will include two distinct presentations.

Moderator: **Christopher Thaiss**, Clark Kerr Presidential Chair and Professor in the University Writing Program—University of California-Davis

STEAM: Putting the Arts and Advocacy into STEM; Improving Written Communication in the Freshman Year

Participants will leave with an understanding of how an oral communication course utilizing parliamentary style debate can lead to an increase in written communication skills within freshman biology.

Recent reports have shown that employers rate preparedness of college graduates much lower than the students' self reported scores on areas such as written and oral communication, teamwork within diverse groups, and organizing and prioritizing information. For first generation students, under preparedness in communication may be linked to high communication apprehension, which has been shown to influence academic and interpersonal success, two primary indicators of college retention. This session will introduce participants to a novel approach to incorporating arts and advocacy into STEM (from STEM to STEAM) in a low-risk environment. Session facilitators will share a cross-disciplinary curricular approach using parliamentary style debate that teaches students to think critically, identify gaps of knowledge in the opposing argument, and translate science. Participants will learn about the successes, challenges, and preliminary findings from the first year.

Kathleen F. Weaver, Director, La Verne Experience and Associate Professor of Biology, **Jerome V. Garcia**, Chair and Associate Professor of Biology, and **Robert Ruiz**, Director of Forensics, Speech and Communications Department—all of University of La Verne

Programming Narratives: An Interdisciplinary Approach to Creative Problem-solving

Participants will gain an understanding of the creation, implementation, and assessment of general education interdisciplinary curricula and case studies that infuse narrative elements into introductory computer programming courses.

Interdisciplinary studies help students achieve the learning goal of making meaningful and multiple connections among the liberal arts, as well as among the liberal arts and the areas of study leading to a major or profession. This session will focus

on implementing lessons learned from mixed-methodology educational research to engage all students in problem solving with computer programming via a general education interdisciplinary course for non-computer majors and a narrative case study module for majors. In this co-taught course, through the study of the structure of narrative, concepts of problem solving, and the logic of computer programming, students develop a narrative-driven video game prototype. Emphasis is placed on creative writing and computational thinking. The facilitators will address how to create a module to help students develop narrative and writing skills that can be incorporated in all sections of introductory computer programming courses.

Reneta D. Lansiquot, Associate Professor and Program Director, Professional and Technical Writing—New York City College of Technology—The City University of New York

CASCADE BALLROOM II, MEZZANINE LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Innovation/Ideation Session

CS 25: Supporting Student Success: Collaborations and Online Tools

This session will include two distinct presentations.

Moderator: **Erin Sanders**, Director of the Center for Education Innovation in Life Sciences—University of California-Los Angeles

REBUILDETROIT: A Systemic Inter-institutional Collaboration to Diversify the Biomedical Workforce

Participants will develop specific collaboration plans related to colleges and universities with whom they might engage on curricular alignment to facilitate student success and engagement.

The overarching goal of the Research Enhancement for BUILDing Detroit (REBUILDETROIT) project is to develop and implement innovative approaches to engage undergraduate students from underrepresented groups in biomedical research. A consortium of four urban Detroit institutions of higher education (Marygrove College, the University of Detroit Mercy, Wayne County Community College District, and Wayne State University) are working together to devise and implement innovative, evidenced-based, and cutting-edge programs to develop the next generation of outstanding biomedical researchers. The program is both research-based and research generating. The program includes an inter-institutional curricular re-design and alignment of target foundational courses in biology, chemistry, and social science as a means to introduce undergraduate students to authentic research early in their college careers. Session facilitators will share the theoretical framework, organizational, logic, and learning community models which support this project.

Jeanne M. Andreoli, Associate Professor of Biology and Chair, Division of Natural Sciences and Mathematics—Marygrove College; **Steven Chang**, Assistant Professor of Biology—University of Detroit Mercy; and **Andrew Feig**, Associate Professor of Chemistry and Associate Dean of the Graduate School—Wayne State University

Kizzle: A Mobile-device App to Augment Classroom Instruction and Increase Student Engagement

Participants will learn about an adaptive learning tool that will support students in the learning of the principles and content that is required in their introductory science courses.

This session will describe a new mobile phone app, Kizzle, that is designed to support student learning in introductory STEM courses. The use of Kizzle provides students with another venue for asking questions, and it provides automatic feedback to the course instructor when students are struggling, providing an opportunity to directly support students.

April Kontostathis, Chair and Professor of Mathematics and Computer Science—Ursinus College

PIKE, WESTLAKE LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Innovation/Ideation Session

CS 26: Innovations in Teaching Mathematics

This session will include two distinct presentations.

Moderator: **Eric Gaze**, Director of the Quantitative Reasoning Program—Bowdoin College, and President—National Numeracy Network

Creating a Meaningful Bridge from Developmental Math Pathways to STEM Courses

Participants will learn about a set of courseware that bridges the Carnegie Foundation's Statway and Quantway Pathways to college level STEM courses and lessons learned by this collaborative approach.

The Carnegie Foundation's Pathways have shown to be successful in getting students to and through college mathematics. The initial design of Statway and Quantway was based on the observation that most students starting in developmental math were unlikely to proceed into advanced math courses. However, the success of these pathways has led to students who now wish to pursue STEM degrees requiring more mathematics. Session facilitator will describe a set of courseware collaboratively developed by Pathways faculty that bridge the Pathways courses to STEM courses. Sample materials and outcomes of the pilot phase will be shared.

Cinnamon Hillyard, Associate Professor and Senior Associate—University of Washington Bothell and Carnegie Foundation for the Advancement of Teaching

Examining the Impact of Flipped Learning in Mathematics

Participants will review and discuss different concepts of flipped learning; distinctions between flipped classes and flipped learning; and the impact of these methods on students in various mathematics courses.

Flipped learning has become a popular topic in higher education. However, the term "flipped" has also been used broadly to describe many different instructional practices. The session facilitator will open discussion with participants about different instructional practices and the characteristics of an effective course that integrates flipped learning. Participants will examine various studies on flipped learning that have been conducted by the facilitators, the differences in how flipped learning was used, and the impact of these differences on students' achievement and attitudes in undergraduate mathematics courses.

Anthony M. Dove, *Assistant Professor of Mathematics and Statistics—Radford University*

PINE, WESTLAKE LEVEL | *Theme 1: Integrative Undergraduate STEM Teaching and Learning | Innovation/Ideation Session*

CS 27: Instructional Tools for Blended Learning

This session will include two distinct presentations.

Moderator: **Thomas Poon**, *Interim President—Pitzer College*

Teaching and Learning STEM: An Integrated Approach

Participants will explore strategies to integrate asynchronous online instructional tools in traditional life science courses and develop efficient instructional strategies and teaching techniques for remedial teaching to promote student learning.

Based on experience, undergraduate students who lack a conceptual foundation in physical and chemical processes struggle to succeed in life science courses. To address this issue, faculty integrated an online module on basic physics as a foundation for biology classes. This online module provides instruction in physics, assesses student comprehension, and offers additional conceptual resources. Facilitators will discuss the results and implications of using this strategy for fostering greater understanding in biology courses.

Galyna Kufryk, *Professor of Biology—Grand Canyon University*

Computational Skill-Building in the Natural Sciences using a Blended Approach

Participants will learn about what has worked in using self-study learning modules with embedded exercises, assessments and journaling using web-based computational notebooks on a dedicated server.

Facilitators will describe a project for improving student learning of scientific computing, algorithmic thinking, and programming skills. This project integrates skill building with content knowledge and emphasizes culturally inclusive strategies to improve the persistence and success of all students. It is designed around a sequence of learning modules that incorporate computational techniques in the context of scientific applications and include exercises to provide practice in applying techniques and assessment activities for students to demonstrate mastery. Participants will learn how in the first iteration, instruction was through a flipped physics course where the modules were made available through online notebooks to be read before class. In class, students worked together to complete the exercises leveraging collaborative peer learning and faculty coaching. Participants will learn how course format also provided faculty the opportunity to explore a variety of culturally inclusive teaching and learning strategies including hybrid reflection and lab journals, student-generated narratives, and feedback from student consultant observers.

Elizabeth McCormack, *Professor of Physics* and **Mark Matlin**, *Senior Lecturer and Laboratory Coordinator—both of Bryn Mawr College*

GRAND BALLROOM III, GRAND LEVEL | *Theme 1: Integrative Undergraduate STEM Teaching and Learning | Innovation/Ideation Session*

CS 28: Innovations in Chemistry and Biology Courses

This session will include two distinct presentations.

Moderator: **Kimberly Specht**, *Associate Professor and Chair (chemistry and biology)* and **James M. and Carolyn O. Gillingham**, *Endowed Professor—Denison University*

Deliberations in Chemistry: Innovating Undergraduate STEM Education

Participants will examine the implementation of deliberation—facilitated group discussion—in a survey of chemistry courses, consider the impact on translation of chemical knowledge to policy, and brainstorm further applications.

While undergraduate STEM education has long been focused on imparting technical information to students, it is critical that faculty address the connection between that scientific knowledge and the ways in which we communicate, make choices, and act as a society. Deliberation is a collaborative tool to access and develop these interdisciplinary skills. Session

facilitators have introduced a deliberation of energy policy into a Survey of Chemistry course for non-majors, with students reporting high levels of satisfaction in both content and critical thinking measures. This session will enable participants to brainstorm opportunities for expanding this pedagogy to other STEM courses.

Laura Marie Wysocki, Assistant Professor of Chemistry and **Sara Ann Mehlretter Drury**, Assistant Professor of Rhetoric—both of Wabash College

Fostering Interdisciplinary Thinking and Learning in First-Year Chemistry and Biology Classrooms

Participants will recognize the impact that an interdisciplinary learning environment has on the ability of students to think and problem solve at a higher level than most traditional introductory science classrooms.

North Seattle College has been working for more than ten years to transform introductory science courses to be more collaborative, interdisciplinary, and research-based. They recently partnered with Central Washington University to develop transportable interdisciplinary investigations (IDIs) that can be incorporated into any first year chemistry or biology classroom or laboratory, thus increasing the number of students who are impacted by these experiences. This presentation will focus on the IDI design process, as well as initial assessment results, which capture how students think, learn, and problem solve an interdisciplinary context early in their college experience.

Ann Murkowski, Professor of Biology and **Kalyn Shea Owens**, Professor of Chemistry—both of North Seattle College

GRAND CRESCENT, GRAND LEVEL | Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education | Innovation/Ideation Session

CS 29: Computer Science: Exploring New Approaches to Integrating STEM and the Humanities

This session includes two distinct presentations.

Moderator: **C. Gary Reiness**, Associate Dean of the College of Arts and Sciences—Lewis & Clark College

Teaching Freshmen-level Art History Through Computer Science Research

Participants will receive information about transforming a humanities core-curriculum course into course-based research experience (CRE) that involves computer science and authentic STEM research.

Computer science is a field with low presence of underrepresented minorities, and the presence of women and minorities has not shown major improvement in the past few decades. The facilitators modified a core-curriculum humanities course so that art history is studied using computer science in a research-driven fashion. Rather than learning art history through lectures, the course-based research experience (CRE) module allows STEM and non-STEM students to experience authentic research related to computer science as early as their freshman or sophomore year. Participants will see findings of student surveys and exit interviews that show strong engagement of students in research activities.

Lior Shamir, Associate Professor of Computer Science and **Franco Delogu**, Assistant Professor—both of Lawrence Technological University

Using Computer Science Research for Student Engagement in Introductory Level Psychology Courses

Participants will receive information about embedding a computer science course-based research experience (CRE) into a psychology core-curriculum course.

While research-experience is one of the most powerful tools to improve recruitment and retention of students in STEM, undergraduate students are not normally exposed to research before their junior or senior year. To make research experience accessible to freshman and sophomore students, we enhanced core-curriculum courses in psychology with research-based modules, allowing the students to perform authentic research as part of a standard core-curriculum course. The CRE module also exposes students of non-technological majors to computer science. Participants will see how student surveys and exit interviews show strong engagement of the students in the research activities.

Franco Delogu, Assistant Professor of Psychology and **Lior Shamir**, Associate professor of Computer Science—both of Lawrence Technological University

GRAND BALLROOM II, GRAND LEVEL | Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education | Innovation/Ideation Session

CS 30: Exploring Metacognition and Active Learning Strategies for Student Success

This session will include two distinct presentations.

Moderator: **Gita Mahalaxmi Banger**, Dean of Undergraduate Research and RISE Institute—Bellevue College

Supporting Underrepresented Students in STEM Disciplines through Metacognitive Practices

Participants will explore metacognitive activities, including novel group and individual assignments, used with first generation STEM majors in RIT's project IMPRESS (Integrating Metacognitive Practices and Research to Ensure Student Success).

Session facilitators will describe IMPRESS, a program that addresses metacognitive practice in deaf/hard-of-hearing and first generation STEM majors. Research shows that these students significantly overestimate their understanding (even more than their hearing/non first generation peers), are more likely to fail a first-year course, and have lower retention rates than their peers. IMPRESS involves a pre-matriculation summer workshop, a general education course on metacognitive practice, and a learning assistant experience. Facilitators will provide program details and materials to enable participants to adapt and replicate the program on their campus.

Elizabeth Hane, Faculty Associate to the Provost for General Education and Associate Professor, School of Life Sciences—Rochester Institute of Technology

Effectiveness of Sequenced Inverted-lecture Interventions to STEM Student Success

Participants will analyze and discuss data assessing the effectiveness of a two-course freshman major sequence taught using an active/collaborative learning approach to overcome common barriers to STEM student success.

Wright State University has implemented a project that utilizes a Student Centered Active Learning Environment with upsidedown pedagogies teaching model to address non-technical barriers that may prevent underrepresented groups from progressing through a STEM discipline. Removing the traditional lecture, classroom time is now used to overcome possible obstacles (psychosocial, STEM identity, academic preparedness, opportunity, and cognitive skills) to student success through targeted group active/collaborative learning activities. Participants will learn of the latest evaluation which focuses on increased retention, success in STEM majors, and improvement of measurable educational outcomes throughout a freshman introductory computer science yearlong sequence.

Kathleen Timmerman, Doctor of Philosophy Candidate, Computer Science and Engineering, **Michael Raymer**, Associate Dean for Research and Graduate Studies, College of Engineering and Computer Science, **John Gallagher**, Professor of Computer Science and Engineering, and **Travis Doom**, Robert J. Kegerreis Distinguished Professor of Teaching—all of Wright State University

ELLIOTT BAY, LOBBY LEVEL | Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education | Engaged Digital Learning Session

CS 31: Make Tech Accessible with iDesign Studio

Participants will get a glimpse into curricular components and hardware options, focusing on students with no technical background, through sample lab material and completed student work.

Designers are continually innovating ways of incorporating technology into today's world, from projections of butterflies on Grammy performance dresses to "smart" purses that sense when your wallet is missing. The recent emergence of low-cost, user-friendly components is making this new world of design accessible to a broad community. The associated development environment provides an opportunity to demystify technology and inspire students from historically underrepresented groups to gain computer science and engineering experience. This session will provide a glimpse into the iDesign Studio, piloted as a First Year Seminar with 14 women at Mount Holyoke College, where students learn the basics of electronics and microcontrollers to design and create prototypes of products from scratch.

Audrey St. John, Associate Professor of Computer Science—Mount Holyoke College

PUGET SOUND, LOBBY LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Workshop

CS 32: Letting Go Of the Status Quo to Meet the Needs of Your Institution

Participants will 1) explore what drives change in STEM education and how to strategically and proactively exceed associated programming and space requirements; 2) understand how change is necessary for STEM education to move forward; and 3) discover ways to implement changes to STEM teaching and research environments on attendees' own campuses.

To make fluid the interdisciplinary nature of STEM education, higher education institutions must overcome barriers that prevent seamless and effective use of spaces that promote interdisciplinary teaching and research. Further, they must come to terms with ever-changing institutional missions that require new ways of teaching and new standards for space. This dynamic session will explore methods of thinking about and adapting to changing needs within STEM environments, including what makes us want to use a space, how well learning occurs in certain environments, and how to strategically think about space in creative ways. Presenters will share a problem set involving the evolution of a science center and the associated administrative and faculty objectives and obstacles to change. In an interactive exchange of ideas, participants will be asked to discuss this problem set and develop solutions applicable to both the case study and to their own individual institutions. Attendees will leave the session with strategies for implementing positive changes in STEM environments.

Leslie Sims, AIA, LEED AP BD+C, Senior Science Expert and **Toni Loiacano**, AIA, NCARB, LEED AP BD+C, Laboratory Planner—both of EYP Architecture and Engineering; and **Ellen L. Aho**, Professor, Academic Program Director, Clinical Laboratory Science—Concordia College

CS 33: National Science Foundation Successful Grantwriting and Technical Assistance - Part II

Participants will examine and explore proposal case studies relevant to STEM higher education reform.

As a direct result of the strategic investments of the National Science Foundation in improving undergraduate STEM education, active learning strategies are accepted, though not uniformly practiced, as the most impactful tools for STEM student learning. Conveying these complex concepts to reviewers remains a significant challenge for most STEM faculty. In the current session, NSF program officers will showcase specific proposal case studies as a tool for equipping potential principal investigators with effective grantwriting skills. This session will also offer insight into the shifting funding priorities of NSF and how potential PIs can best address them in the grant writing and submission processes.

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

3:15 – 4:15 p.m.

Concurrent Sessions

CS 34: Interdisciplinary Curricular Transformation and Research Experience to Advance Stem Education

Participants will learn about strategies to implement interdisciplinary STEM education models including integrative teaching and research experiences for students, resource requirements, institutional commitments, and faculty.

Lehigh University has engaged in a comprehensive program that has transformed life science education into an interdisciplinary experience that integrates STEM fields. With support from the Howard Hughes Medical Institute and the University, they have transformed over 45 courses, significantly increased research-based course experiences, and implemented a now 9-year old interdisciplinary summer research training program for undergraduates. Participants will learn how this approach covers the full 4-year undergraduate experience and assessments show significant positive impact on students. Session facilitators will discuss the processes central to building faculty engagement and institutional commitment to developing an interdisciplinary culture in STEM education.

Vassie C. Ware, Professor of Biological Sciences and **Neal G. Simon**, Professor of Biological Sciences—both of Lehigh University

CS 35: The Productive Pause: Practical Strategies for Incorporating Reflection in Engineering Education

Participants will have the opportunity to discuss and share reflective practices; wrestle with the challenges associated with reflection in engineering; and identify strategies to infuse reflection into engineering education practice and culture.

Educators will discuss benefits and methods of reflection for both educators and students. The discussion will begin with considering the ways in which consortium members have implemented reflection with students in their practice through a field guide of 120 reflection activities used at 12 diverse campuses. The first portion of the conversation will focus on the ways in which the educators participating in the session have supported student reflection in their classes and co-curricular interactions with students. Each table will discuss topics such as: creatively infusing reflection into the classroom, supporting students' value of reflection, and supporting high-level academic initiatives through reflection. The discussion context will broadly focus on integrative undergraduate STEM teaching and learning so that participating educators working in institutions of various sizes and populations will benefit.

Lauren D. Thomas, Research Scientist—University of Washington

CS 36: Learning to Write and Writing to Learn: A Rhetorical Approach to Teaching Professional Writing to Advanced STEM Undergraduates

Participants will explore how rhetorical, professional writing assignments encourage STEM students to not only write in their discipline, but to deepen their discipline-specific knowledge.

Session facilitators will use the Writing Across the Curriculum framework, specifically the learning to write and writing to learn model, to engage participants in a conversation about rhetorical writing for STEM undergraduates. Specifically, they will facilitate discussion of genres for professional and public audiences, assignment design, instructional scaffolding, and peer review activities that are proven to be effective in improving students' preparation for writing in and beyond campus.

Chris Thaiss, Clark Kerr Presidential Chair and Professor in the University Writing Program, **Brenda Rinard**, Assistant Director of Writing Across the Curriculum and Lecturer in the University Writing Program, **Melissa Bender**, Writing Across the Curriculum Workshop Member and Lecturer in the University Writing Program, and **Katie Rodger**, Lecturer, University Writing Program—all of University of California at Davis

CS 37: For Good Measure: Assessing Quantitative Literacy and Reasoning (QLR) in General Education

Participants will be able to comprehend QLR in the context of general education assessment in a liberal education setting; evaluate five QLR learning outcomes, and map a QLR assessment tool onto those SLOs; evaluate a pre/post assessment plan for QLR and identify relevant transferrable practices; interpret initial findings and propose corroborating sources of evidence; and anticipate possible challenges to implementation.

Session facilitators will introduce the development of a Quantitative Literacy/Reasoning initiative at Duke University. At many institutions, assessment of QLR often focuses narrowly on outcomes achieved in individual courses, such as Calculus I. In contrast, the flexibility of the general education curriculum in Trinity College requires that the assessment methodology accommodates the plurality of pathways through which students develop mastery of QLR. Facilitators will introduce the process by which to measure the development of QLR within general education, including a review of the QLRA instrument developed by a partnership of educators from Bowdoin College, Colby-Sawyer College, and Wellesley College.

Jennifer L. Hill, Associate Director, Office of Assessment and **Matt Serra**, Director, Office of Assessment—both of Duke University

CS 38: Decreasing Effective Class Size and Engaging Students in Interactive Learning in the “Large” Lecture

Participants will discuss challenges and opportunities associated with teaching and engaging students in large lectures; develop strategies to promoting engagement using LAs (learning assistants) in large classrooms; and examine data related to the effectiveness of interactive learning with and without LAs.

Participants will learn how trained peer facilitators (Learning Assistants, LAs) in the classroom can increase engagement, outcomes, and participation with active learning activities. Session facilitators will describe a project designed to decrease the effective class size of large lectures by using LAs to aid in execution of classroom activities. Faculty work closely with LAs to increase student outcomes, create community, and increase interactive learning. Participants will explore implementation, strategies for success, and examine data related to the implementation of interactive learning with and without LAs as evidence of the success of this program.

Lori J. Kayes, Course Coordinator/Instructor and **Devon Quick**, Course Coordinator/Instructor—both of Oregon State University

CS 39: Integrating Authentic Research in Curricula to Teach Scientific Inquiry and Enhance Student Learning

Participants will discuss strategies, advantages, and disadvantages of integrating authentic research into undergraduate science curricula and review assessment data on the impact of this model on student learning.

In science education, providing learning environments that allow students to experience the authenticity of scientific practice has been suggested since Dewey. Scholars argue that when students are exposed to authentic research projects in which students are active participants, they are engaged in the inquiry process in a manner similar to professional scientists. Establishing authentic science learning environments requires several crucial components. Research projects must be adapted for college students and sufficient and accessible resources and guidance must be provided. Opportunities for communication and interaction between students and instructors are critical. Mechanisms to promote cooperation in one institute, or across multiple institutions facilitates cooperation and successful long term implementation. Facilitators and participants will discuss a web-based model of integrating authentic research into undergraduate science curricula to teach authentic scientific inquiry. Practical experience and formal assessment data will be reviewed and discussed.

Derek Wood, Professor of Biology, **Daihong Chen**, Graduate Assistant, and **Jennifer Tenlen**, Assistant Professor of Biology—all of Seattle Pacific University

CS 40: Bringing Effective Metacognitive Self-assessment to Teaching and Assessment of Student Learning

Participants will learn how to write self-assessment challenges and to further students' learning by teaching them to use the challenges and to create their own self-assessment instruments and measures. They will use paired data taken from self-assessments and direct measures of competency to learn sources of frequent misinterpretations and to acquire the skills to test the validity of conclusions made from their own measures.

If students believe that they can do something given their present skill and knowledge, how well can they actually do it? Data obtained from two well-aligned, reliable paired instruments from nearly 1,200 participants indicated that students, despite a few exceptions, are generally aware of their competency; that self-assessments correlate positively with performance (explain at least 30% of variance); and that teaching self-assessment skills is likely to improve student learning.

Session facilitators will explain how beliefs that self-assessments are random noise or that people are largely "unskilled and unaware of it," can arise from innumeracy or mistaking mathematical artifacts for displaying the actual character of human self-assessments.

Edward Nuhfer, Professor and Director (retired)—California State University Channel Islands and Humboldt State; and **Karl Wirth**, Associate Professor of Geology—Macalester College

GRAND CRESCENT, GRAND LEVEL | Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education | Workshop

CS 41: Research Training Models Leading to Nationally Recognized Outcomes

Participants will consider the impact of research training practices and graduate school preparation within the framework of mentoring, science identity, and community building.

The adoption of best practices has become a major focus of STEM research training interventions. A growing literature of successful practices exists, but predicting how they may impact outcomes when implemented in a new training location, or institutional environment, can be daunting. Understanding the socio/behavioral framework, in which a best practice operates, facilitates selecting the right practice. Participants will learn about graduate school preparation of STEM undergraduates, in two different academic divisions at Morgan State University and examine the impact of various training practices on minority students.

Jumoke Oluwakemi Ladeji-Osias, Associate Professor and Associate Chair for Graduate Studies, Department of Electrical and Computer Engineering, **Christine F. Hohmann**, Professor, Department of Biology, **Cleo Hughes-Darden**, Chair of Biology, and **Stella Hargett**, Professor and Chair, Department of Sociology—all of Morgan State University

GRAND BALLROOM III, GRAND LEVEL | Theme 3: Supporting, Rewarding, and Building Capacity of STEM Faculty | Workshop

CS 42: Is There A Formula for Understanding and Improving STEM Student Motivation?

Participants will gain knowledge about a unifying framework of student motivation, experiences on how to apply the framework to improve student motivation, and resources/tools for later use.

Ideally knowledge of motivation theory and research would be used by all faculty to improve learning and instruction. However, because of its complexity and the numerous theoretical models that have been proposed, understanding motivation theory and research can be daunting. This workshop will showcase a new professional development approach aimed at simplifying this complexity. Instead of training faculty about multiple theoretical models of motivation, workshop participants will be trained on a single, unifying motivation formula to help quickly understand the major sources of student motivation and what faculty and administrators can do to redesign STEM courses and STEM curriculum to better promote student motivation. In addition to providing examples based on an on-going program of motivation research and past experiences working with STEM faculty, workshop participants will be provided opportunities to apply this formula to address motivational issues that they face on their college campus.

Kenneth Barron, Professor of Psychology and Co-Director of James Madison University's Motivation Research Institute—James Madison University; and **Steve R. Getty**, Director, Quantitative Reasoning Center—Colorado College

PUGET SOUND, LOBBY LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Facilitated Discussion

CS 43: Collaborating to Transform Undergraduate STEM Education at Interlinked 2- and 4-Year Institutions

Participants will identify critical factors at 2- and 4-year institutions that enable the widespread use of evidence-based teaching and learning practices by faculty and students at their institutions.

This session will actively engage participants in discussions that promote undergraduate education reform across all STEM disciplines, at individual and interlinked, two- and four-year institutions. Particular attention will be paid to institutional policies (faculty reward systems), departmental practices (course evaluations, annual faculty reviews) and faculty and student factors (diversity, understanding of effective teaching and learning practices, resistance to change) that either enable or inhibit reform efforts. Participants will have the opportunity to discuss the various roles that faculty members, chairs, deans, and administrators play in supporting widespread use of student-centered learning practices.

Ed Geary, Director of Science, Mathematics and Technology Education, **Joann J. Otto**, Professor and Chair, Biology Department, and **Emily Borda**, Associate Professor of Chemistry and Science Education—all of Western Washington University

FIFTH AVENUE, GRAND LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Workshop

CS 44: Transforming STEM Education: Examining Change by Discipline, 2004-2012

Participants will gain awareness of trends in effective educational practices in STEM fields; explore how different STEM fields have or have not been changing; and consider trends as a basis for assessing effectiveness of STEM education reform efforts and what may be needed for ongoing reform.

Much of the effort in reforming undergraduate STEM education over the last several decades has focused on improving undergraduate teaching and learning and demonstrating the effectiveness of certain educational practices. This session will highlight results from a current study using time series data from the National Survey of Student Engagement between 2004 and 2012 for a diverse cohort of institutions to assess trends in the use of effective educational practices in particular STEM fields. Discussion will focus on interpreting findings by comparing engagement between STEM and non-STEM and across STEM fields, and investigating trends in relation to reform efforts, including Project Kaleidoscope (PKAL). Results will be presented to encourage audience interaction and interpretation of findings with special attention to differences by field and what this suggests for institution, department, and STEM field transformation in teaching and learning.

Jillian Kinzie, Associate Director, Center for Postsecondary Research, School of Education and **Thomas Nelson Laird**, Associate Professor, Educational Leadership and Policy Studies—both of Indiana University Bloomington; and **Kelly Mack**, Vice President for Undergraduate STEM Education and Executive Director of Project Kaleidoscope and **Christina Shute**, Program Coordinator, Project Kaleidoscope—both of AAC&U

4:30 – 6:00 p.m.

Bullitt Center Tour

Separate registration required. Tour is limited to 25 persons. Participants will meet AAC&U staff Cindy Koebke and Dennis Renner in hotel lobby to walk 1.4 miles to the Bullitt Center located at 1501 E. Madison Street.

The Bullitt Center, now recognized as “the greenest commercial building in the world” is recipient of the Living Building certification—the most challenging benchmark of sustainability in the built environment. In 2014, the Bullitt Center produced 60 percent more energy from solar panels on its roof than it used, largely due to efficiencies that exceeded expectations, making it the most energy efficient office building in the United States and possibly the world. We are pleased to offer tours of the Center thanks to Seattle University’s Center for Environmental Justice and Sustainability, which is housed at the Bullitt Center. The Center’s mission is to support interdisciplinary scholarship, teaching, and learning in environmental justice and sustainability. Visit their website at www.seattleu.edu/cejs.

4:30 – 6:30 p.m.

Poster Sessions and Reception

GRAND BALLROOM I, GRAND LEVEL

For poster descriptions, please see http://www.aacu.org/sites/default/files/files/STEM15/STEM15Posters_0.pdf.

THEME 1: INTEGRATIVE UNDERGRADUATE STEM TEACHING AND LEARNING

POSTER 1: BRAINS - Biosciences Retention and Academic Innovation Network for Students

Melinda A. Hamilton, Director, STEM Education and **Patricia Hartzell**, Professor, Department of Biological Sciences—both of University of Idaho

POSTER 2: Using ePortfolios and Folio-Thinking to Highlight and Advance Science Communication Skills

Megan O'Connor, Academic Technology Specialist, Program in Writing and Rhetoric and **Jennifer Stonaker**, Lecturer, Program in Writing and Rhetoric—both of Stanford University

POSTER 3: Using Large Data Analyses to Learn Lessons about the Impact of Pre-Health Undergraduate Experiences

Adrienne N. Haggins, Lecturer—University of Michigan

POSTER 4: Implementation of Student-Centered Pedagogy in Large Biology Courses

Erin R. Sanders, Director, Center for Education Innovation in Life Sciences and Assistant Adjunct Professor and **M. Kevin Eagan**, Managing Director, Higher Education Research Institute and Assistant Professor in Residence—both of University of California, Los Angeles

POSTER 5: Development of BioSquare, an Instrument to Assess Undergraduate Biological Quantitative Skills

Marcelo Vines, Director, Center for Learning, Education and Research in the Sciences—Oberlin College; and **Elizabeth Stanhope**, Associate Professor of Mathematics—Lewis & Clark College

POSTER 6: Examining the Role of Numeracy in College STEM Courses

Katherine Follette, Postdoctoral Scholar—Stanford University

POSTER 7: Increasing and Retaining STEM Majors through an Integrated Freshman Year Experience

Nathan Rank, Professor of Biology and *Martha Shott*, Assistant Professor of Mathematics and Statistics—both of Sonoma State University

POSTER 8: Crossing Disciplinary and Cultural Boundaries to Improve Quantitative Skills

Genk Suphioglu, Associate Professor of Biomedical Science—Deakin University

POSTER 9: Building Better Interactive Online Modules for Hybrid and Flipped Classes

Andrea C. Nicholas, Instructional Professor (LPSOE)—University of California, Irvine

POSTER 10: Findings from the Engineering Majors Survey

Helen L. Chen, Research Scientist and Director of ePortfolio Initiatives—Stanford University

POSTER 11: Promoting Leadership Development within Undergraduate STEM Curricula

Kelynn Reed, Professor of Biology and *Lance Barton*, Associate Professor of Biology—both of Austin College

POSTER 12: Teaching Statistics and Research Methods - To Integrate or Not to Integrate?

Kenn E. Barron, Professor of Psychology and Co-Director, Motivation Research Institute—James Madison University

POSTER 13: Writing Interactive Fiction - Developing an Interdisciplinary Computer Science/Creative Writing Course

Alexandra Coman, Assistant Professor of Computer Science and *Lisa Robeson*, Professor of English, Chair of the Department of English—both of Ohio Northern University

POSTER 14: Faculty Perspectives on Course-Based Undergraduate Research Experiences

Erin E. Shortlidge, Postdoctoral Research Scholar and *Sara E. Brownell*, Assistant Professor of Biology—both of Arizona State University; and *Gita Bangera*, Dean of Undergraduate Research—Bellevue College

POSTER 15: The Peer Enhanced Experiential Research in STEM (PEERS) Project at Northeastern Illinois University

Sudha Srinivas, Professor of Physics—Northeastern Illinois University

POSTER 16: Crossing Boundaries in Undergraduate Biology Education

Mika Munakata, Professor of Mathematics Education and *Dirk Vanderklein*, Professor of Ecology—both of Montclair State University

POSTER 17: Teaching to Learn – The Impact of Teaching Science in Elementary Schools on College Undergraduates

Christopher M. Himes, Jorge Endowed Professor in Education/STEM Program Manager—Massachusetts College of Liberal Arts

POSTER 18: Using MakerSpace Technology to Promote Innovation and Creativity

Patrice M. Ludwig, Assistant Professor of Biology, *Erica J. Lewis*, Assistant Professor of Nursing, and *Jacquelyn Nagel*, Assistant Professor of Engineering—all of James Madison University

POSTER 19: Enhancing STEM Education - An Example of Design-Based Implementation Research in Higher Education

Ann Sitomer, Postdoctoral Scholar—Oregon State University

POSTER 20: Teaching Computer Science and Mathematics through Audio and Music

Sambit Bhattacharya, Associate Professor of Computer Science, *Chekad Sarami*, Associate Professor of Mathematics, and *Daniel Okunbor*, Professor of Computer Science—all of Fayetteville State University

POSTER 21: Inquiry-Based Learning for Every Biology Student

Luis F. Matos, Assistant Professor of Biology—Eastern Washington University

POSTER 22: Using Living-Learning Cohorts to Foster Student Learning and Engagement in STEM

Marie A. Turner, Associate Professor of Chemistry and *Ryan Theroux*, Assistant Professor, First Year Studies—both of Curry College

POSTER 23: Embedding Undergraduate Research in Student Success Programs

Jennifer Lundmark, Professor, Biological Sciences and *Lynn Tashiro*, Professor, Physics and Astronomy and Director of Center for Teaching and Learning—both of California State University Sacramento

POSTER 24: Designing a Robust Summer Bridge Program Centered upon Interdisciplinary STEM Research

Stephen Waratuke, Associate Professor of Chemistry, *Thomas Kling*, Professor of Physics, and *Matthew Salomone*, Assistant Professor of Mathematics—all of Bridgewater State University

POSTER 25: Effective Use of Student Presentations in a Mathematics Course: An Analysis of Student Performance

Chinenye Ofodile, Professor of Mathematics, *Rhonda Catina Porter*, Professor of Mathematics Education, and *Janis Carthon*, Assistant Professor—all of Albany State University

POSTER 26: Deliberative Pedagogy and Integrative STEM Learning - Scaffolding for Student Success

Gwen Shusterman, Professor of Chemistry and Director of STEM Initiatives—Portland State University

POSTER 27: Implementation and Evaluation of a Course-Based Research Experience in Introductory Biology

Jeffrey Olimpo, Assistant Professor of Biological Sciences—University of Texas at El Paso; *Sue Ellen DeChenne*, Assistant Professor of Biology Education and *Ginger Fisher*, Assistant Professor of Biology—both of University of Northern Colorado

POSTER 28: Instilling Scientific Competencies in First-Year Students via Cell/Molecular-Based Food Research

David Koetje, Professor of Biology and *Herbert Fyneweaver*, Associate Professor of Chemistry and Biochemistry—both of Calvin College

POSTER 29: Broadening Opportunities and Leveraging Diversity - Collaborating across Boundaries

Sarah Monisha Pulimood, Associate Professor and Chair of Computer Science and *Kim Pearson*, Associate Professor of English—both of The College of New Jersey

POSTER 30: FIRE - The First-Year Innovation and Research Experience

Patrick J. Killion, Director of First-Year Research Programs—University of Maryland

POSTER 31: URISE - University of Richmond Integrated Science Experience

April Hill, Professor of Biology—University of Richmond

POSTER 32: Ocean Acidification Data Analysis in the Chemistry Classroom

Hilary I. Palevsky, Graduate Student, School of Oceanography—University of Washington

POSTER 33: I-CUBED, RISE and BUILD Programs - Addressing Student Preparation

Maryam Foroozesh, Chair, Division of Mathematical and Physical Sciences and Head, Department of Chemistry and Margaret W. Kelly Endowed Professor in Chemistry and *Tiera S. Coston*, Educational Improvement Specialist, STEM—both of Xavier University of Louisiana

POSTER 34: The Development of a Thriving, Large Scale Transformative PLTL Program in the Sciences and Mathematics

John W. Sibert, Associate Professor of Chemistry—The University of Texas at Dallas

POSTER 35: Chemistry and Biochemistry Learning Community for First Year Students

Carmen Works, Professor of Chemistry and *Jennifer Lillig*, Professor of Chemistry—both of Sonoma State University

THEME 2: INCLUSIVE EXCELLENCE/BROADENING PARTICIPATION IN STEM HIGHER EDUCATION

POSTER 36: Retention of Diverse Students in STEM Fields through Achieving Excellence in Math, Engineering, and Science

Patricia DiBartolo, Professor of Psychology and Director of the Science Center and *Valerie Joseph*, Mentoring Coordinator—both of Smith College

POSTER 37: Promoting Institutional Change in STEM Courses Using High-Impact Practices and Scaffolding

Katie Rodriguez, Assistant Professor, School of Science and Math and *Suzanne Iwanicki*, Adjunct Instructor, School of Science and Math—both of Pasadena City College

POSTER 38: Psychosocial and Academic Outcomes of an All-Female Residence Learning Community
Eden J.V. Hennessey, Student Research Coordinator, Laurier Centre for Women in Science—Laurier University

POSTER 39: An Investigation of STEM as a Viable Career Option for GI Bill Recipients with Disabilities
Christine H. Grauer, Assistant Director, Center on Transition Innovations and Chelsea Russell, Graduate Research Assistant—both of Virginia Commonwealth University

POSTER 40: The Role of Interactions among Students and Faculty in Predicting a Supportive Campus Climate
Kristina A. Monteiro, Assistant Director of Evaluation and Assessment—Brown University; and Michael C. Savaria, Graduate Student—University of Massachusetts Dartmouth

POSTER 41: Gateway to Research Careers in Science
Janet A. Morrison, Professor and Chair of Biology, Director of Gateway to Graduate School, Pelson Chair in Faculty-Student Engagement—The College of New Jersey

POSTER 42: Leveraging Existing Structures into NSF S-STEM Grants
Donald Lovett, Professor of Biology, Co-Director of PERSIST S-STEM Program and S. Monisha Pulimood, Associate Professor and Chair of Computer Science, Co-Director of iPics S-STEM Program—both of The College of New Jersey

POSTER 43: Improving Retention of Underrepresented Students in Biology at a Liberal Arts College.
Thomas C. Peeler, Associate Professor of Biology and Margaret T. Peeler, Professor of Biology—both of Susquehanna University

POSTER 44: Overcoming Barriers to Practice-Based STEM Disciplines for Students with Disabilities
Wilella D. Burgess, Managing Director, Discovery Learning Research Center—Purdue University

POSTER 45: Empirically Testing a Three-Step Intervention to Increase Gender Diversity in STEM Faculty
Martha Potvin, Provost and Vice President for Academic Affairs—Montana State University

POSTER 46: Julian Scholars - An NSF S-STEM Project with a 100% Graduation Rate and Subsequent Institutional Change
Gloria Townsend, Professor of Computer Science—DePauw University

POSTER 47: AccessEngineering - Improving Engineering by Increasing the Participation of People with Disabilities
Brianna Blaser, Coordinator/Counselor—University of Washington

POSTER 48: The Case for LGBTQ+ Faculty and Students in STEM
Benny C. Chan, Associate Professor Chemistry, Co-Director of the PERSIST S-STEM Program and Matthew Cathell, Assistant Professor of Technological Studies—both of The College of New Jersey

THEME 3: SUPPORTING, REWARDING, AND BUILDING CAPACITY OF STEM FACULTY

POSTER 49: Promoting Student Access and Success in STEM through the Teaching-Research Nexus
Cynthia Y. Lester, Executive Director of STEM Initiatives—Georgia Perimeter College

POSTER 50: Increasing the Use of Active Teaching Methods by STEM Faculty
Marilyn Lockhart, Director of the Center for Faculty Excellence and Professor Adult and Higher Education—Montana State University

POSTER 51: SPARCT - A Faculty Development Program to Transform STEM Teaching Culture
Laura Frost, Director, Whitaker Center for STEM Education—Florida Gulf Coast University

POSTER 52: Evaluation of a Faculty Development Program to Design Inquiry-Based Curriculum across a Department
Kelly K. McDonald, Assistant Professor of Biological Sciences, Thomas E. Landerholm, Professor of Biological Sciences, and Allison R. Martin, Graduate Student in Biological Sciences—all of California State University Sacramento

POSTER 53: Using Course Syllabi as a Tool for Increasing Multicultural Engagement in STEM Fields

Michael C. Savaria, Graduate Student—University of Massachusetts Dartmouth; and *Kristina A. Monteiro*, Assistant Director of Evaluation and Assessment—Brown University

POSTER 54: Supporting Faculty in the Accountability Era: Fostering Instructional Data Use for STEM Improvement

Jana Bouwma-Gearhart, Associate Professor, Postsecondary STEM Education—Oregon State University; and *Hyoung Joon Park*, Graduate Student Researcher—University of Wisconsin-Madison

POSTER 55: Boyer Model of Scholarship and the Impact of Reduced Load in the Scholarly Productivity of STEM Faculty

Karinna M. Vernaza, Professor of Mechanical Engineering and Associate Dean and *Weslene Tallmadge*, Professor of Chemistry—both of Gannon University

POSTER 56: Growing Professional Learning Communities through Interdisciplinary Collaboration and G6-16 Partnerships

Darlene Panvini, Professor and Chair of Biology, *Ryan Fox*, Assistant Professor of Mathematics Education, Department of Mathematics and Computer Science, *Lauren Lunsford*, Associate Dean, College of Liberal Arts and Social Sciences, and *Bonnie Smith Whitehouse*, Professor, Department of English—all of Belmont University

POSTER 57: Bringing Online Teaching Resources and Communities to Undergraduate Life Science Educators

Miranda Byse, Program Manager, Life Science Teaching Resource Community and Professional Skills Training—American Physiological Society

POSTER 58: Fighting the Fear - A Faculty Collaboration to make Statistics Accessible to Introductory Students

Kristen Maxwell, Assistant Professor, Mathematics, *Sarah Augustine*, Assistant Professor, Social Science, and *Tamara Wiley-Fauth*, Assistant Professor, Mathematics—all of Heritage University

THEME 4: INSTITUTIONAL TRANSFORMATION FOR UNDERGRADUATE STEM EDUCATION REFORM

POSTER 59: Supporting Teaching Innovation to Promote STEM Student Success

David Polcyn, Professor of Biology and *Laura Woodney*, Associate Professor of Physics—both of California State University-San Bernardino

POSTER 60: Enhancing Student Success in Biology, Chemistry, and Physics by Transforming the Faculty Culture

Howard E. Jackson, Professor of Physics, *Jill R. Beyette*, Assistant Professor of Biology, and *Anne M. Vonderheide*, Assistant Professor of Chemistry—all of University of Cincinnati

POSTER 61: Interventions for First-Time STEM Students Informed by Mixed Methods Analysis

Carina Beck, Director, Allen Yarnell Center for Student Success and *Diane Donnelly*, Director, University Students and Academic Advising Center—both of Montana State University

POSTER 62: InTeGrate - Using a Systems Approach to Effect Educational Transformation

Cathryn A. Manduca, Director of Science Education Resource Center—Carleton College

POSTER 63: Transformation of the Introductory Biology Experience for All Students

Anne E. Kruchten, Chair and Associate Professor of Biology—Linfield College; and *Walter Shriner*, Instructor of Biology—Mt. Hood Community College

POSTER 64: Transforming STEM Education at Two-Year Colleges

Deann Leoni, Mathematics Instructor and *Jenny McFarland*, Biology Instructor—both of Edmonds Community College

POSTER 65: Increasing Retention and GPA Using Living-Learning Communities and Research Collaboration

David A. Blair, Director of Institutional Assessment and *Richard Kopec*, Professor of Computer Science and Chemistry—both of St. Edward's University

POSTER 66: Collaborative Learning through Faculty-Student Learning Communities in STEM

Anita Mandal, Associate Professor of Biology and *Felicia Wider-Lewis*, Assistant Professor of Mathematics—both of Edward Waters College

POSTER 67: Collaborations for SySTEMic Change - A Scalable Model for Student Transitions

Cheryl Young, Associate Professor of Geology, STEM Activities Coordinator, *Kristen Maxwell*, Assistant Professor, Mathematics, and *Tamara Wiley-Fauth*, Assistant Professor, Mathematics—all of Heritage University

POSTER 68: What's Space Got to Do with It?

Wilella D. Burgess, Managing Director, Discovery Learning Research Center and *Loran C. Parker*, Assessment Specialist Discovery Learning Research Center—both of Purdue University

POSTER 69: Implementing a Reformed Curriculum in a Multi-Section Undergraduate General Chemistry Course

Jonathan Cox, Postdoctoral Research Associate—University of Arizona

POSTER 70: Discipline-Based Experts for Teaching Transformation - The Carl Wieman Science Education Initiative

Warren J. Code, Associate Director of Science Centre for Learning and Teaching—University of British Columbia

SATURDAY, NOVEMBER 14, 2015

8:00 - 11:00 a.m.

Conference Registration and Membership Information

GRAND BALLROOM FOYER, GRAND LEVEL

Please visit the conference registration desk for conference and membership materials and information.

8:00 – 8:30 a.m.

Continental Breakfast

Breakfast will be available 8:00 – 8:30 a.m. Continental breakfast will be available in Lobby-, Westlake-, Mezzanine-, San Juan- and Grand-Level foyers. Please select the discussion in which you would like to participate then visit the breakfast buffet in the foyer area closest to that discussion room. Please enjoy your breakfast in the discussion room of your choice.

8:30 – 9:30 a.m.

Concurrent Sessions

PUGET SOUND, LOBBY LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Facilitated Discussion

CS 45: Cross-Disciplinary Efforts to Enhance the Written Communication Skills of STEM Students

Participants will come away with ideas to enhance the writing experiences of students in their classes and will consider the incorporation of writing in the discipline programs within their curriculum.

English and science faculty will present their experience of collaborating and developing writing intensive courses within the science curriculum. Chemistry and biology faculty have collaborated with writing specialists on campus, through faculty writing fellowships, to develop scaffolded writing assignments and comprehensive rubrics in an attempt to improve student writing within the science disciplines. Faculty have worked to differentiate between creative writing and scientific writing, as well as laboratory notebook keeping versus formal science writing. Faculty have also collaborated with students through our Classroom Partner writing program, embedding student writing tutors in specific courses and establishing a regimen of writing lab workshops, to enhance undergraduate science writing and improve student confidence in writing. Both science and English faculty members will describe these writing initiatives, how they have been developed, administered, and assessed in the classrooms, and share their experiences and results thus far.

Marlee B. Marsh, Assistant Professor of Biology, *Adrienne Y. Oxley*, Associate Professor of Chemistry, and *Allan Nail*, Associate Professor of English—all of Columbia College

FIFTH AVENUE, GRAND LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | LEAP Featured Session

CS 46: Transforming Curriculum to Implement Course-Based Research Experiences Across the Sciences

Participants will learn about successful models for collaboratively working with students including the challenges and principles of creating and sustaining CBREs from first-year to graduation.

The sciences at Smith College have a strong history of providing research opportunities to undergraduates, although much of that work is centered in faculty research labs rather than integrated within the science curriculum. Recently, Smith has expanded its course-based research experience (CBRE) offerings throughout the curriculum, at various stages of student development. Consistent with AAC&U's LEAP initiative, these courses focus on the high-impact educational practices of providing collaborative research opportunities for students in order to teach the art of inquiry and innovation, a LEAP principle of excellence. Session facilitators will describe the demonstrated benefits to students as well as faculty involved with CBREs. Participants will have the opportunity to hear about and discuss models of CBREs and their accompanying

outcomes, challenges, underlying principles, and relevant assessments so that they can imagine how similar courses might be possible at their home institutions.

Patricia DiBartolo, Faculty Director of the Sciences and Professor of Psychology and **Kevin Shea**, Professor of Chemistry—both of Smith College

GRAND BALLROOM II, GRAND LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Workshop

CS 47: iCons Approach to Integrated Science Education: Case Study Design

Participants will experience the iCons learning environment; consider the integrated learning objectives they have for their own students; and design a case study, including inception material, student activities, and products.

The iCons program at UMass Amherst offers a unique approach to integrated science education, aimed at capturing the enthusiasm and productivity of students motivated by a need to address and solve real societal challenges. In the iCons program, multidisciplinary teams of students are placed in situations where collaboration, distributed scientific expertise, and creative original thinking are needed to confront significant global challenges. Session facilitators will demonstrate the broad case study approach, and take participants through the process of designing their own case studies intended to meet the integrated learning objectives in their courses and institutions.

Justin T. Fermann, Lecturer in Chemistry and iCons Program and **Erin Amato**, second year Master's student, Animal Biotechnology and Biomedical Sciences Graduate Program in the Veterinary and Animal Sciences Department, expected graduation Spring 2016—both of University of Massachusetts, Amherst

PINE, WESTLAKE LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Workshop

CS 48: Convincing your Colleagues to Adopt a Common Intra-departmental Peer-Cooperative Learning Program

Participants will learn about and begin to apply a successful approach to creating and implementing a coherent set of pedagogical changes involving peer-cooperative learning programs across multiple STEM departments.

Participants will learn how to apply Bridgewater State University's successful STREAMS grant (NSF-DUE 0969109) implementation to their local STEM departments. At Bridgewater State, student performance and retention across five STEM departments has significantly improved due to a coherent set of pedagogical changes that incorporate inquiry curricula and peer-cooperative learning models. Participants will practice a method of working with local faculty leaders to identify learning objectives in gateway courses that can be effectively targeted by better curricula and support.

Thomas Kling, Professor of Physics, **Stephen Waratuke**, Associate Professor of Chemistry, and **Matthew Salomone**, Assistant Professor of Mathematics—all of Bridgewater State University

CASCADE BALLROOM II, MEZZANINE LEVEL | Theme 1: Integrative Undergraduate STEM Teaching and Learning | Facilitated Discussion

CS 49: Improving STEM Courses by Focusing on Threshold Concepts: What Should We Teach and How Can We Decide?

Participants will learn proven strategies to initiate a process to identify TCs in their discipline or interdisciplinary areas and identify necessary steps to changing curriculum using a TCs framework.

Threshold concepts (TCs) are concepts and skills that when mastered, represent a transformed understanding of a discipline, without which the learner cannot progress. The TCs framework has a record of promoting curricular changes across the disciplines and is a valuable tool to promote transformation in STEM education. The TC process has proven to be an exciting and accessible mechanism to engage faculty, putting their disciplinary expertise at the forefront. Participants will be guided to explore the TCs framework and to consider how TCs can help drive collaborative curriculum reform efforts within their disciplines. They will discuss strategies that have proved successful in initiating a process to identify TCs at their home institutions and/or in their wider disciplinary communities. Identifying TCs helps faculty make their goals for student learning more explicit, a necessary first step toward gathering assessment data in support of evidence-based learning.

Jennifer Loertscher, Associate Professor of Chemistry, **Vicky Minderhout**, Professor of Chemistry, and **David Green**, Director of the Center for Faculty Development—all of Seattle University

PIKE, WESTLAKE LEVEL | Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education | Facilitated Discussion

CS 50: Supporting STEM Transfer Student Success

Participants will explore issues related to STEM transfer student success through facilitated focused discussions including opportunity for sharing of strategies, networking, and resource development.

Transfer shock is a nationally recognized phenomenon for transfer students. Transfer students are academically talented and interested in STEM and provide opportunities to increase the STEM pipeline. Providing academic support and programming for successful transfer, retention, and completion of bachelor's degrees of all is key. Over 100 students transfer into the College of Science at Texas A&M University each year. Initiated in 2012, all transfer students are required to participate in a learning community upon transfer. Based on the College's NSF S-STEM program, essential components

have been incorporated into the program. Having scaled up and learned how to sustain the program, campus educators continue to focus efforts on meeting the ongoing needs of their transfer student population. This session will provide an opportunity for participants to explore issues related to STEM transfer student success.

Timothy P. Scott, Associate Dean of Undergraduate Programs and **Sara Thigpin**, Administrative Coordinator, Undergraduate Programs—both of Texas A&M University

GRAND BALLROOM I, GRAND LEVEL | Theme 3: Supporting, Rewarding, and Building Capacity of STEM Faculty | Facilitated Discussion

CS 51: Using Small Group, Peer Mentoring to Support Faculty Development and Career Advancement

Participants will learn how peer mentoring through small groups of STEM faculty from different institutions can support professional development and career advancement.

Peer mentoring helps promote career satisfaction and success, especially among women in STEM, who may lack colleagues with whom they can identify. An NSF-ADVANCE project has created 15 small peer-mentoring groups of STEM women faculty from 27 institutions across the country. Dr. Smieja will describe the structure of this network and conditions that support effective mentoring in small groups as well as obstacles that should be avoided. Representatives from four of the groups will describe their experiences and open a discussion of how the project can serve as a model for supporting diverse faculty across multiple institutions.

Joanne Smieja, Principle Investigator, ASAP ADVANCE—Gonzaga University; **Luanne Tilstra**, Professor of Chemistry—Rose-Hulman Institute of Technology; **Sudha Srinivas**, Professor of Physics, Northeastern Illinois University; **Vicki-Lyn Holmes**, Associate Professor of Math—Hope College; and **Stephanie Conant**, Associate Professor of Biology—University of Detroit Mercy

CASCADE BALLROOM I, MEZZANINE LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Workshop

CS 52: Catalyzing Institutional Transformation: An Integrated Model for Effective Practice

Participants will explore the four categories of change model and consider the ways in which the model can apply to transformation initiatives on their home campuses.

Workshop facilitators and participants will explore a four-square model of change strategies in undergraduate STEM education (Henderson, Beach, Finkelstein, 2011) whose categories are based on the answers to: “Does the change strategy seek to primarily impact individuals or environments/structures?” and “Is the intended outcome prescribed or emergent?” The model is useful for conceptualizing how a range of activities, when aligned, may catalyze deeper and longer lasting institutional change. A case study will examine an NSF-funded WIDER institutional change project aimed at widespread adoption of evidence-based instructional practices. Participants will gain insight into how educational leaders can translate strategies into practice to affect institutional transformation.

Tony Roark, Dean, College of Arts and Sciences, **Anthony Marker**, Professor, Organizational Performance and Workplace Learning, and **Brittnee Earl**, Project Manager, WIDER PERSIST grant leadership team—all of Boise State University

ELLIOTT BAY, LOBBY LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Facilitated Discussion

CS 53: Moving Mountains: Lessons from Twenty Institutions Engaged in Department-wide Undergraduate STEM Education Reform

Participants will come away with practical tools and advice about how members of a department can develop a shared vision to enact reform at their institution.

Working under the premise that the department, rather than the individual, is the smallest unit of change needed to leverage widespread reform of undergraduate STEM education, leaders at NSF, HHMI, and NIH/NIGMS created the Partnership for Undergraduate Life Sciences Education (PULSE). In June 2014, teams from twenty southeastern institutions, representing the full spectrum of institution types, including seven minority-serving institutions, attended a three-day Southeastern Regional PULSE (SERP) Institute, and each team developed an action plan for department-wide reform. Ten months later, all teams reported on their progress and challenges at a regional conference (Association for Southeastern Biologists). A team of southeastern PULSE Leadership Fellows will share tools from the Institute and summarize key findings across the twenty institutions. The evidence from this longitudinal study indicates that departments that develop a shared vision can enact substantial improvements to their programs in a fairly short period of time.

Ellen S. Goldey, William R. Kenan Jr. Professor of Biology—Wofford College; **Christopher Finelli**, Associate Professor and Chair, Department of Biology and Marine Biology—University of North Carolina Wilmington; **Susan A. Musante**, Science Education Fellow—Howard Hughes Medical Institute; **Melanie Lee-Brown**, Associate Professor of Biology and Director of Undergraduate Research & Creative Endeavors—Guildford College; **April Hill**, Professor of Biology and Clarence E. Denoon Professor of Science—University of Richmond; and **Judy Awong-Taylor**, Professor of Biology—Georgia Gwinnett College

VASHON, SAN JUAN LEVEL | *Theme 1: Integrative Undergraduate STEM Teaching and Learning* | *Facilitated Discussion*

CS 54: Risk and Reward: Remodeling STEM Education Around Research

Participants will engage in a conversation on the risks and rewards of redesigning the first two years of undergraduate education around research, with Ocean Research College Academy as a model.

The Ocean Research College Academy (ORCA) was founded twelve years ago as a magnet STEM program at Everett Community College. Co-presenters established a two-year learning community founded on best practices from How People Learn with start-up funding from the Bill and Melinda Gates Foundation. The ORCA model of student driven questions grounded in local marine environmental research with a supportive, cohort based infrastructure has yielded unparalleled graduation rates in the community college system (85%). However, in the eight years since the publication of High-impact Educational Practices: What they Are, Who Has Access to Them, and Why They Matter, few community colleges have fully embraced these recommendations. What are the barriers to implementing undergraduate research with writing-intensive courses including capstone projects? Facilitators will share the programmatic results of imbedding all 10 High-impact Practices and assist the group to develop a vision of what's possible on a community college campus.

Ardi Kveven, Executive Director and **Josh Searle**, Founding Faculty Member—both of Everett Community College

CASCADE BALLROOM I, MEZZANINE LEVEL | *Theme 1: Integrative Undergraduate STEM Teaching and Learning* | *Workshop*

CS 55: The X-Lab: Finding Common Ground in Introductory Biology, Chemistry and Physics Lab Learning Outcomes

Participants will be able to describe and evaluate overlap and synergies in objectives and learning outcomes in biology, chemistry and physics lab courses at a variety of higher education institutions.

The Cross-Disciplinary Laboratory (X-Lab) at the University of Florida (UF) is a two-semester, six-credit course that integrates introductory biology, chemistry, and physics laboratory coursework while training students in basic biomedical research skills. The X-Lab replaces the standard two-semester lab courses in each discipline that are typically required of students in STEM majors, and is accepted by all STEM majors programs and graduate and professional programs at UF. Student pre- and post-surveys are positive, indicating that the X-Lab experience meets or exceeds the learning gains of a research experience, and outperforms the student engagement of apprentice-based research. Participants will learn how the development of the X-Lab began with the faculty from the participating departments recognizing and leveraging the interdisciplinary common ground in course objectives, student learning outcomes and research skills training.

David Julian, Director of Curriculum and **Gabriela Waschewsky**, Program Coordinator—both of University of Florida

PINE, WESTLAKE LEVEL | *Theme 1: Integrative Undergraduate STEM Teaching and Learning* | *Workshop*

CS 56: Global Problems, Big Projects, and First Year Students: A Potent Mix!

Participants will leave with a packet of materials: assignments, assessments, student work, and external evaluations of our courses, and a more clear understanding of the value of project-based-learning in the first-year.

Within the context of the question “What should freshmen know and be able to do?” the participants and session facilitators will compare educational purposes and processes at their institutions with regard to project-based learning in the first year. To promote this discussion for the new and experienced, WPI faculty present curriculum, instruction and assessment materials, and student work from their freshmen project-based courses. For WPI, the projects utilize global issues such as food, water, health, education, and energy. The students’ intrinsic desire to address these problems drives their research, writing, and presenting. The open-ended, real-world, problematic nature of the issues promotes critical thinking, out-of-the box problem solving, interdisciplinary awareness, cultural and ethical sensitivity, and hard work. External evaluation demonstrates significant benefits accrue to students and to participating faculty. Through the examination of our materials, participants and facilitators will discuss the larger questions of culture, support, and resistance to such programs.

Kristin Wobbe, Associate Dean, Undergraduate Studies, **Derren Rosbach**, Assistant Teaching Professor, and **Marja Bakermans**, Assistant Teaching Professor—all of Worcester Polytechnic Institute

ELLIOTT BAY, LOBBY LEVEL | *Theme 2: Inclusive Excellence/Broadening Participation in STEM Higher Education* | *Facilitated Discussion*

CS 57: Profess? Guide? Nurture? Coach? Designing the Relationship Framework for Inclusive STEM Education

Participants will be given tools to analyze the relationship framework for STEM learning at their institutions as a means to improve persistence and learning outcomes in STEM fields.

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. The discussion will center on analyzing the relationship framework for STEM education at participants’ institutions through a series of short writing

prompts followed by small and large group discussion. Participants will look at the underlying institutional values and beliefs about student learning that frame relationships and move toward a broader, more inclusive look at how the full range of relationships—faculty, advisors, and other student support staff, families, peer mentors, and classmates—can facilitate or hinder student success in STEM fields. How can we structure relationships among students, staff, and faculty to build the broadest acquisition of cognitive and social capital in STEM learning communities?

Julia Willis, Student Academic Success Center Assistant Director and **Rebecca Ciancanelli**, Student Academic Success Center STEM Coordinator—both of University of Colorado Boulder

CASCADE BALLROOM II; MEZZANINE LEVEL | Theme 3: Supporting, Rewarding, and Building Capacity of STEM Faculty | Facilitated Discussion

CS 58: Promoting Cultural Change: Using Mini-Grants to Incentivize Faculty to Reform Undergraduate STEM Education

Participants will reflect on similar reform efforts at their home institutions, discuss challenges and obstacles that prevent implementation, conduct a gap analysis, and develop an action plan.

Catalyzing reform in undergraduate STEM education is challenging but can be accomplished by changing the culture of STEM faculty so that a student-centered learning approach to STEM education is the norm. Session facilitators will describe how they were able to implement such cultural change using an internal STEM Mini-Grant Program along with supportive practices to help faculty achieve their goals. Session facilitators will highlight ways of providing incentives, empowering faculty to re-imagine STEM education, and supporting and rewarding faculty to develop new and innovative ways to engage their students using research and creative experiences in their classrooms. To date, over 200 STEM faculty (full-time and part-time) have directly or indirectly participated, 117 proposals were submitted, 78 proposals were funded, 77 courses have been re-designed, and each year over 2500 students are impacted. Facilitators will discuss challenges encountered, data from faculty surveys, and the impact made to date.

Judy Awong-Taylor, Associate Dean and Professor of Biology, **Clay Runck**, Assistant Professor of Biology, **Tirza Leader**, Assistant Professor of Psychology, **Allison D’Costa**, Associate Professor of Biology, and **Thomas Mundie**, Professor of Biology—all of Georgia Gwinnett College

GRAND BALLROOM I, GRAND LEVEL | Theme 3: Supporting, Rewarding, and Building Capacity of STEM Faculty | Facilitated Discussion

CS 59: Building the Capacity of STEM Faculty through Equity Training: A Case Study

Participants will become aware of new research documenting the impact of cultural biases and beliefs in the classroom; the requirements to transform classrooms into equitable learning environments; and see examples of strategies that increased the participation, performance, and persistence of females in STEM.

Session facilitators will share the results of a study titled Educators’ Equity in STEM (EESTEM) that used professional development to increase the performance, participation, and retention of females in STEM courses. Over one hundred STEM educators from three Maryland community colleges and two high school districts were assessed for the impact of the professional development on their understanding of micromessaging and equity concepts. The average responses across all 3 cohorts were statistically significant (at 5%), indicating that participants’ attitudes toward their students’ STEM capacity and their own ability to create equity in their classrooms strengthened over the course of the program. Additionally, careful coding and analysis of 71 participant capstone presentations indicated that 81% of participants demonstrated a measurable improvement either in grades, participation/attendance, and/or attitudes toward STEM or STEM interest. Participants will learn how faculty projects that utilized micromessaging as their intervention had the greatest impact followed by projects that incorporated information about STEM careers.

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

PIKE, WESTLAKE LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Facilitated Discussion

CS 60: Crossing Theoretical Boundaries: Frameworks To Promote STEM Education Organizations and Improvement

Participants will develop an understanding of empirically-based research frameworks and methodologies for studying organizations and change and contacts representing diverse organizations attempting to study and improve postsecondary STEM education.

This discussion will examine how to study and aid postsecondary organizations in their quests to improve STEM education. Facilitators will share experiences implementing a project to increase evidence-based instructional practices in large, intro-level STEM courses via interdisciplinary communities of practice, targeted synergy with other STEM improvement entities, and modification of pertinent organizational structures. They will then lay out a research framework attempting to document and study the associated change, a careful and deliberate meld of various theoretical frameworks from organizational, cultural, and cognitive sciences. These frameworks include quantitative and qualitative methodologies to robustly study various phenomena at individual, departmental, and institutional levels. Facilitators will document their evidence-based approach to promote institutional transformation, via feeding research data back into STEM organizations

towards continuous improvement. Participants will discuss how to study change in complicated organizations, and provide opportunity to collectively work through issues and challenges from multiple perspectives.

Jana Bouwma-Gearhart, Associate Professor of Postsecondary STEM Education, **Christina Smith**, Doctoral Student, School of Chemical, Biological, and Environmental Engineering, and **Ann Sitomer**, Postdoctoral Researcher—all of Oregon State University

PUGET SOUND, LOBBY LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Workshop

CS 61: Align Your Curriculum to Vision and Change Using the BioCore Guide and BioMaps Programmatic Assessment

Participants will learn about and gain hands on experience with two tools designed to help biology departments align their curriculum with the goals of Vision and Change and used to promote institutional reform.

Session facilitators will address how biology departments can align their curriculum with the goals of the AAAS/NSF report Vision and Change, specifically the core concepts of biology. Participants will have hands-on experience using two tools designed to help them drive curricular change: the BioCore Guide and BioMaps general biology programmatic assessment.

Sara E. Brownell, Assistant Professor in Biology Education—Arizona State University; and **Alison J. Crowe**, Principal Lecturer in Biology and **Mary Pat Wenderoth**, Principal Lecturer in Biology—both of University of Washington

FIFTH AVENUE, GRAND LEVEL | Theme 4: Institutional Transformation for Undergraduate STEM Education Reform | Workshop

CS 62: PULSE: Promoting Vision and Change through Departmental Transformation

Participants will clarify how well their department aligns with the Vision and Change recommendations by completing and discussing an assessment rubric and will explore PULSE resources to assist departmental transformation.

The 2011 AAAS/NSF report “Vision and Change in Undergraduate Biology Education” recommends that science education be focused on core organizing concepts and developing adaptable intellectual skills using student-centered, active pedagogies throughout the curriculum. Although individual instructors may embrace this vision, it is often difficult to achieve department-wide consensus. The PULSE project was created to help biology departments overcome barriers to achieving a shared commitment and develop a strategy to implement it. This workshop will provide an opportunity for participants to assess their own department’s alignment with the Vision and Change recommendations, using a rubric developed by PULSE, and to reflect on that assessment individually and in groups. PULSE Fellows will introduce participants to the many resources that the PULSE project provides—such as regional workshops for departmental teams, especially in the Pacific Northwest, departmental mentoring by trained “ambassadors”, and online materials designed to encourage and support adoption of the Vision and Change recommendations.

C. Gary Reiness, Professor of Biology and Associate Dean of the College—Lewis & Clark College; **Jenny L. McFarland**, Tenured Faculty, Biology Department—Edmonds Community College; and **Joann J. Otto**, Professor and Chair of Biology—Western Washington University

11:00 a.m. – 12:00 p.m. Plenary

GRAND BALLROOM II & III, GRAND LEVEL

Culminating Remarks

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

Plenary Address

Examining the Intersections of Equity, Diversity, Community Engagement, and STEM Education

Nancy Cantor, Chancellor of Rutgers University—Newark

Building campus cultures of equity, inclusion, and engagement are essential for equipping today’s students with the knowledge and skills necessary to successfully address the increasingly complex challenges of our global society. Dr. Cantor will share insights, strategies, and practices emanating from her work on “Realizing STEM Equity and Diversity through Higher Education-Community Engagement” (co-authored with Ira Harkavy and Myra Burnett), as well as from her years of experience and leadership in reframing the public mission of higher education.

Thank you for sharing your expertise and contributing to the ongoing conversations and work in transforming STEM education. Please let us know what you would like to see in next year’s conference by completing the online conference evaluations. And please don’t hesitate to contact us anytime at 202.387.3760.