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<td>Application of the Mass and Energy Balance in Preparing Students for Industrial Assignments</td>
<td>Marc Privitera and Paul Tucker</td>
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<td>Breathing Life and Relevance into Chemical Engineering Thermodynamics</td>
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<td>Digital Tools Inside and Outside the Classroom for Enhanced Student Learning</td>
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<td>Engaging students in the 21st Century: Using YouTube to develop course content</td>
<td>Matthew Liberatore, Margot Vigeant, and J. Patrick Abulencia</td>
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<td>How to introduce your students to Problem Solving and Troubleshooting Skills and help them transition to the workplace</td>
<td>H. Scott Fogler and Steven E. LeBlanc</td>
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<td>Incorporating Active Learning into Chemical Engineering Courses – Practical Tips and Techniques</td>
<td>Wayne Seames</td>
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<td>Insights from Industry: Vendors Describe Industrial Equipment and Key Engineering Concepts</td>
<td>Avila, Grettenberger, Mallon, Osenga</td>
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<td>Integrating Community-, Industry-, Research-, and Entrepreneurial Design Challenges into Core and Early Chemical Engineering Coursework to Enhance Diversity</td>
<td>Vanessa Svihla and Jamie Gomez</td>
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<td>Integrating Practical Examples in the Classroom</td>
<td>John Clay</td>
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<td>LabVIEW and Data Acquisition as a Problem-Solving and Design Tool in Chemical Engineering</td>
<td>Heidi B. Martin and R. Craig Virnelson</td>
<td>Wednesday 9:30 am-noon Thursday 9:30 am-noon</td>
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<tr>
<td>Learn Aspen Plus™ in 24 Hours: A Modular Approach to Teaching Process Simulation</td>
<td>Thomas A. Adams II and Mario R. Eden</td>
<td>Sunday 9:30 am-noon Monday 9:30 am-noon</td>
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<tr>
<td>Methods and Tools to Help Students Learn Core ChE Concepts</td>
<td>Milo D. Koretsky, Tom Ekstedt, Margot Vigeant</td>
<td>Monday 1-4 pm</td>
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<tr>
<td>New Faculty Career Development</td>
<td>Tim Anderson and Geoff Prentice</td>
<td>Sunday 1-2:30 pm, Sunday 2:45-4:15 pm, Monday 1-2:30 pm</td>
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<td>Putting Chemistry in ChE Classes</td>
<td>Phil Westmoreland</td>
<td>Wednesday 9:30 am-noon</td>
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<tr>
<td>SAFEZONE: Creating an Inclusive and Supportive Environment</td>
<td>Anthony Butterfield and Kyle Branch</td>
<td>Sunday 1-2:30 pm, Wednesday 1-2:30 pm</td>
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<tr>
<td>Scale Up: Tools and Tips for Teaching a Large Class</td>
<td>Matthew Liberatore, Daniel D. Burkey and Reginald Rogers</td>
<td>Sunday 1-2:30 pm, Wednesday 1-2:30 pm</td>
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<td>Sustainable Design of Industrial Processes: Integration of Sustainability into the Curriculum</td>
<td>Mario Richard Eden, Yinlun Huang, and Mahmoud M. El-Halwagi</td>
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<td>Students Are People Too – Tips on Advising</td>
<td>Taryn Bayles and Joshua Enszer</td>
<td>Sunday 2:45-4:15 pm, Wednesday 1-2:30 pm</td>
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<td>Taking it to the Next Level...Game-Based Learning in ChE</td>
<td>Cheryl Bodnar, Daniel D. Burkey, Joshua Enszer and Daniel Anastasio</td>
<td>Monday 9:30 am-noon Thursday 9:30 am-noon</td>
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<td>Teaching Across the Chemical Engineering Curriculum with Food!</td>
<td>Polly Piergiovanni and Margot Vigeant</td>
<td>Sunday 9:30 am-noon Monday 9:30 am-noon</td>
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<td>Teaching Modules for Integrating Biological Systems Models into the Undergraduate Curriculum</td>
<td>Ali Cinar and Michael A. Henson</td>
<td>Monday 1-2:30 pm, Monday 2:45-4:15 pm</td>
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<td>Teaching Process and Product Design</td>
<td>Warren D. Seider and Ka Ming Ng</td>
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<td>Unit Operations Laboratory</td>
<td>John Clay</td>
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<td>Updating the Process Controls and Dynamics Course for the 21st Century</td>
<td>Wayne Seames</td>
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<td>Using Arduino Microcontrollers in Your Classroom or Laboratory</td>
<td>Anthony Butterfield and Kyle Branch</td>
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<td>Using interactive molecular simulations to help students understand thermo, transport, and kinetics</td>
<td>David A. Kofke and Andrew J. Schultz</td>
<td>Sunday 1-4 pm, Wednesday 1-4 pm</td>
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<td>What are NSF Broader Impacts? How does this fit into teaching and outreach?</td>
<td>Caryn L. Heldt</td>
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<td>You Too Can Flip! Overcoming Activation Energy Barriers for Active Learning in ChE courses</td>
<td>Anna L. Bostwick Flaming and Julie L. P. Jessop</td>
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Navigating the Curriculum and Guiding Student Chapters:  

**Academic and Student Group Advising**

**Presenter:** Laura P. Ford (laura-ford@utulsa.edu), University of Tulsa

**Offered:** Monday 1-2:30 pm, Wednesday 2:45-4:15 pm

Even if you are not an academic advisor, you need to know how your courses fit into the department’s or university’s curriculum. What are the prerequisites for your course, and what it is a prerequisite for? Where can you find this information? How is academic advising done on your campus, and where can you find information if you are the academic advisor? What resources are available for student chapter advisors? What happens at the regional and national conferences, and why should your chapter attend?

*Note: there are two sessions on the broad theme of advising. This session is more about the crunchy bits of curriculum and resources for advising student chapters. The other session, Students are People Too, is more about the softer side of interacting with students. Both aspects are helpful!*
Application of Numerical Problem Solving in Chemical Engineering Coursework

Presenters: Robert P. Hesketh (hesketh@rowan.edu), Rowan University; Michael B. Cutlip (michael.cutlip@uconn.edu), University of Connecticut

Offered: Wednesday 9:30 am-noon, Thursday 9:30 am-noon

This workshop will provide hands-on experience in the use of interactive problem solving software to participants. Emphasis will be placed on the application of PolyMath 6 for PCs and a new version of PolyMathLite 1.1 for Android Smartphones and Tablets. The workshop presenters will give multiple examples of how numerical problem solving can be integrated into common chemical engineering courses. Participants will be encouraged to integrate numerical methods into their courses so that their students will understand and appreciate the types of problems and efficiencies that solutions using numerical methods can bring to problem solving and modeling of chemical systems. The PolyMath 6 and revised PolyMathLite 1.1 software will be provided to all the participants for this workshop and future use for a full calendar year at no cost. This software is provided by the CACHE Corporation and PolyMath Software. Participants will be required to bring a laptop with the ability to run Windows software.

Robert P. Hesketh       Michael B. Cutlip
Application of the Mass and Energy Balance in Preparing Students for Industrial Assignments

Presenter: Marc Privitera (marc@preprocessinc.com), San Jose State University, Paul Tucker (Paul.Tucker@ipaper.com), International Paper

Offered: Tuesday 9:45-11:45, Tuesday 1-2:30

This presentation will show techniques and content on how to bridge the academic presentation of the mass and energy balance to the practical application as its basis for all process engineering efforts in an industrial setting. The discussion will present how to focus on the pieces of the MEB at different levels to support the various layers of analysis important to different audiences in an industrial setting.

Techniques will include practical energetic style and effective weaving of not only the rigorous technical details required for the MEB and PFD, but also the nuances that make the presentation to the students compelling, structured and exciting.
Applied Statistics and Data Analytics

Presenters: Richard D. Braatz (braatz@mit.edu), Massachusetts Institute of Technology; Michael A. Henson (mhenson@engin.umass.edu), University of Massachusetts Amherst

Offered: Monday 9:30 am-noon, Wednesday 9:30 am-noon

Statistics is the study of the collection, analysis, interpretation, presentation, and organization of data. Data analytics is an emerging area that examines data with the objective of discovering useful information and constructing predictive models for supporting decision-making. Statistics and data analytics are closely related, with data analytics drawing on a broader set of tools. With the rapid growth of the quantity of data available in industry, applied statistics and data analytics are becoming increasingly important for maximizing employee productivity, and employers are increasingly demanding that chemical engineering undergraduates have a solid background in these areas. A recent NSF-funded report with extensive industrial input recommended that new emphasis is needed on the effective integration of applied statistics into the undergraduate curriculum. The purpose of this session is to provide guidance and resources to help new faculty excel in teaching applied statistics and data analytics to undergraduates. Intended outcomes are:

1. The attendees gain a strong enough understanding of the relative importance of various subtopics within the area of applied statistics and data analytics in chemical engineering practice to make good selections of subtopics to include within the time allotted to this area within their curriculum.
2. The attendees become familiar with available software resources for teaching applied statistics and data analytics.

Richard D. Braatz    Michael A. Henson
Breathing Life and Relevance into Chemical Engineering Thermodynamics

**Presenter:** Richard J. Spontak (spontak@ncsu.edu), North Carolina State University

**Offered:** Monday 2:45-4:15 pm

The overarching purpose of this proposed session is to demonstrate how such a ubiquitous and yet somewhat esoteric topic as chemical thermodynamics can be taught to undergraduates so as to

(i) keep them interested in the course material and

(ii) encourage them to avoid equation hunting.

The expected outcomes of the session include description of successful in-class activities, instructional strategies for higher-level thinking skills, new topics that are becoming increasingly relevant, and opportunities to foster team and individual building.

Richard J. Spontak
Chemical Engineering Course Packages

**Presenters:** John L. Falconer (John.Falconer@colorado.edu) and Katherine McDanel (katherine.mcdanel@gmail.com), University of Colorado Boulder

**Offered: Monday 1-2:30 pm, Wednesday 1-2:30 pm**

This workshop will demonstrate how to use chemical engineering course packages, which are comprehensive sets of course materials that use active learning methods and other best practices in chemical engineering education. The overall goal is to assist faculty in adopting a course package in their classes. Another goal is to convince faculty of the effectiveness of the active-learning resources that are incorporated into the course packages, so faculty can adopt this approach for any course. Significant time can be saved in course preparation and student learning can increase by using course packages, which include a complete set of in-class materials for a semester class, links to screencasts that can be assigned as part of a flipped classroom, links to interactive simulations, multiple years of assignments and exams (with solutions), pre-class reading quizzes, learning objectives/exam study guides, organization materials (syllabi, schedules), and information on how to use the packages. The course packages are available as OneNote notebooks for material and energy balances, thermodynamics, and kinetics, but the approach can be used for almost all courses. Another goal of this workshop is to make faculty aware of the resources available on [www.LearnChemE.com](http://www.LearnChemE.com) for twelve chemical engineering courses, and to demonstrate how to use those tools. The LearnChemE website contains screencasts, interactive simulations, ConcepTests, and resources for students on how to study/learn. The course packages and the LearnChemE resources will be used during the workshop, which will be most effective if attendees bring their laptops with Microsoft OneNote (part of Microsoft Office) and the free Wolfram CDF player ([http://demonstrations.wolfram.com/download-cdf-player.html](http://demonstrations.wolfram.com/download-cdf-player.html)) installed, and have requested access to the course packages and ConcepTests (send an email to LearnChemE@gmail.com).
Developing Successful Collaborative Research with Industry

**Presenters:** Dwight Anderson ([dwight.anderson@ipaper.com](mailto:dwight.anderson@ipaper.com)) and Shari Brown (shari.brown@ipaper.com), International Paper; David Sholl (david.sholl@chbe.gatech.edu) and Krista Walton (Krista.Walton@chbe.gatech.edu), Georgia Institute of Technology

**Offered:** Tuesday 9:45-11:45, Tuesday 1-2:30

The value to young chemical engineering faculty of establishing industrial research collaborations are easy to appreciate; these activities bring funds into a research group, bring researchers closer to problems where they can have real-world impact, and often create a pipeline for employment for students after graduation. Many young faculty, however, have little or no first-hand experience with how to establish industrial collaborations or how to make them succeed once they exist. We will present a discussion of key issues, then open the session for discussion and questions. Specific topics that will be covered in the presentation section of the session will include:

- Motivations for establishing industrial collaborations
- Brief examples of successful industrial collaborations from the presenters
- Why getting industry research funding is completely different from getting government funding
- Sometimes it is better to say no (or, why you are not a research vending machine)
- Pitfalls and good practices for industry collaborations
- How to win friends and influence people in your institution’s legal and contracting office
- How to make contacts in industry
- Connecting industry-driven research with your teaching
Digital Tools Inside and Outside the Classroom for Enhanced Student Learning

**Presenters:** Matthew Liberatore (Matthew.Liberatore@UToledo.edu), University of Toledo; Daniel Lepek (lepek@cooper.edu), Cooper Union

**Offered:** Sunday 2:45-4:15 pm, Monday 2:45-4:15 pm

Educational studies have shown a direct correlation between student engagement and student learning. By developing strategies to keep their students engaged in the course material, faculty members have the ability to improve student learning. Although student engagement products, such as the *i>clicker*, have been around since the 1990s, newer and more advanced engagement products, software programs, and even electronic textbooks have been developed to aid faculty members with student engagement.

This workshop will be broken down into three main sections: introducing the literature linking student engagement and student learning, introducing techniques to engage students *inside* the classroom, and introducing techniques to engage students *outside* the classroom. For the *inside* the classroom section, products such as the *i>clicker*, *Socrative*, and *Learning Catalytics* will be shown, including advice and examples on using these products in the classroom. For the *outside* the classroom section, examples of how to bring digital textbooks “to life” will be shown by describing how to implement and leverage software applications such as *Perusall* and *zyBooks*. Many examples from undergraduate and graduate chemical engineering courses will be used to highlight the versatility and robustness of these digital engagement methods.

Daniel Lepek          Matthew Liberatore
Engaging students in the 21st Century: Using YouTube to Develop Course Content

Presenters: Matthew Liberatore (Matthew.Liberatore@UToledo.edu), University of Toledo; Margot Vigeant (mvingeant@bucknell.edu), Bucknell University; J. Patrick Abulencia (james.abulencia@manhattan.edu), Manhattan College

Offered: Wednesday 2:45-4:15 pm

Today, most students enrolled in higher education were born in the 1980s or 1990s and have grown up with access to computers, the Internet and many other electronics for daily use. The men and women who make up this demographic are designated as digital natives or the Net Generation. Numerous studies on the positives and negatives of the technology savvy students in education and the work force have been published. Here, a simple use of technology, specifically videos from YouTube, can be used to engage this generation of students and be a source of new course material.

We will share and workshop on two approaches to video content in the classroom, exemplified by “YouTube Fridays” and “Lights, Cameras, Thermo!”. YouTube Fridays devotes a small fraction of class time to student-selected videos related to the course topic, e.g., thermodynamics. The students then write and solve a homework-like problem based on the events in the video. Numerous recent pilots involving hundreds of students have developed a database of videos and questions that reinforce important class concepts such as energy balances and phase behavior. “Lights, Cameras, Thermo!” asks students to make brief videos presenting an engaging metaphor for a complicated concept. These videos were then shown in class and posted to YouTube for broad access. This approach approximates peer-instruction, but at both times and locations most convenient for learners.
From Sage on the Stage to Guide by the Side: Design of Group Activities that Promote Meaningful, Consequential Learning

**Presenters:** Milo Koretsky (milo.koretsky@oregonstate.edu), Oregon State University; Susan Nolen (sunolen@uw.edu), University of Washington

**Offered:** Sunday 9:30 am-noon, Monday 9:30 am-noon

You have just been assigned a course in the core curriculum. You really want this to be a great learning experience for your students and are thinking about all the things you need to be ready for day 1. This workshop will help you with that. You will learn how to create activities where students better see the connection between the work they do in class to what they will do in their professional careers. These type of activities will not only motivate them to participate more fully, but research shows students will learn the core concepts and content better, retain it longer, and be more likely to operationalize it in practice. Would you like to use group work where student interactions are productive towards learning and also reaffirming to other students in the group? We will learn about the type of problems that make group work productive, but just as importantly about ways to facilitate learning of students in groups.

This workshop focuses on developing group activities for classes in the core chemical engineering curriculum. The workshop facilitators include a chemical engineer faculty member with experience with curriculum design, program development, and engineering education research and a learning scientist with experience with developing problem-based learning curricula and with expertise in student motivation and engagement. The workshop is intended to help early-career ChE faculty begin to learn the principles for constructing and implementing these types of activities in their courses.

Milo Koretsky  
Susan Nolen
Groups, Teams, and Conflicts

**Presenters:** Kelly Cross (kjcross@illinois.edu), University of Illinois at Urbana-Champaign; Troy Vogel (tvogel1@nd.edu), University of Notre Dame

**Offered:** Monday 2:45-4:15 pm, Wednesday 2:45-4:15 pm

This session will provide a semi-collaborative learning environment to explore strategies for forming groups and teams, dealing with conflict arising from such, and strategies for teaching teamwork in engineering.

Specifically we aim to help participants identify and adapt effective strategies to:

- Form groups and teams
- Identify common group and team conflicts
- Identify strategies to manage conflict
- Summarize best practices with literature sources

Troy Vogel  
Kelly Cross
Hands-on Chemical Engineering Design Projects for Use in Outreach Programs and Undergraduate Classes

**Presenters:** Taryn Bayles (tbayles@pitt.edu), University of Pittsburgh; Karen High (khigh@clemson.edu), Clemson University

**Offered:** Sunday 9:30 am-noon, Monday 9:30 am-noon

The goal of this workshop is to provide the participants, with a variety of hands-on engineering design projects which have real world relevance. Threaded by STEM content and utilizing the engineering design process, these projects are inexpensive to implement and can be used for K-12 through junior level chemical engineering courses. In addition, participants will learn how to engage students using hands-on activities and will learn how to include project based learning in large classrooms.
How to Introduce Your Students to Problem Solving and Troubleshooting Skills and Help Them Transition to the Workplace

**Presenters:** H. Scott Fogler (sfogler@umich.edu), University of Michigan; Steven E. LeBlanc (steven.leblanc@utoledo.edu), University of Toledo

**Offered:** Sunday 9:30 am-noon, Monday 9:30 am-noon

The goals of this workshop are to introduce instructors to ways to hone and enhance their students’ problem solving skills. The workshop will be divided into six segments.

1. Overview of the workshop and a brief discussion of a senior elective course that discusses problem solving techniques and a term project with a local business where they have to apply these techniques.
2. Helping the student make the transition to the workplace includes Seven Actions for a Successful Career, Steven Covey’s Seven Habits of Highly Effective People and a discussion on “Failure” (if there is such a thing).
3. Critical thinking actions, critical thinking questions and structured critical reasoning.
5. Problem solving, Duncker diagram and Kepner-Tregoe strategies.
6. Troubleshooting.

The above problem solving skills and troubleshooting skills are essential to ease engineering students’ transition from college classrooms and laboratories to the corporate workplace.
Impactful TA Mentoring/Training for Optimized ChE Learning Experiences

Presenters: Bihter Padak (PADAK@cec.sc.edu), University of South Carolina; Brad Bundy (bundy@byu.edu), Brigham Young University

Offered: Monday 2:45-4:15 pm, Wednesday 2:45-4:15 pm

The goal of this workshop is to provide resources and ideas to faculty for developing a teaching assistant (TA) mentoring/training program. Excellent TAs are instrumental to the success of any course. In order to develop effective TA’s, a mentoring/training program targeted for graduate students has been developed both at University of South Carolina (USC) by Dr. Bihter Padak and at Brigham Young University (BYU) by Dr. Brad Bundy. In this session they will share their experiences from running the program and interacting with TA’s and discuss its impact through student feedback. This workshop will provide the attendees with resources for TA guidance via videos, presentations, interactive discussions, and handouts with the goal of facilitating the development/improvement of TA training programs for the TAs they work with.
Incorporating Active Learning into Chemical Engineering Courses – Practical Tips and Techniques

Presenter: Wayne Seames (wayne.seames@engr.und.edu), University of North Dakota

Offered: Sunday 9:30 am-noon, Monday 1-4 pm

Do you want to increase active learning content in your courses while still getting full topic coverage? How about advice on the problems with student group assignment? How can I get students more engaged if I have a large lecture bowl type class? Come get advice from an experienced ChE Professor. The Active Learning Workshop provides practical tips for course design and gives you a chance to experience many of the active learning techniques used in teaching professional today in a highly interactive environment.

Wayne Seames
Incorporating Dynamic Simulation into Chemical Engineering Curricula

Presenters: John D. Hedengren (john_hedengren@byu.edu), Brigham Young University; Thomas A. Badgwell (thomas.a.badgwell@exxonmobil.com), ExxonMobil Research and Engineering Company

Offered: Tuesday 9:45 - 11:45

Although dynamics are critical for understanding most chemical processes, its coverage is limited in most chemical engineering curricula. Even then, coverage is usually limited to mathematical techniques and analytical solutions rather than physically motivated, industrially relevant problems. We feel that chemical engineering is best taught by having the students actively employ realistic dynamic simulations of industrial processes, that is, which include such phenomena as nonlinearities, constraints, disturbances, and uncertainties. A typical class period may include presentation and discussion of a motivating industrial problem and time for the students to solve the problem using analytical techniques and simulation using MATLAB/Simulink or Python.

The session will provide instructors with specific chemical and biological engineering examples for use in various courses within the chemical engineering curriculum to motivate students to learn different modeling, analysis, and control techniques and to have the students engaged in authentic learning experiences. The expected outcomes are that participants will be exposed to practical engineering problems, will implement solutions in MATLAB/Simulink or Python, and discuss the effects of nonlinearities, disturbances, and design changes.

Thomas A. Badgwell                      John D. Hedengren
Insights from Industry:
Vendors Describe Industrial Equipment and Key Engineering Concepts

**Presenters**: Leo Avila (lavila@bahnson.com), EMCOR-Bahnson; Will Grettenberger (wgrett@bahnson.com), EMCOR-Bahnson; Dean Mallon (dean.mallon@us.endress.com), Endress+Hauser; George Osenga (george.osenga@thierry-corp.com), Thierry Plasma

**Offered**: Tuesday 1:00 – 2:30

Companies that supply equipment to the chemical process and related industries, those industries where chemical engineers are very often employed, have a strong knowledge about the key engineering concepts that form the basis for the effectiveness of their equipment. In this workshop, three companies will describe their equipment, how and why it works and provide key insights that the audience may take back to their classroom to educate the next generation of chemical engineering students. Topics discussed include environmental chambers and control, level instrumentation and plasma reactors.

After this workshop, the presenters will be available at the EXPO for more detailed and individualized discussions.
Integrating Community-, Industry-, Research-, and Entrepreneurial Design Challenges into Core and Early Chemical Engineering Coursework to Enhance Diversity

Presenters: Vanessa Svihla (vsvihla@unm.edu) and Jamie Gomez (jrgomez@unm.edu), University of New Mexico

Offered: Sunday 1-4 pm, Wednesday 1-4 pm

The primary learning goal of this session is for participants to develop an understanding of how integrating community-, industry-, research-, and entrepreneurial (CIRE) design challenges into early and core chemical engineering coursework can support diverse students to learn. The specific outcomes are as follows; participants will be able to: (1) adapt or design their own design challenge to use in their teaching; (2) plan formative and summative assessment for the design challenge; (3) explain why such approaches are beneficial for students, especially for those from underrepresented groups; and (4) plan to implement a design challenge in their course.

The intended impact of this workshop is to increase the diversity of students in chemical engineering by enhancing the capacity of faculty to provide learning experiences that engage, inspire, and instruct.

Vanessa Svihla           Jamie Gomez
Integrating Practical Examples in the Classroom

**Presenter:** John Clay (clay.32@osu.edu), Ohio State University

**Offered:** Monday 1-2:30 pm, Wednesday 2:45-4:15 pm

A topic in chemical engineering can be distilled into equations, facts, and rules. However, this method of learning is often not effective, as students will not retain vital information and will not be able to determine how the rigid rules fit into the larger scope of problem solving and analysis that lie at the core of a solid chemical engineering education. Identifying industrially relevant and/or real-world examples is an excellent technique to enhance the student learning experience. Linking theory and calculations from the lecture to something concrete to which the students are routinely exposed provides relevancy and can successfully reinforce key aspects of the topic.

This session will illustrate the integration of practical examples into a chemical engineering curriculum, with examples pulled from a Mass and Energy Balances course and a Separations course. Participants will role-play the part of students in the courses, with the problems posed at a high level, followed by successive levels of detail that will clearly show how a complex problem can be deconstructed into simpler, solvable portions. Active learning techniques will be used to engage the audience during the session. The linkage between the problem to be solved and the real world application will be stressed at multiple points during the solution process to demonstrate relevancy. Faculty who are interested in finding proven techniques to integrate practical examples into their lectures are urged to attend this session.
LabVIEW and Data Acquisition as a Problem-Solving and Design Tool in Chemical Engineering

**Presenters:** Heidi B. Martin (hbm@case.edu) and R. Craig Virnelson (rcv5@case.edu), Case Western Reserve University

**Offered:** Wednesday 9:30 am-noon, Thursday 9:30 am-noon

Our goal is to provide instructors with a manageable framework for the use of LabVIEW integrated with data acquisition as a versatile and fun tool for addressing design problems, while enabling creativity and bridging the gap between engineering theory and practice. Participants will be given hands-on experience with LabVIEW and data systems, in order to gain appreciation for how to incorporate these tools in a modular way within a course to stimulate learning and problem solving. They will also be exposed to our methods for guiding students through their first process of independent design, in our specific case of control systems. We anticipate that this session will increase participants’ awareness of the advantages of the LabVIEW platform for motivating student interest in design and in reinforcing engineering concepts. In addition, the session will provide informational resources to help instructors integrate data collection into courses, even for a larger class size.

Heidi B. Martin                           R. Craig Virnelson
Learn Aspen Plus™ in 24 Hours: A Modular Approach to Teaching Process Simulation

Presenters: Thomas A. Adams II (tadams@mcmaster.ca), McMaster University; Mario R. Eden (edenmar@auburn.edu), Auburn University

Offered: Sunday 9:30 am-noon, Monday 9:30 am-noon

Unless someone has significant experience with process simulation software like Aspen Plus™, being asked to teach courses involving such tools can indeed be daunting, particularly to new faculty. This workshop is intended to introduce a series of learning modules developed at McMaster University that allow students (and instructors/TAs) to become proficient in the selection and use of the appropriate tools to solve specific problems. Topics covered in these modules include:

- Getting Started – The Fundamentals of Aspen Plus™
- Physical Property Modeling
- Problem Solving Tools
- Advanced Reactor Models
- Simple Distillation Models
- Rate-Based Distillation Models
- Advanced Modeling Tools
- Capital Cost Estimation – Formerly Aspen Icarus™
- Heat Exchanger Networks – Aspen Energy Analyzer™

These modules are NOT meant to teach chemical unit operations, but are specifically focused on problem solving using process simulation tools.

Workshop participants should bring laptops/tablets that have a Remote Desktop client in order to participate in hands-on Aspen Plus workshops. Modern versions of Windows (8.1 and up) have the Remote Desktop Connection client already installed, so most windows users will not need to make changes to their system. Mac OS X 10.6.6 or greater users can get the Microsoft Remote Desktop Connection app for free from the Mac App Store.
Methods and Tools to Help Students Learn Core ChE Concepts

Presenters: Milo D. Koretsky (milo.koretsky@oregonstate.edu) and Tom Ekstedt (Tom.Ekstedt@oregonstate.edu), Oregon State University; Margot Vigeant (mvigeant@bucknell.edu), Bucknell University

Offered: Monday 1-4 pm, Wednesday 9:30 am-noon

The goal of this workshop is to provide early career faculty members with specific educational methods and tools that they can incorporate into their classroom to encourage their students to think deeply about the central concepts in core chemical engineering courses. The workshop pedagogical content will include the use of peer instruction and ConcepTests, Inquiry-Based Activities, Interactive Virtual Laboratories, concept inventories, and a technology-based tool to facilitate active learning pedagogies.

The workshop will introduce an interactive web-based tool that we have developed called the AIChE Education Division Concept Warehouse. The Concept Warehouse will enable interactive delivery of workshop content and give participants a direct way to use that content in practice. To facilitate adoption of the active learning pedagogies that are presented, participants will be provided continued access to conceptual questions and other instructional tools for core chemical engineering classes, including: Material and Energy Balances, Thermodynamics, Transport Phenomena, Kinetics Reactor Design, Separations and Materials Science. The bank of over 2,500 conceptual questions, the easily navigable software interface, and the other available resources will substantially lower the activation barrier for instructors to integrate the pedagogical methods into instruction and assessment.
New Faculty Career Development

**Presenters:** Tim Anderson (tja@umass.edu), University of Massachusetts, Amherst; Geoff Prentice (GPRENTIC@nsf.gov), National Science Foundation

**Offered:** Sunday 1-2:30, Sunday 2:45-4:15, Monday 1-2:30

New engineering faculty are required to make many choices that affect their academic career and personal life. This workshop is intended to encourage faculty to identify suitable career goals and to specify objectives and begin to develop a plan for achieving them. Elements of the career plan will include: *Establishing a Research Program* (obtaining funding, CAREER Award preparation, research problem identification and selection, contacting funding sources, collaborations, network development), *Managing Research* (student project definition, group & individual meetings, student evaluation and feedback, placement and professional development, group continuity, teamwork, managing undergraduates and post docs, and safety), *Understanding the University Environment* (tenure & promotion, service activities, sabbaticals, reward structure, mentoring expectations), *Balancing Your Life* (dual careers, personal & family time), *Developing as a Professional* (role of consulting, professional service, peer groups) and *Managing Your Time* (goal setting & priorities, stress reduction, good habits).

Perspectives on how to rapidly become an effective and efficient faculty will be presented through group activities, sharing of experiences, and advice from the instructors.

Geoff Prentice    Tim Anderson
Putting Chemistry in ChE Classes

Presenter: Phil Westmoreland (prwestmo@ncsu.edu), North Carolina State University

Offered: Wednesday 9:30 am-noon

This workshop will provide insights and teaching material about understanding and predicting properties for use across the curriculum, especially in thermodynamics, kinetics, transport, separations, and biotechnology. Content will be provided that can be used in core ChE courses, as well as reporting on a full-semester course that the presenter has given.

(1) Introduction: Molecule-based properties
(2) Empirical correlations.
(3) Statistical mechanics.
(4) Computational quantum chemistry
(5) Correlating and predicting kinetics
(6) Transport properties
(7) Biological functions

Phil Westmoreland
SAFEZONE: Creating an Inclusive and Supportive Environment

Presenters: Anthony Butterfield (tony@chemeng.utah.edu) and Kyle Branch (kyle.j.branch@gmail.com), University of Utah

Offered: Sunday 1-2:30 pm, Wednesday 1-2:30 pm

The perception of campus environment influences learning and developmental outcomes, and discriminatory environments have a negative effect on student learning. Research supports the pedagogical value of a diverse student body and faculty on enhancing learning and creativity/quality of final products. LGBTQIA (lesbian, gay, bisexual, transgender, queer or questioning, intersex, and asexual) individuals have a more negative perception of campus climate than other populations. For example, one-third of LGBTQIA students consider leaving due to a negative campus climate; 31 percent perceive a homophobic climate; and 11 percent experience harassment. Despite these compelling statistics, only seven percent of universities offer support services specifically geared to the needs of LGBTQIA students.

Safe Zone Workshops are interactive training sessions to raise awareness for LGBTQ inclusion in STEM and create a visible network of allies to foster a supportive atmosphere for LGBTQ individuals. Participants in our research-informed workshops will:

- Develop an understanding of LGBTQ concepts and terminology
- Develop an awareness of biases and assumptions
- Understand the coming out process
- Learn basic ally tips to support LGBTQ students and colleagues

Anthony Butterfield              Kyle Branch
Scale Up: Tools and Tips for Teaching a Large Class

Presenters: Matthew Liberatore (Matthew.Liberatore@UToledo.edu), University of Toledo; Daniel D. Burkey (daniel.burkey@uconn.edu), University of Connecticut; Reginald Rogers (rerche@rit.edu), Rochester Institute of Technology

Offered: Sunday 1-2:30 pm, Wednesday 1-2:30 pm

Enrollment in chemical engineering has grown in the last decade due to a variety of reasons, e.g., the inclusion of chemical and bio-x engineering degrees, favorable job placement, and continued high salary jobs. With larger enrollments come larger classes with some new challenges. Defining a ‘large’ class will set the stage for the core content of the workshop. Alternating between short presentations and active learning exercises, the workshop will help a small number of faculty improve learning for a large number of students.

Topics include:

1. Logistics for humanizing a large course.
2. Engaging students in class - active learning challenges at scale
3. Engaging students outside of class – traditional and technology-aided office hours and discussion groups
4. Recruiting and training your students to act as extra instructional resources for your large classes.
5. Project-based learning at scale
Sustainable Design of Industrial Processes:
Integration of Sustainability into the Curriculum

Presenters: Mario R. Eden (edenmar@auburn.edu), Auburn University; Yinlun Huang (yhuang@wayne.edu), Wayne State University; Mahmoud M. El-Halwagi (el-halwagi@tamu.edu), Texas A&M University

Offered: Wednesday 9:30 am-noon, Thursday 9:30 am-noon

The purpose of the workshop is to provide the attendees with state-of-the-art methodologies, tools, and case studies in the area of sustainable design of industrial processes. Emphasis will be given to educational materials that can be readily integrated into the chemical engineering curriculum. By the end of the workshop, the attendees are expected to:

• Evaluate overall sustainability targets (fresh usage, waste discharge, yield, energy usage, etc.) for a given process
• Screen and synthesize conceptual design alternatives
• Use educational modules covering various issues in the area of sustainable manufacturing

Mario R. Eden  Mahmoud M. El-Halwagi  Yinlun Huang
Students Are People Too – Tips on Advising

Presenters: Taryn Bayles (tbayles@pitt.edu), University of Pittsburgh; Joshua Enszer (enszer@udel.edu), University of Delaware

Offered: Sunday 2:45-4:15 pm, Wednesday 1-2:30 pm

The goals of this workshop are to help new faculty better understand the needs of their students and to prepare them to provide the best advice to their students as they encounter academic and personal challenges. The topics to be addressed can be categorized into three areas: a) Course-based advising of undergraduate students, b) non-course specific advising of undergraduate students, and c) research-based mentoring of graduate students. Some of the topics to be addressed include office hours, FERPA rules, academic advising, career planning, mental health issues, supporting students with disabilities, and hallmarks of a successful mentoring relationship.

Taryn Bayles                             Joshua Enszer
Taking it to the Next Level...Game-Based Learning in ChE

**Presenters:** Cheryl Bodnar (bodnar@rowan.edu), Rowan University; Daniel D. Burkey (daniel.burkey@uconn.edu), University of Connecticut; Joshua Enszer (enszer@udel.edu), University of Delaware; Daniel Anastasio (anastasi@rose-hulman.edu), Rose-Hulman Institute of Technology

**Offered:** Monday 9:30 am-noon, Thursday 9:30 am-noon

The goal of this session is to familiarize new chemical engineering faculty with game-based learning pedagogy. Upon completion of this session, participants will be able to:

- List the key properties of a game or game-based learning exercise
- Describe different types of games that can be applied in chemical engineering classes
- Identify games that match specific learning objectives
- Discuss differences in facilitation approaches
- Provide ideas for debriefing questions that allow the game to be linked back to technical content
Teaching Across the Chemical Engineering Curriculum with Food!

**Presenters:** Polly Piergiovanni (pieriop@lafayette.edu), Lafayette College; Margot Vigeant (mvigeant@bucknell.edu), Bucknell University

**Offered:** Sunday 9:30 am-noon, Monday 9:30 am-noon

Kitchens are chemical processing facilities that are much more familiar to our students than is a petroleum refinery. Food-based examples and experiments are capable of helping illuminate nearly every element of the core chemical engineering curriculum and a great way to engage students’ interest while developing their technical expertise. This session will share a number of examples for activities large and small that integrate food and core concepts as well as provide time and feedback to workshop additional activities for your own classes. Please alert the instructors if you have any food allergies or restrictions prior to entering the workshop.

Polly Piergiovanni                                         Margot Vigeant
Teaching Modules for Integrating Biological Systems Models into the Undergraduate Curriculum

Presenters: Ali Cinar (cinar@iit.edu), Illinois Institute of Technology; Michael A. Henson (mhenson@engin.umass.edu), University of Massachusetts Amherst

Offered: Monday 1-2:30 pm, Monday 2:45-4:15 pm

This workshop describes teaching modules for the integration of biological systems models into the undergraduate chemical engineering curriculum. The workshop provides programs with associated teaching materials for three modules. The modules are designed for integration into courses on mathematical modeling, chemical reaction engineering, biochemical engineering, process design, and/or process dynamics and control. The goal of the workshop is to provide sufficient coverage of the modules for young faculty to incorporate them directly into their existing courses.
Teaching Process and Product Design

**Presenters:** Warren D. Seider (seider@seas.upenn.edu), University of Pennsylvania; Ka Ming Ng (kekmng@ust.hk), The Hong Kong University of Science and Technology

**Offered:** Sunday 9:30 am-noon, Wednesday 9:30 am-noon

Undergraduate chemical engineering courses continue to focus on process design. Typically, lectures and design projects assume a chemical product and concentrate on finding optimal processes to manufacture it. With limited time, although important, faculty often opt not to cover methods of product selection; i.e., product design. This workshop is intended to discuss methods of introducing product design while focusing on process design. It also describes ways to focus on product design strategies, often in a separate product-design course that follows a process-design course, using case studies carried out by undergraduate chemical engineering students. A principal goal is to convey various approaches for introducing the concepts of product design.
Unit Operations Laboratory

Presenter: John Clay (clay.32@osu.edu), Ohio State University

Offered: Sunday 1-2:30 pm, Wednesday 1-2:30 pm

The goal of this session is to provide chemical engineering faculty who will manage laboratory courses with proven best practices that are used in support of the Unit Operations Laboratory at The Ohio State University (OSU). High level learning objectives from this course include the following:

• Plan efficient laboratory experiments to collect relevant data while minimizing error
• Design and conduct experiments in the laboratory
• Compare experimentally measured results with literature data and quantify the sources of error that contribute to differences between measured data and literature data
• Prepare high quality written reports and oral presentations to summarize a project in a professional and informative manner.
• Practice effective group dynamics to work as a member of a team
• Apply safe laboratory practices important in the chemical industry, including laboratory safety protocols, interpretation of material safety data sheets (MSDS), and proper handling, storage, and disposal of chemicals.

This presentation is geared to faculty who will lead or assist with chemical engineering laboratory sessions. The expected outcome for these faculty includes an understanding of how these learning objectives are realized in the course through a variety of student assessments. Participants in the session will be able to identify tools and techniques that have proven effective in the Unit Operations Laboratory at OSU, enabling them to tailor these tools and techniques for their own laboratory courses.

John Clay
Updating the Process Controls and Dynamics Course for the 21st Century

Presenter: Wayne Seames (wayne.seames@engr.und.edu), University of North Dakota

Offered: Wednesday 9:30 am-noon, Thursday 9:30 am-noon

The process controls and automation industry went through a technology revolution in the 1980s and 1990s. So why are we still covering the same material in this core course that was covered in the 1960s and 1970s? The workshop leader has redesigned the topical material to be more relevant for the needs of the 21st century. A typical course outline is provided and participants receive all of the resource material they need including a new textbook, PowerPoint slides, quiz questions (for flipped instruction), etc. The workshop leader is a former Project Manager for Plant Automation Systems for Saudi Aramco.
Using Arduino Microcontrollers in Your Classroom or Laboratory

Presenters: Anthony Butterfield (tony@chemeng.utah.edu) & Kyle Branch (kyle.j.branch@gmail.com), University of Utah

Offered: Monday 9:30 am-noon

By the end of the session the attendees will be able to use simple microcontrollers (Arduino Unos) with a variety of inexpensive sensors to create small hands-on data-driven projects for their students in core chemical engineering courses. Four hands-on activities will walk participants from getting started with Arduino boards to performing a simple control experiment. Activities will be performed in groups of two. Small group discussions will begin and end the session to help participants realize how they may incorporate the material in their classrooms or labs. Demonstrations will be interspersed to illustrate more complicated uses of inexpensive microcontrollers and sensors.

Anthony Butterfield            Kyle Branch
Using Interactive Molecular Simulations to Help Students Understand Thermo, Transport, and Kinetics

Presenters: David A. Kofke (kofke@buffalo.edu) and Andrew J. Schultz (ajs42@buffalo.edu), University of Buffalo

Offered: Sunday 1-4 pm, Wednesday 1-4 pm

Participants in this workshop will become acquainted with the basic concepts of molecular simulation, and learn how to use the etomica graphically-oriented molecular simulation modules in their teaching. These modules can help students make the connection between the macroscale phenomena they learn as part of the core ChE curriculum and the microscale phenomena that give rise to the non-intuitive macroscale behaviors. It is notable that the results from the simulations can be analyzed using the standard constructs of thermodynamics, transport, and kinetics that the students learn about in their traditional coursework. The quantitative connection between the molecular behavior that they observe in the simulation and the otherwise abstract analyses that they perform for their coursework may help them develop a more concrete understanding of the traditional course material, with instructors who know how to use the modules.
What are NSF Broader Impacts? How Does This Fit into Teaching and Outreach?

Presenter: Caryn L. Heldt (heldt@mtu.edu), Michigan Technological University

Offered: Sunday 2:45-4:15 pm, Monday 1-2:30 pm, Wednesday 1-2:30 pm

NSF Broader Impacts (BI) are often a nebulous and ill-defined criteria for receiving an NSF research award. After serving on many NSF panels, my experience is that exceptional research will get you to the top of the list, and the BIs often distinguish which of the top proposals will be funded. However, the goal when proposing BIs is to make it fun, ignite the passion of the researcher, and be contained within the limited resources of an NSF grant. This workshop will give participants examples of successfully funded BIs and allow them to design a unique BI program that will increase their chance of funding and improve their teaching and outreach.
You Too Can Flip!
Overcoming Activation Energy Barriers for Active Learning in ChE Courses

**Presenters:** Anna L. Bostwick Flaming (anna-flaming@uiowa.edu) and Julie L. P. Jessop (julie-jessop@uiowa.edu), The University of Iowa

**Offered:** Monday 2:45-4:15 pm, Wednesday 2:45-4:15

Flipping is an appealing method to engage students for meaningful and active learning. In a flipped classroom, the in-class and out-of-class elements are often reversed (e.g., typical lecture content is gained by watching short podcasts at home, while homework problems are conquered in class with coaching by an instructional team). However, many find the perceived barriers to developing and coordinating content and activities for a flipped classroom daunting. In this hands-on, participant-driven workshop, we:

1. Consider strategies for removing barriers to active learning, both inside and outside the classroom
2. Plan strategies for designing and facilitating an active-learning course, including in a traditional, fixed-seat classroom
3. Explore concrete examples of how active learning can look in an engineering classroom
4. Identify colleagues with whom participants could network and potentially continue as a cohort of engineering instructors interested in “flipped” teaching strategies