Wednesday, August 4 morning

Symposia sessions

Start	End	Room	Title
9:00	12:00	U-418	Adding ___casts to Your Chemistry Teaching Toolbox
9:00	12:00	WH-119	Center for Workshops in the Chemical Sciences (CWCS)
9:00	12:00	U-413	Chemical Education Around the World
9:00	12:00	U-412	Educating the Next Generation: Green and Sustainable Chemistry
9:00	12:00	WH-212	Electronic Homework: What Have We Learned?
9:00	12:00	WH-121	Engaging Students in Organic Chemistry
9:00	12:00	U-415	Inquiry Activities for High School Teachers
9:40	12:00	WH-113	Mentoring Faculty: Lengthening and Strengthening the Chain
9:00	12:00	WH-316	Modernizing Teaching about Molecules and Bonding in General Chemistry Courses
9:00	12:00	WH-310	Physical and Computational Chemistry in the Undergraduate Curriculum: Applied, Interesting, and Relevant
9:00	12:00	U-411	Research in Chemistry Education
9:00	12:00	WH-214	Science and Civic Engagement: A Curriculum for the 21st Century
9:00	12:00	U-409	Student-Centered Learning in Chemistry
9:20	11:20	BIOL-106	Teaching with Discrepant Events
9:00	12:00	WH-213	The Science Writing Heuristic in Laboratory Instruction

Symposia sessions

9:00 AM - 12:00 PM U-418

S53: Adding ___casts to Your Chemistry Teaching Toolbox – Part 1 of 2

Keith Walters (Northern Kentucky University, USA)

With every year new tools are available to create multimedia "casts" (e.g., podcasts, screencasts, vidcasts) and increasing numbers of chemistry educators are using them in their courses. While most people say that producing these "casts" is difficult and time-consuming, producing high-quality "casts" is actually easier and faster than you might think. Presentations in this symposium will share the successes, failures, and new advancements in producing and using "casts" in chemistry coursework, as well as providing lots of tips and tricks for instructors to get started with these in their own classes. Come see how easy it is to add "casts" to your arsenal of chemistry educational tools!

9:00		introduction
9:05	Sarah Pierce	P517: Podcasting in five minutes
9:25	Brad Herrick	P518: Web-based first-year general chemistry: Addressing the at-risk student (and they are ALL at-risk students)
9:45	Dan Stasko	P519: Lecturettes and Pencasts: Lecture capture and supplemental instruction to produce a more learner centered classroom
10:05	Marc Richard	P520: Podcast tutorials in mathematics and problem solving for physical chemistry
10:25		break
10:40	Keith Walters	P521: Can I make a ___cast? Absolutely!
11:00	Mark Morvant	P522: Lecture podcasting in organic chemistry
11:20	Owen Priest	P523: Podcasting in the classroom and laboratory at Northwestern University
11:40		discussion

P517: Podcasting in five minutes

Sarah Pierce (Cumberland University, USA)

Podcasting is an easy method for distributing lectures, classroom discussions, and other information via new electronic channels that appeal to today's students. At Cumberland University, a small liberal arts institution with approximately 1300 students, chemistry lectures have been podcast for two years in an effort to distribute classroom material more effectively. On average, time dedicated to preparing a podcast by the professor is five minutes per course. Through the use of a digital voice recorder that records in a MP3 file format, the professor eliminates the time required to convert audio files to a useful format and is able to upload files immediately after class and with little additional work. Files can be uploaded to Blackboard or other University supported systems and students are able to download the files from the

appropriate site. Furthermore, using MP3 format allows students who have iPods or MP3 players the added utility of being able to listen to lectures whenever is most convenient. Not only does podcasting allow for reiteration of material, it also allows students who travel for school events to remain connected to class. With nearly 50% of Cumberland University students participating in collegiate athletics, this is especially advantageous due to rigorous travel schedules imposed upon students. Overall, podcasting is a tool both faculty and students can take advantage of to improve not only the school's use of new teaching methods, but to provide students with an efficient, timely option to access classroom material with little additional effort required by the faculty.

P518: Web-based first-year general chemistry: Addressing the at-risk student (and they are ALL at-risk students)

Brad Herrick (The University of Texas at Austin, USA)

We know students are poorly prepared to succeed in chemistry coming out of high school. Consider a MWF lecture course with material presented on Monday and Wednesday assessed on a Friday quiz. We expect students will attend the Monday and Wednesday lectures in preparation for the quiz, but that isn't usually the case. In the presentation of our course, all student's are considered at-risk until THEY prove otherwise. In other words, they are not be allowed to take the quiz until they have proven mastery of the concepts (the 'Monday and Wednesday' material) necessary to do so. An underlying critical feature is the presentation of additional materials based on pre-course diagnostic tests (e.g., learning style, math skills, prior knowledge of chemistry) and during the course (e.g., previous concept scores on exams, quizzes, and homework). Thus the course is individually tailored to the student's needs and performance.

P519: Lecturettes and Pencasts: Lecture capture and supplemental instruction to produce a more learner centered classroom

Dan Stasko (University of Southern Maine, USA)

Two major components of learner centered education involve altering the balance of power in the classroom and reexamining the role of the teacher. In the digital age, these features are even more important because the 'content delivery' model of education is quickly fading due to information being a mouse-click away. Providing alternate means of access to instruction, in a timeframe and mode that students prefer, is one strategy to improve student engagement. To this end, we have been examining two techniques that allow students alternate opportunities to explore the lecture in the form of lecturettes that contain supplemental examples or review material and a flexible, low impact, low cost lecture capture method, pencasting, to provide copies of classroom sessions and lecture notes. Student access to lecturettes and perception of the material will be discussed as well as assessment of effectiveness of the the two techniques.

P520: Podcast tutorials in mathematics and problem solving for physical chemistry

Marc Richard (The Richard Stockton College of New Jersey, USA)

The combination of chemistry with topics from physics and mathematics seems like a daunting and impossible challenge to many students. Possibly the largest hurdle is students' inherent fear of mathematics. Sometimes this fear is based on inadequate preparation in previous math courses, but more often it is due to lack of confidence in applying previous concepts taught in mathematics courses to the solving of problems in chemistry. With an infinite amount of classroom and face-to-face time it would be possible to review these important math skills and to

present these concepts in the context of chemistry. However, it is impossible to devote sufficient time to calculus and other math skills while also covering the essential core components of the physical chemistry curriculum. To address this problem, a series of podcast tutorials have been developed and offered on demand to physical chemistry students. These modules address important topics in calculus in the context of their applications to physical chemistry. They offer students a review of the mechanics of performing a variety of mathematical operations as well as highlighting a conceptual understanding of calculus as it applies to physical chemistry. A pre- and post-semester skills inventory showed a positive impact of the tutorials in both the mechanics of calculus and conceptual understanding.

P521: Can I make a ___cast? Absolutely!
Keith Walters (Northern Kentucky University, USA)
Can I make quick example problem recordings for my students to refer to online? Absolutely! Can I record my lecture content so students can review the material before their next exam? Absolutely! Will I need complicated software and high-end equipment to make these? Absolutely not! Will it take hours and hours to make these? Absolutely not! This paper will present easy, quick methods to create these recordings with the equipment and materials you already have and use every day. Come learn how to add these multimedia components to your teaching toolbox!

P522: Lecture podcasting in organic chemistry
Mark Morvant (University of Oklahoma, USA)
During the past three years, the author has produced enhance podcasts and screencasts of his organic chemistry lectures for students to use as supplemental instructional material. With over 70,000 views and thousands of downloads, it is obvious that the students are taking advantage of the availability of the lecture podcasts. I will discuss my experience with producing the podcasts, the pedagogical advantage of the video screencast format over the enhanced podcast format in organic chemistry, and my perception of the impact of the podcasts on my courses. I will also present the utilization data obtained from Feedburner and student survey responses.

P523: Podcasting in the classroom and laboratory at Northwestern University
Owen Priest (Northwestern University, USA)
Teachers who incorporate technology into their teaching find that it can help motivate today's technologically savvy students. Audio and video podcasting is not only becoming increasingly popular on campuses, but it is also becoming ever more easy to do. This speaker routinely produces podcasts that incorporate audio, video, photographs, and screen captures. The content of the podcasts includes quiz answer keys, lab technique videos, safety videos, and tutorials to name a few. This new form of media cannot stand in for class attendance but does provide an additional means of explaining complicated material to students. This talk will focus on how these podcasts are used in teaching organic chemistry at Northwestern University. Both the pedagogical and practical implementations of this new technology will be discussed, including how to quickly and easily produce media that can be used in the classroom or the laboratory.

9:00 AM - 12:00 PM WH-119

S42: Center for Workshops in the Chemical Sciences (CWCS) – Part 3 of 3

David Collard (Georgia institute of Technology,USA), *Lawrence Kaplan* (Williams College,

USA)
The Center for Workshops in the Chemical Sciences (CWCS) conducts workshops primarily for college and university faculty. The workshops are designed to provide a background of key areas of the chemical sciences along with pedagogical methods to introduce the topics into the undergraduate curriculum. In addition, CWCS develops Communities of Scholars in topical areas derived from workshop activities for the adaptation, implementation and development of high-quality course content and pedagogy, and the propagation of the use of successful teaching strategies. This symposium will include presentations concerning all aspects of the CWCS program including an overview of the workshop program, the content and scope of individual workshops, and the impact participation in the workshop program has had on the ability of workshop alumni to develop new pedagogical material. The CWCS is supported by the NSF, DUE, CCLI Program (DUE-0618678).

9:00		introduction
9:05	Owen Priest	P524: How CWCS helped change the way laboratory is done at Northwestern
9:25	Christina McCartha	P525: Integration of CWCS workshop material into the organic laboratory curriculum at Newberry College
9:45	Christine Hermann	P526: Using the FT-NMR in organic chemistry
10:05	Robert Long	P527: Promoting more critical thinking in organic chemistry labs
10:25		break
10:40	Dalila Kovacs	P528: Teaching organic laboratory courses via student-driven research, centered on green chemistry concepts and principles
11:00	Sarah Kenick	P529: It's easy being green: A project developed from the Green Chemistry in Education Workshop
11:20	James Spell	P530: CWCS Environmental Workshop as a catalyst for change in both non-majors and majors chemistry at Columbia College
11:40	Douglas Armstrong	P531: Undergraduate student research in microwave-promoted organic syntheses

P524: How CWCS helped change the way laboratory is done at Northwestern
Owen Priest (Northwestern University, USA)
The experiences gained at the 2006 CWCS workshop (Teaching Guided Inquiry Organic Chemistry) were instructive when Northwestern overhauled the undergraduate organic laboratory curriculum to reflect a more green and guided inquiry model. Following the workshop, a 2.5 million dollar renovation of the laboratory space was undertaken. The new space is much more open and conducive to the types of collaborative experiments that were part of the 2006 workshop. In addition, more guided inquiry experiments have been introduced into Northwestern's curriculum. One such guided inquiry experiment has since been published in J. Chem. Ed. (2008, 85, 698-700). Details of both the lab renovation and the curriculum overhaul will be presented.

P525: Integration of CWCS workshop material into the organic laboratory curriculum at

Newberry College
Christina McCartha (Newberry College, USA)
The integration of organic laboratory material from the CWCS workshop, "Chemical Education: Teaching Guided-Inquiry Organic Chemistry Labs" at a 4 year liberal arts college of 1000 students will be presented. An NSF CCLI grant (DUE # 0633174) provided funding to develop laboratories utilizing a newly purchased GC/MS into the chemistry curriculum. Several traditional organic laboratories have been recast including an essential oil lab that introduces distillation, GC, and refractometry with reinforcement of extraction techniques and GC/MS analysis. An over the counter drug laboratory provides an introduction to TLC and IR with reinforcement of extraction techniques and GC/MS analysis. An ester lab provides the students the opportunity to design a chemical synthesis using the chemical literature with introduction of 1H, 13C NMR and reinforcement of distillation techniques, IR, and GC/MS analysis. The essential oil lab and the ester lab provide mini-projects for the students in which each student is provided different samples.

P526: Using the FT-NMR in organic chemistry
Christine Hermann (Radford University, USA)
On September 11, 2001 our FT-NMR Anasazi spectrometer was installed while our nation was under attack. In the years since then, our NMR has served us well. In the summer of 2009, the spectrometer was upgraded to newer technology. Each year, all of the students in the organic chemistry laboratory use the FT-NMR during the spring semester. In the spring semester of 2010, almost 90 students, working in pairs, obtained the 1H, 13C, and DEPT spectra of both benzocaine and DEET after the synthesis in the laboratory. They also work independently in the identification of an unknown liquid. 1H, 13C, DEPT, COSY, and HETCOR spectra are used during the lecture to explain the interpretation of NMR spectra. Many spectra from the FT-NMR spectrometer have been published in the 8th edition of "The Systematic Identification of Organic Compounds."

P527: Promoting more critical thinking in organic chemistry labs
Robert Long (Eastern New Mexico University, USA)
How several lab experiments used in the traditional two-semester organic lab course at Eastern New Mexico University have been modified to add critical thinking components (subsequent to a 2005 CWCS workshop) to promote better student engagement. One lab modified was a kinetics experiment (using varied starting materials, conditions) which concludes with group comparative analysis of results to discover trends. Inquiry was also incorporated into a new biodiesel experiment by using different starting oils and having students perform comparative analyses of resulting biodiesel products. Presentation of effective and simple strategies (as well as potential pitfalls) for incorporating more inquiry and critical thinking into traditional organic labs.

P528: Teaching organic laboratory courses via student-driven research, centered on green chemistry concepts and principles
Dalila Kovacs (Grand Valley State University, USA)
CHM 245 & 248 are two subsequent organic laboratory courses designed for chemistry majors at Grand Valley State University (GVSU) in Michigan. The experience gained by coordinating & teaching these courses after participating in the Green Chemistry Workshop, organized by Center for Workshops in Chemical Sciences, at University of Oregon (July 09) will be presented. A

series of traditionally required experiments were run in parallel with new or greener versions. Research projects covering the last five laboratory sessions were designed; the actual completion of the research project shifted the project's ownership onto the students. A central component was the time-management piece as the students had to prepare and schedule multiple-weeks work. To complete the project students had perform literature search, select methods and procedure, perform the actual lab work, analyze and interpret the data collected and, as culminating experience, prepare an oral presentation. The final presentation were evaluated by their peers an a panel of faculty engaged in teaching tall the lab sections. Student presentation emphasized the application (or lack f thereof) of green chemistry concepts and integration of the 12 principles. Despite the challenges and downfalls of a new methodology requiring coordination of multiple projects going on at different stages in the same laboratory section, the students' interest and enthusiasm in the concepts and principles of green chemistry compensated well the effort and made it worthwhile.

P529: It's easy being green: A project developed from the Green Chemistry in Education Workshop

Sarah Kenick (University of New Hampshire at Manchester, USA)

After attending the Green Chemistry in Education Workshop in 2006, I redesigned the organic chemistry course sequence and implemented an outreach project. The organic chemistry laboratory sequence contains green laboratory activities, and the lecture course has integrated green chemistry throughout. This paper will discuss the planning and execution of these projects, as well as the main outcomes as a result. An ongoing service learning outreach component to the K-12 science teaching community will also be discussed.

P530: CWCS Environmental Workshop as a catalyst for change in both non-majors and majors chemistry at Columbia College

James Spell (Columbia College, USA)

Extraordinary Chemistry, a non-majors chemistry course taught at Columbia College, SC (a private liberal-arts women's college) was given an environmental focus to provide a unifying theme within which to present the basic concepts of chemistry. Modification of this existing course involved changing the structure of the course to emphasize man's impact on nature's biogeochemical cycles and the many successes of chemistry in addressing global environmental issues. Laboratories added included nuclear radiation, global warming, field sampling, and environmental measurements of air and water quality. Ideas from the workshop were also incorporated into a traditional analytical chemistry course taught for majors to make the lab more relevant.

P531: Undergraduate student research in microwave-promoted organic syntheses

Douglas Armstrong (Olivet Nazarene University, USA)

I participated in a CWCS workshop in 2005 at Miami University (Ohio) which included (among other areas) the use of microwave to promote chemical reactions. This presentation will highlight what I learned and experienced there (and elsewhere)as applied to my mentoring undergraduate students in research in microwave-promoted organic syntheses, using our Biotage microwave instrument ("Initiator" model).

9:00 AM - 12:00 PM U-413

S43: Chemical Education Around the World – Part 3 of 3

John Kotz (SUNY, USA)

Advances in chemical education occur throughout the world, especially now that we are so interconnected. We invite submissions on innovative programs and on approaches to education of students and teachers in other nations, particularly in the developing world. A portion of the symposium will also be devoted to the International Chemistry Olympiad program.

9:00		introduction
9:05	Arden Zipp	P532: Evolution of the US National Chemistry Olympiad Program
9:25	Cecilia Hernandez	P533: Chemistry Olympiad in your classroom
9:45	John Kiappes	P534: Chemistry Olympiad: Perspectives as a student and mentor
10:05	John Kotz	P535: An inside look at the U.S. and International Chemistry Olympiad: Working with the best in the world
10:25		break
10:40	Andrew Dicks	P536: The Canadian Chemistry Olympiad regional & national programs
11:00	Sheila Woodgate	P537: BestChoice: Web-based learning around the world, the VSEPR story
11:20	Husamettin Akcay	P538: The study of the effectiveness of a computer-based constructivist learning material for teaching atomic structure and radioactivity

P532: Evolution of the US National Chemistry Olympiad Program

Arden Zipp (SUNY Cortland, USA)

The USNCO Program has changed dramatically in size since its inception in 1984 (from 209 nominees in 54 Local Sections in 1984 to 916 nominees in 130 Local Sections in 2009). In addition, it has undergone several alterations such as the introduction of a Lab Practical, more extensive exam review, and a revised Study Camp calendar. This presentation will describe these changes and assess their effects on students and the success of the program.

P533: Chemistry Olympiad in your classroom

Cecilia Hernandez (American Chemical Society, USA)

This presentation will provide an overview of the US National Chemistry Olympiad and how to participate and prepare your students for the competition. The Chemistry Olympiad provides a stimulating challenge to students who participate at the local, national and international levels. The program challenges the chemical knowledge and skills of students in an international arena. A former mentor of the USNCO will share his perspectives on the two-week student study camp held at the US Air Force Academy each June in Colorado and the experience at the IChO. Participants will receive a CD compendium of the USNCO laboratory practical problems.

P534: Chemistry Olympiad: Perspectives as a student and mentor

John Kiappes (The Scripps Research Institute, USA)

The International Chemistry Olympiad has now been annually organized for over 40 years, and the United States has participated for over 25. This talk will cover the basic structure of the international level of the experience, from the perspectives of both a student competitor and as a

mentor. In addition, the talk will provide some insight into the United States selection process and ways to incorporate the style and principles of the organization into local events and the classroom.

P535: An inside look at the U.S. and International Chemistry Olympiad: Working with the best in the world

John Kotz (SUNY, USA)

The International Chemistry Olympiad program (IChO) began in 1968 in what was then Czechoslovakia, and it has since expanded to almost 70 participating countries. The U.S. has entered the competition since 1984. In the U.S. approximately 11,000 students take an initial examination each year, and about 1000 are chosen to take a second screening exam. The 20 top scorers are invited to the U.S. Air Force Academy for a "Study Camp" for two weeks in early June. During that time the students have many hours of lecture in chemical theory and laboratory experience. Three chemistry teachers are chosen by the American Chemical Society to serve as mentors at the camp, and two of these mentors accompany the four students chosen to represent the U.S. at the overseas competition. The author spent four years as a mentor for the U.S. National Chemistry Olympiad team and will describe the experience of organizing the Study Camp, the nature of the theoretical and laboratory work, and what students and mentors experience at the IChO.

P536: The Canadian Chemistry Olympiad regional & national programs

Andrew Dicks (University of Toronto, Canada), Stanislaw Skonieczny (University of Toronto, Canada)

Annual International Chemistry Olympiads are the premier academic contests for talented high school students worldwide. Held in a different country each year, these week-long events represent the ultimate scientific global gatherings, where chemistry students compete for medals and attendant recognition on an individual basis. During the last decade, University of Toronto undergraduates (and graduates) have been key players in mentoring, selection and training of participants to represent Canada at international meetings. These activities have led to students learning unparalleled interpersonal, leadership and teaching skills by co-organization of both local and national academic events. This involvement has a huge developmental impact and the corollary benefit of recruiting the very best teenagers into chemistry, who typically become mentors themselves! This presentation will discuss history and organization of the Canadian Chemistry Olympiad program at regional and national levels and significant changes due to begin in August 2010.

P537: BestChoice: Web-based learning around the world, the VSEPR story

Sheila Woodgate (The University of Auckland, New Zealand)

BestChoice is an open-access interactive web site (bestchoice.net.nz) that was developed initially to support learning in large first-year Chemistry classes at The University of Auckland in New Zealand. The model underpinning BestChoice learning activities is simulation of the interchange of a student with an experienced teacher, and content is developed in a systematic, incremental fashion. BestChoice is innovative in its emphasis on teaching both concepts and problem-solving strategies by guiding students to interact with a web-based system that poses question sequences in ways aimed at promoting understanding. This paper will describe how different strategies for teaching VSEPR in Britain and New Zealand led to the development of a generic activity with a

emphasis on the conceptual basis for this topic. This activity has been used in British, New Zealand and US educational settings, and usage data has revealed some unexpected gaps in student understanding.

P538: The study of the effectiveness of a computer-based constructivist learning material for teaching atomic structure and radioactivity
Husamettin Akcay (Dokuz Eylul University, Turkey)
The aim if this study is to evaluate the effect of computer based chemistry instruction with regards to success on atomic structure and radioactivity in 9th and 10th grade students. For this reason the design of pretest and posttest was applied with two experiments (E-1 and E-2) and a control group (C-1) chosen randomly. A computer-aided learning method based on the atomic structure and radioactivity of high school curriculum was prepared to carry out its effect on students' success and attitudes towards chemistry. For this purpose the attitude scales were developed. Four instruments were used as pretest and posttest: An open-ended questionnaire for computer and computer based learning attitude, Chemistry Achievements Test, Computer Attitudes Scale, and Chemistry Attitudes Scale. The study was conducted during 2002-2003 and 2005-2006 education periods with 124 high school 9th and 10th class students of Aydin Department (Turkey). The first experimental group was taught by computer-aided education, the second experimental group used both the computer-aided education and conventional learning, and the control group was taught only by a conventional learning approach. The results indicate that the new instruction method shows a significant and positive change relative their attitude and success toward chemistry.

9:00 AM - 12:00 PM U-412

S44: Educating the Next Generation: Green and Sustainable Chemistry – Part 1 of 2

Loyd Bastin (Widener University, USA)
This symposium will highlight the incorporation of green and sustainable chemistry across the curriculum. Papers are sought that will assist educators in providing students at all age levels with course materials (lecture and laboratory) that illustrate the integration of green and sustainable chemistry throughout the chemical enterprise. Topics of significant interest include the relationship between the practice of green chemistry and its impact on designing a sustainable civilization, pedagogical activities that instill in students the knowledge and practice of green chemistry, laboratory exercises that facilitate the incorporation of green chemistry across the curriculum, the impact of green chemistry on chemical hygiene issues, and resources that facilitate the incorporation of these materials into the curriculum.

9:00		introduction
9:05	Robert Peoples	P539: Green chemistry: Key to a sustainable future, part 1
9:25	Robert Peoples	P540: Green chemistry: Key to a sustainable future, part 2
9:45	Mary Kirchhoff	P541: ACS: Promoting green chemistry and sustainability education
10:05	Robert	P542: Use of the ChemPRIME wiki to engage students in sustainability

	Belford	issues
10:25		break
10:40	Ted Pappenfus	P543: Renewable energy and sustainable chemistry across the undergraduate chemistry curriculum
11:00	Tim Zauche	P544: Developing a cross-discipline major in renewable energy
11:20		discussion

P539: Green chemistry: Key to a sustainable future, part 1
Robert Peoples (ACS Green Chemistry Institute, USA), Jennifer Young (American Chemical Society, USA)
Green chemistry is the key to a sustainable future, and educators and students are paving the way to making this a reality. In part 1 of this series we will set a global context for the importance of green chemistry. Not only is sustainability necessary to meet the needs and demands of an expanding population, but also prepare for the scarcity of key resources which underpin the national, political and economic security of nations. We'll learn why and how the tools of green chemistry will enable humankind to achieve a sustainable world.

P540: Green chemistry: Key to a sustainable future, part 2
Robert Peoples (ACS Green Chemistry Institute, USA), Jennifer Young (American Chemical Society, USA)
In part 2 of this series we will discuss the basic definition of green chemistry and the 12 principles that facilitate implementation. We will give short examples of green chemistry in action and review available resources for teaching green chemistry in both the classroom and laboratory. In partnership with key collaborators, ACS GCI has recently published several new educational books and cases studies. ACS GCI also provides workshops for educators and for students each year, webinars, an annual 10-day green chemistry summer school program for graduate students and postdoctoral fellows, the annual Green Chemistry & Engineering Conference, and student awards. The presentation will provide an overview of these resources and opportunities, which are highlighted on the ACS GCI website, www.acs.org/greenchemistry. We will set you on the path to getting started with green chemistry.

P541: ACS: Promoting green chemistry and sustainability education
Mary Kirchhoff (American Chemical Society, USA), Laura Pence (University of Hartford, USA)
The Joint Board/Council ACS Committee on Environmental Improvement (CEI) and the ACS Education Division have complementary roles in facilitating the incorporation of sustainability and green chemistry principles into the chemistry curriculum at multiple levels. CEI crafts environmental policy statements for the Society and promotes the incorporation of sustainability into chemical education through joint programming with the Division of Chemical Education and through specifically targeted projects. The Education Division offers resources such as the Chemistry in Context textbook, whose new edition features sustainability integrated throughout, and workshops in green chemistry. The ACS website also provides a central location for a wide variety of chemical education resources for kindergarten through graduate school. The initiatives and resources of both the Education Division and CEI will be discussed.

P542: Use of the ChemPRIME wiki to engage students in sustainability issues
Robert Belford (University of Arkansas – Little Rock, USA), Justin M. Shorb (University of Wisconsin – Madison, USA)
This presentation we will present a project where students in a non-majors "Chemistry and Society" course at the University of Arkansas at Little Rock used the ChemEd DL ChemPRIME general chemistry textbook wiki (http://wiki.chemprime.chemeddl.org) to create exemplars which related the core content of ChemPRIME to an issue of societal sustainability. Each exemplar covers the same material as the traditional text, but with a different context for the text and example problems. These exemplars were where the students used the wiki to rewrite the chemistry text to present a story and the chemistry behind that story. For example, a student rewrote the text on electrochemical cells to tell the tale of how child laborers in Bangladesh recycled batteries from the garbage. Links, images, YouTube® videos and CNN news streams were introduced to explain how a battery and a fuel cell works, their differences, and a possible vision of how fuel cells might reduce the waste stream and its unintended consequences. At the end of the semester each student was required to write a series of exam questions their exemplar should cover, distribute them to the class and give a presentation to their classmates. This material was then included in the fourth exam. We will discuss issues like plagiarism, the usage of web resources, getting students to learn how to write to a wiki and present a couple of the student's exemplars.

P543: Renewable energy and sustainable chemistry across the undergraduate chemistry curriculum
Ted Pappenfus (University of Minnesota, Morris, USA)
Issues of energy and sustainability are having a direct impact on the public and are capturing the interests of many. As result, it is no surprise that science, including the field of chemistry, will become more connected with society in the future. To address this connection, we are in the process of integrating important elements of renewable energy and sustainable chemistry across the undergraduate chemistry curriculum at the University of Minnesota, Morris. This project strives to create a curriculum which is more interdisciplinary with respect to both teaching and research and which introduces topics that are timely, yet essential in preparing undergraduate students. Our initial efforts are focused on three key areas: (i) developing new courses in renewable energy and sustainability; (ii) integrating photovoltaics across the undergraduate curriculum; and (iii) illustrating the role of biochemistry in renewable energy and sustainability. Our goal is to develop a far-reaching energy and sustainable chemistry curriculum that complements the traditional curriculum and better prepares our future graduates for success in addressing global problems. An overview of the project will be presented along with our preliminary results.

P544: Developing a cross-discipline major in renewable energy
Tim Zauche (University of Wisconsin – Platteville, USA)
Not many of us have developed new majors outside or our departments. However, at the Univ. of Wisc-Platteville, we will be implementing a new major in Renewable Energy next year. The success and headaches of developing a new major across multiple departments in a University will be presented.

9:00 AM - 12:00 PM WH-212

S45: Electronic Homework: What Have We Learned? – Part 1 of 2

Margaret Asirvatham (University of Colorado-Boulder, USA)

Electronic homework in general and organic chemistry offers an online tool to keep students on track in the course. In this symposium, instructors and graduate students are invited to share their experiences in regard to pedagogical efficacy, student accountability, assessment, and impact on student learning and knowledge retention.

9:00		introduction
9:05	Marc Loudon	P545: Effect of electronic homework on student attitudes and performance in organic chemistry
9:25	Gary Kinsel	P546: Electronic teaching resources: An overview of a 3-Year effort to improve student success / retention in freshman chemistry
9:45	Natalie Foster	P547: SmartWork: Observations on student learning, faculty office hours, and everyone's attitude
10:05	Vickie Williamson	P548: Ten years of OWL: Impressions and findings
10:25		break
10:40	Sylvia Esjornson	P549: Strategies for assigning and scheduling electronic homework to improve completion rates
11:00	Mary Turner	P550: WebAssign as a laboratory assessment tool
11:20	Margaret Asirvatham	P551: Confronting reality: Online homework that addresses individualized learning and student accountability
11:40	Diana Mason	P552: Comparison of five online homework systems

P545: Effect of electronic homework on student attitudes and performance in organic chemistry

Marc Loudon (Purdue University, USA), Laurie Parker (Purdue University, USA)

An online homework system (Sapling Learning) was used in the first semester of a large-enrollment sophomore organic chemistry course consisting mostly of pre-pharmacy students (262 students enrolled, 246 completing). Students were given the option of using the online-homework system for a limited amount of extra credit (maximum 5.6% of total points). The effect of the online homework system on student performance was assessed, and student attitudes about the system were surveyed (93% student response).

P546: Electronic teaching resources: An overview of a 3-Year effort to improve student success / retention in freshman chemistry

Gary Kinsel (Southern Illinois University Carbondale, USA)

The presentation will focus on the effects and outcomes of the implementation of two technology based teaching tools in the delivery of Freshman Chemistry for Science and Engineering majors at Southern Illinois University Carbondale. The technologies utilized include the eInstruction Classroom Performance System and the McGraw-Hill ARIS system for homework delivery. Over the 3 year reporting period (AY0708-AY0910), these two technologies have been implemented for nearly 2300 students taking first semester general chemistry and the outcomes have been tracked through individual exam performance, final course grade and anonymous

student survey. The results of these studies are impressive in the overall improvement in student performance. Specifically, there were 4-8% reductions in student withdrawal rates accompanied by 5-10% improvements in student pass rates (grade of C, or better). Concurrent with these improvements in student performance an overall improvement in student retention was achieved, as measured by a significant increase in student registration in second semester general chemistry. Correlation studies show a strong relationship between student performance as measured by the implemented electronic technologies and overall course performance as measured by final grade. Finally, student surveys showed a high level of perceived value and satisfaction with the technologies utilized. The presentation will detail the manner in which these results were achieved, lessons learned through experience and, significantly, provide a highlight of problems requiring further address.

P547: SmartWork: Observations on student learning, faculty office hours, and everyone's attitude

Natalie Foster (Lehigh University, USA)

We have used SmartWork for 2 1/2 years (first as a beta-test site and then as regular users) in two semesters of introductory chemistry: the first semester (Chem 30) for all science and engineering majors and the second semester follow-on course (Chem 31) taken by science students and those engineers who need a full year of introductory chemistry. Both Chem 30 and 31 run every semester, and over the 2 1/2 year period approximately 1500 students have used SmartWork. In this presentation we will discuss, using both quantitative and anecdotal information, the impact and effects of on-line homework on student learning; on the conduct and nature of the help sought by students in office hours with faculty; and on the attitude of faculty members, teaching assistants, and students with regard to the role and usefulness of homework in the introductory courses. In addition, we will describe the ease with which existing problems can be modified within the system and new problems for both homework and other assessment activities can be authored. We will also mention the impact that quantitative information available within the system about student performance has made on the way we teach and test.

P548: Ten Years of OWL: Impressions and findings

Vickie Williamson (Texas A&M University, USA)

Online Web Learning (OWL) is an electronic homework system that promotes learning via mastery learning techniques. After using the product for ten years, both student survey data and educational research studies have been conducted with OWL. The session will present these findings, including one study comparing written homework to OWL and another comparing OWL with full feedback and OWL with restricted feedback. The richness of ten years of student surveys gives a picture of student attitudes towards the project.

P549: Strategies for assigning and scheduling electronic homework to improve completion rates

Sylvia Esjornson (Southwestern Oklahoma State University, USA)

A truism in electronic homework is “It helps-- if they do it.” This talk reviews assignment and scheduling strategies designed by a veteran user of Chemi-Skill Builder®, Eduspace®, and MasteringChemistry® that allow repetition and self-paced learning and increase completion rates of electronic homework. Positive, false positive, and negative completion rates are analyzed. Current practice addressing the role of the humans and the role of the machine, including

personal contact and paper and pencil tasks, in the successful implementation of electronic homework are discussed. Self-defeating behaviors of students are revealed. A continuous improvement model drives the analysis. Student investment in the homework increases with the points assigned, and so, if the homework is to be worth as much as the final exam, the points earned should not be a sham. Therefore, a grade is not recorded unless the student validates the online score by submitting a notebook filled with pages and pages of worked problems. In this way, electronic homework can transfer the work of learning to the student, while utilizing the machine to reduce the drudgery of the professor, and thereby allow more fruitful student professor interactions.

P550: WebAssign as a laboratory assessment tool

Mary Turner (Maryville College, USA), John Grossenbacher (Maryville College, USA)

WebAssign®, the online homework and grading tool, has been successfully used for several years in the General Chemistry courses at Maryville College to automate the assessment of electronically-submitted homework assignments. This year the technology available at WebAssign was used to evaluate student performance in the General Chemistry Laboratory. WebAssign assignments were created in the online question editor by programming in a form of straightforward markup language. Detailed evaluation of student-submitted data/results was automated including the checking of significant figures in quantitative work. It was found that the programming yielded flexible yet specific number checking and point-value allocation during grading. The assignments were modeled after the existing laboratory manual for the course. Although there was an initial expenditure of time required to code the questions, test the programming, and validate the assessment results, the time saved in grading for a large course was significant. The major advantages and disadvantages of this form of assessment will be discussed, along with recommendations for planning and implementing laboratory assignments appropriately using WebAssign.

P551: Confronting reality: Online homework that addresses individualized learning and student accountability

Margaret Asirvatham (University of Colorado-Boulder, U.S.A)

Many online homework systems encourage and facilitate peer collaboration, and students tend to prefer this type of learning. However, some students acquire a false sense of security about course mastery and continue to lack basic math and chemistry skills. We will examine the effects of using an online system that uses an initial assessment, adaptive questioning, and progress assessments to provide drill and practice as needed.

P552: Comparison of five online homework systems

Diana Mason (University of North Texas, USA)

The reported national D,F,W rate for student success in general chemistry I is 47%. As part of a course redesign project, several electronic homework systems have been employed including Online Web-based Learning (OWL), MasteringChemistry, WileyPLUS with CATALYST, Smart Work, and Assessment and Learning in Knowledge Spaces (ALEKS). A detailed comparison of these programs and resulting student success will be reported.

9:00 AM - 12:00 PM WH-121

S29: Engaging Students in Organic Chemistry - Lecture Methods Emphasis,-

Part 3 of 3

Barbara Murray (University of Redlands, USA)
Presentations of a variety of methods for engaging students in organic chemistry. These could range from individual creative activities to yearlong methods of teaching using new pedagogies and anything in between.

9:00		introduction
9:05	Douglas Schirch	P553: Effectiveness of a two-cycle organic chemistry sequence
9:25	Jonathan Lavezo	P554: Organic chemistry I: Redesigned for the next generation
9:45	Lakshmy Ravishankar	P555: Exciting students towards organic chemistry: A study circle approach
10:05	Brent Yoder	P556: Incorporating supplemental instruction into the organic chemistry classroom
10:25		break
10:40	Jennifer Muzyka	P557: Organic chemistry with Just-in-Time Teaching
11:00	Sara Hein	P558: Positive effects of POGIL implementation in the organic chemistry classroom
11:20	Marc Loudon	P559: Twelve year journey into cooperative-learning methods in a large organic chemistry class
11:40		discussion

P553: Effectiveness of a two-cycle organic chemistry sequence
Douglas Schirch (Goshen College, USA)
Converting standard yearlong organic chemistry courses into a two-cycle sequence serves dual purposes: one-semester students receive a more comprehensive overview of the discipline, and two-semester students demonstrate improved retention at the end of the year. In the traditional sequence, students in majors requiring only one semester of organic chemistry are not taught many functional groups pertinent to biology (amines, carboxylic acids, ketones, etc.), but are required to learn material of marginal utility to their major. Many schools cannot offer a one-semester organic survey course and a distinct two-semester organic sequence for students in the chemistry major or pre-health professions. In a two-cycle sequence the first semester is a survey course and the second semester is more advanced, covering all the remaining topics normally taught in a yearlong sequence. Others have reported that this approach, which requires students in the second semester to recall and apply material learned in the first semester, increases student retention by the end of the year. The author of this presentation will show that his students, who took ACS examinations at the end of each academic year, showed similar improvements when comparing scores from years with a traditional sequence versus the two-cycle sequence. The presentation will also include choice of topics for each semester, other challenges particular to the alternative sequence, and student perceptions about its effectiveness.

P554: Organic chemistry I: Redesigned for the next generation
Jonathan Lavezo (University of North Texas, Denton), **Sushama Dandekar** (University of North Texas, USA)
The course covers topics traditionally presented in the first semester of organic chemistry. While

all sections of this course cover the same material, this particular section, designated as a N-Gen course (Next-Generation), is taught differently than the other sections of the course. There is a strong emphasis on fostering extensive student participation in the learning process, with the expectation that actively engaged students are more likely to successfully master the desired Student Learning Outcomes. There are many newly created interactive components, including online tutorials, peer-led video tutorials, numerous review exercises, assignments and quizzes, etc. These materials, placed on the UNT Blackboard Vista site, require students to become familiar with navigating this site. The diligent use of these materials is expected to enhance students' understanding of the complexities of organic chemistry. Several exercises, designed as small-group activities, encourage students to collaborate with their peers to complete the assignments. Some are done in-class, while others are assigned as homework. Only some of the assessment is currently online: several assignments and all the exams (mid-term and final) will be given in-class. Each student is also expected to complete a 9-week-long term project, titled "Adopt-A-Molecule". This newly created assignment is designed to encourage students to actively explore the world of organic chemistry via substances commonly encountered in everyday life, and, in the process, help them develop independent learning skills. The increased student engagement with the course material is expected to result in improved student success rates for this traditionally challenging course.

P555: Exciting students towards organic chemistry: A study circle approach
Lakshmy Ravishankar (V.G.Vaze College of Arts, Science and Commerce, India), Savita Ladage (Homi Bhabha Centre for Science Education, India), Gomathi Shridhar (V.K.Krishna Menon College of Commerce & Science, India)
Problem solving is an important activity that can be used to bring about academic excitement and motivation among chemistry students [1,2]. In the Indian context, problem solving is not yet an integral part of the classroom teaching/learning process which often emphasizes rote learning rather than understanding the concepts. The current paper shares experiences about one of the models, namely, the study circle that is being employed to initiate and develop undergraduate students' interest and conceptual understanding in organic chemistry. The paper reviews the outcomes of this activity that has been running uninterruptedly for almost two decades. It analyzes the effectiveness of the activity with respect to pedagogy, content and its impact on choices of careers opted by the participants.

P556: Incorporating supplemental instruction into the organic chemistry classroom
Brent Yoder (Illinois College, USA)
In the Spring of 2009, Illinois College began a Supplemental Instruction (SI) program for students in six math and science "gateway" courses, including Organic Chemistry I and II. Although SI is peer-led instruction, it is not simply group tutoring, and we have tried to encourage our student leaders to facilitate discussion, rather than re-lecture. Building upon the successful blueprint created by The Center for Academic Development at The University of Missouri – Kansas City, we have established a basic format that works well for our small, residential liberal arts college. Although the SI sessions vary somewhat from discipline to discipline, students are generally quite pleased to study with a veteran of the course in a structured, yet informal setting. This presentation will describe the goals of Supplemental Instruction, how it is used to facilitate learning specifically in an organic chemistry course, and the lessons learned from the first three semesters of implementation.

P557: Organic chemistry with Just-in-Time Teaching
Jennifer Muzyka (Centre College, USA)
In the Just-in-Time Teaching approach, a faculty member assigns readings to students before every class. After the students have done the daily reading, they access a short reading quiz on a course management system (e.g., Moodle). The faculty member uses student responses to the quiz in the preparation of the day's class material and is able to tailor his or her explanations to target specific student questions or confusion. This presentation will describe the use of this approach to engage students in organic chemistry classes at Centre College.

P558: Positive effects of POGIL implementation in the organic chemistry classroom
Sara Hein (Winona State University, USA)
The development of student-centered learning techniques has been augmented by recent trends to get students engaged in the classroom. One method, Process-Oriented Guided Inquiry Learning (POGIL), has been developed as a pedagogical technique that facilitates collaborative and cooperative learning in the chemistry classroom. Using this technique, students enhance their higher order thinking skills and process skills synergistically. In addition, they develop positive relationships with other students in the course. At Winona State University, POGIL was implemented and has been used in the organic chemistry sequence for the past three years. Comparisons of standardized exam data and proficiency data indicate that students are achieving higher scores than students who were taught using traditional methods. These results indicate that the learning cycle experienced by the students was important for their success. An analysis of these comparisons will be presented.

P559: Twelve year journey into cooperative-learning methods in a large organic chemistry class
Marc Loudon (Purdue University, USA), George Bodner (Purdue University, USA)
Cooperative-learning techniques have been used for 12 years in a large-enrollment sophomore organic chemistry course consisting mostly of pre-pharmacy students. A description of these techniques, an assessment of their effect on performance, and student attitudes towards them will be reported. Our work shows that large class sizes need not be an impediment to the use of such techniques with conventionally available resources.

9:00 AM - 12:00 PM U-415

S46: Inquiry Activities for High School Teachers – Part 1 of 2

Julie Henderleiter (Grand Valley State University, USA)
This symposium is for high school teachers who have tested inquiry activities they wish to share with their peers. The activity along with classroom results demonstrating its strengths are expected. Handouts or electronic copies of both student and teacher materials are encouraged.

9:00		introduction
9:05	Deanna Cullen	P560: Electrochemical cell model: A guided inquiry laboratory
9:25	Angela Slater	P561: May the force be with you: A guided inquiry lab
9:45	Dale Eizenga	P562: The world in a box: Developing a particulate view of matter
10:05	Susan Hershberger	P563: Inquiry with everyday materials

10:25	break
10:40 James Mandrick	P564: Mole money
11:00 Patricia Ligon	P565: High school POGIL initiative
11:20	discussion

P560: Electrochemical cell model: A guided inquiry laboratory
Deanna Cullen (Whitehall High School, USA)
High school chemistry students often struggle with concepts related to redox and electrochemistry. Student misconceptions related to electrochemistry are well documented. Created as a part of the Target Inquiry Program at Grand Valley State University, this activity helps students make connections between the symbolic, macroscopic and particulate levels of an electrochemical cell. Students manipulate electrons and ions within the model after observing the same reaction within the laboratory. The model will be presented along with sample student data and facilitation tips.

P561: May the force be with you: A guided inquiry lab
Angela Slater (Muskegon Heights Public Schools, USA)
Ionic bonding, covalent bonding, and intermolecular forces are very abstract concepts for chemistry students to grasp. This lab has been designed to help students connect macroscopic observations to the particulate level. Using guided inquiry, students determine relative melting points and evaporation rates in the lab, view animations of melting at the particulate level, and determine relative intermolecular forces based on lab results and make connections to molecular structure. This activity was developed as part of the Target Inquiry Program at Grand Valley State University where it was evaluated by high school chemistry teachers. This presentation will include an overview of the activity, sample student data, facilitation tips, and evaluation data.

P562: The world in a box: Developing a particulate view of matter
Dale Eizenga (Holland Christian High School, USA)
Understanding the phases of matter and elements, compounds, and mixtures on the particulate level is a crucial concept for high school students. Most students enter a high school chemistry course with preconceived ideas of this topic. Understanding these preconceived ideas is the first step to addressing any misconceptions. An inquiry activity was developed as part of the Target Inquiry Program at Grand Valley State University to uncover student views of the particulate nature of matter and begin to address misconceptions. Student and teacher resources and student responses will be presented.

P563: Inquiry with everyday materials
Susan Hershberger (Miami University Middletown, USA)
Most high schools allocate time to laboratory investigations, where hands-on activities might be expected to teach the inquiry standards. In fact, laboratory investigations often emphasize technique or procedure over inquiry. Using common everyday materials in investigations fosters inquiry and learning because the use of familiar items frees students to think about the chemistry occurring. With familiar materials, the barriers to changing conditions, a necessary part of inquiry, are lower. The challenge is encouraging students to see the chemistry behind these everyday items and crafting inquiry experiences where students change conditions and materials

to learn the important concepts of chemistry. Several open-ended activities that address central topics such as ions or molecules, polar or nonpolar compounds, chemical structure, and acidity will be presented. The use of writing to support and assess student knowledge is also an important part of inquiry. Access to electronic files of the activities will be available. Included in the files are a materials list, student and teacher prompts for the activities, and a sample writing rubric.

P564: Mole money
James Mandrick (Portage Central High School, USA)
Students commonly have problems developing the skill of proportional reasoning. This inquiry based lab helps students develop this skill from the use of materials they are familiar with. Students utilize their prior knowledge of money along with the factor label method to develop their understanding of proportional reasoning leading up to stoichiometry. Discussion will include the lab experience, student results and teacher reflection on instruction.

P565: High school POGIL initiative
Patricia Ligon (Broughton High School, USA)
The High School POGIL Initiative is looking for more Chemistry and Biology High School teachers to become involved in developing and testing new Inquiry activities. The primary goals of this 3-year project (running through September, 2011) are to increase the availability of POGIL (Process Oriented Guided Inquiry Learning) activities for HS chemistry and biology courses. These activities provide content development and process skills such as critical thinking, effective communication and teamwork.

9:00 AM - 12:00 PM WH-316

S47: Modernizing Teaching about Molecules and Bonding in General Chemistry Courses

David Woon (University of Illinois at Urbana-Champaign, USA)
Much of the current material on molecules and the nature of chemical bonding that is presented in general chemistry textbooks and courses is dated and fails to reflect the mature state of knowledge on the topic, particularly from the perspective of modern quantum chemistry. Better options are available than Lewis structures, Pauling hybridization, and VSEPR theory. This symposium will allow presenters to describe alternate strategies for teaching the subject matter that are in development or already in use. While the primary emphasis of the symposium will be on new approaches to the material itself, talks that address misconceptions about molecules and bonding and related pedagogical issues will also be appropriate.

9:20		introduction
9:25	Barbara Bull	P566: Atomic models and periodic trends
9:45	Michael Sanger	P567: Using electrostatic potential maps from Spartan to teach about bond types, molecular polarity, and solution miscibility
10:05	Rebecca Ricciardo	P568: Inorganic coordination chemistry in undergraduate courses: Design, implementation, and evaluation of an integrated laboratory/classroom experience

10:25		break
10:40	David Woon	P569: New foundations for teaching about the nature of molecular bonding in General Chemistry: Moving beyond Lewis structures, hybridized orbitals and VSEPR with modern quantum chemical theory
11:00	David Woon	P570: New foundations for teaching about the nature of molecular bonding in General Chemistry: What is a chemical bond?
11:20	Lina Chen	P571: New foundations for teaching about the nature of molecular bonding in General Chemistry: Atom-by-atom insight into molecular structure
11:40		panel discussion

P566: Atomic models and periodic trends
Barbara Bull (Clemson University, USA), Melanie Cooper (Clemson University, USA), Alma Gonzales (Clemson University, USA), Minory Nammouz (Clemson University, USA)
The structure of the atom is probably one of the first places where students must confront the idea that scientific theories change over time as evidence accumulates to either support the theory, or require modifications. Many students appear to be confused by the succession of atomic models, conflating aspects of different models, and representations. There is little prior research on the relationship between students' mental models of atomic structure and their understanding of related topics. This presentation will focus on a preliminary study designed to determine whether atomic structure is a threshold concept for student understanding of bonding and periodic trends.

P567: Using electrostatic potential maps from Spartan to teach about bond types, molecular polarity, and solution miscibility
Michael Sanger (Middle Tennessee State University, USA)
As a general chemistry instructor, I have used electrostatic potential maps of simple molecules to teach about concepts involving charges within these molecules. These topics include identifying bonds as ionic, polar covalent or nonpolar covalent; determining whether a molecule is polar or nonpolar; and explaining the results of simple miscibility experiments (why water and ethanol mix, why water and pentane do not, etc.). As a chemical education researcher, I have been involved in research to test the effectiveness of using these maps on studentsï¿½ conceptions of bond type, molecular polarity, and solution miscibility. This paper will focus on the uses of these electrostatic potential maps as instructional and assessment tools, and will discuss the research results as they pertain to the effective use of these maps in the general chemistry classroom.

P568: Inorganic coordination chemistry in undergraduate courses: Design, implementation, and evaluation of an integrated laboratory/classroom experience
Rebecca Ricciardo (The Ohio State University, USA), Ted Clark (The Ohio State University, USA), Heather Cuthbert (The Ohio State University, USA), Matthew Stoltzfus (The Ohio State University, USA), Patrick Woodward (The Ohio State University, USA)
In this presentation we examine a laboratory experiment addressing topics pertinent to inorganic coordination chemistry, including coordination compounds, isomerism, and the spectrochemical series. Although used here in a large enrollment general chemistry course, it is held that this laboratory experiment is extendable to upper-level inorganic chemistry courses as well. When designing this experiment attention was given to integrating the student's laboratory and lecture

experiences. Specifically, critical thinking exercises and hands-on atomic orbital/molecular modeling are combined with inorganic synthesis and UV-VIS spectrometry for detailed student exploration completed in the laboratory. The implementation of this experiment, its integration with lecture, and issues concerning its evaluation will be discussed.

P569: New foundations for teaching about the nature of molecular bonding in general chemistry: Moving beyond Lewis structures, hybridized orbitals and VSEPR with modern quantum chemical theory

David Woon (University of Illinois at Urbana-Champaign, USA), Lina Chen (University of Illinois at Urbana-Charmpaign, USA), Thom Dunning (University of Illinois at Urbana-Champaign, USA)

While modern experimental and theoretical chemistry have made enormous advances in understanding the fundamental nature of molecular bonding at the nanoscale, the approach to teaching the subject in General Chemistry courses is often limited to introducing ideas such as Lewis dot structures (1916), Pauling's ad hoc hybridized orbital model (1931), and Gillespie's valence shell electron pair repulsion (VSEPR) model (1957). The argument for continuing to use these models is their simplicity, although students still struggle to understand them. Furthermore, the knowledge they provide of the electronic structure of atoms and molecules is limited. This talk will examine particular cases where the models in common use fall short or even create misconceptions and show how intuitive, visual models based on rigorous quantum chemical theory and high accuracy calculations can provide a far better foundation for understanding the nature of chemical bonding.

P570: New foundations for teaching about the nature of molecular bonding in general chemistry: What is a chemical bond?

David Woon (University of Illinois at Urbana-Champaign, USA), Lina Chen (University of Illinois at Urbana-Charmpaign, USA), Thom Dunning (University of Illinois at Urbana-Champaign, USA)

Explaining the nature and origin of chemical bonding at a level suitable for General Chemistry students is very challenging. If too much emphasis is placed on electrons and electron pairs, it may lead to misconceptions such as the idea that electrons are somehow attracting one another in a bond pair. An effective way to avoid this and other misconceptions is to show that bonding arises from the interplay of both attractive and repulsive interactions between electrons and nuclei. It is also helpful to approach the subject heuristically, by giving students the chance to guess what will happen when certain atoms and ions are brought together, such as the sequence H+-H+, He-He, He-H, He-H+, and H-H. In this approach, the students learn to see bonding as a potential interaction analogous to their day-to-day experience with topography. In association with the potential, students are shown the process of bond formation, with atomic orbitals changing continuously to molecular orbitals as the bond is formed.

P571: New foundations for teaching about the nature of molecular bonding in general chemistry: Atom-by-atom insight into molecular structure

Lina Chen (University of Illinois at Urbana-Champaign, USA), Thom Dunning (University of Illinois at Urbana-Champaign, USA), David Woon (University of Illinois at Urbana-Champaign, USA)

Building on foundational knowledge of why molecular bonds form, we explore the manner in

which common stable molecules such as water, ammonia, carbon monoxide, carbon dioxide, methane, and sulfur hexafluoride can be constructed. By building these molecules atom-by-atom, we naturally form a number of intermediate radicals, and students are led to understand how these species differ from the stable molecules found in the world around us. We will also discuss the similarities and differences between the atom-by-atom approach and the existing models that are currently taught in General Chemistry courses.

9:00 AM - 12:00 PM WH-310

S57: Physical and Computational Chemistry in the Undergraduate Curriculum: Applied, Interesting, and Relevant - Physical and Computational Chemistry in the Undergraduate Curriculum: Applied, Interesting , and Relevant - Part 1 of 2

Roy Jensen (Grant MacEwan University, Canada), *Craig Teague* (Cornell College, USA)
Key aspects of student engagement are student interest and the ability of students to see the applicability and relevance of the material to their immediate world and/or their future careers. This symposium focuses on these aspects of physical and computational chemistry. One session focuses on the use of computational chemistry in undergraduate classrooms and laboratories. Activities range from classroom activities (demonstrations, simulations), stand-alone laboratory experiments, supplements to wet laboratory experiments, an entire course, and in undergraduate research. Presentations at all levels of the undergraduate curriculum are included. A second session explores non-computational physical chemistry lecture instructional material and laboratory experiments that make physical chemistry interesting and relevant to students.

9:00		introduction
9:05	Erik Epp	P572: Physical chemistry in practice DVD
9:25	Jonathan Rienstra-Kiracofe	P573: A fresh look at p-nitrophenylacetate hydrolysis kinetics with and without catalysis by á-chymotrypsin: a two-part biophysical chemistry experiment
9:45	Robert Parson	P574: Interactive engagement strategies in undergraduate physical chemistry: Peer instruction, just-in-time-teaching, and in-class group activities
10:05	Kim Linenberger	P575: What is fresh meat's true color? An upper-level undergraduate laboratory investigating the effects of ligand binding using optical and paramagnetic resonance spectroscopy
10:25		break
10:40	Kristina Lantzky	P576: Differential thermal analysis in the physical chemistry laboratory
11:00	John Dudek	P577: Modifying the bomb calorimetry experiment for physical chemistry laboratory
11:20		discussion

P572: Physical chemistry in practice DVD

Erik Epp (Purdue University, USA), Gabriela Weaver (Purdue University, USA)
The Physical Chemistry in Practice DVD is a set of hypermedia documentaries that showcase applied physical chemistry research. Topics include: atomic force microscopy (AFM), semiconductor growth, electronic structure of vitamin B-12 corrinoids, Bose-Einstein

condensates, single-molecule manipulation of DNA, solid-acid electrolytes, hydrogen fuel cells, thin-film polymer kinetics, nuclear magnetic resonance (NMR), magnetic resonance imaging (MRI), and surface-enhanced Raman spectroscopy (SERS). The hypermedia interface allows for great flexibility and can be used as a supplement to existing lectures and labs, or as an outside of class assignment for students. In addition to the video, there are definitions, animations, practice problems, diagrams and a full transcript of the video. Features and accessibility options will be shown and educational uses discussed.

P573: A fresh look at p-nitrophenylacetate hydrolysis kinetics with and without catalysis by á-chymotrypsin: a two-part biophysical chemistry experiment

Jonathan Rienstra-Kiracofe (North Park University, USA), Rebecca Gustafson (North Park University, USA)

á-chymotrypsin (á-CT) catalyzes the hydrolysis of p-nitrophenylacetate (PNPA) to the p-nitrophenylate ion. Reaction progress can be monitored by measuring light absorbance at 400 nm. We employed a CCD-array detector and all data was numerically fit by computer. While previous studies have run the catalyzed reaction in a phosphate buffer, we have chosen to use a carbonate buffer allowing for a pseudo-first order kinetic analysis of PNPA hydrolysis in the buffer alone. Subsequently, the catalytic effects of á-CT were investigated and directly compared to the uncatalyzed reaction, nicely demonstrating the effects of enzymatic catalysis.

P574: Interactive engagement strategies in undergraduate physical chemistry: Peer instruction, just-in-time-teaching, and in-class group activities

Robert Parson (University of Colorado at Boulder, USA)

We have explored the use of interactive engagement in two first-semester Physical Chemistry courses. While the two courses are directed, respectively, towards chemistry and biochemistry majors, they have identical prerequisites, satisfy the same major requirements, and in practice attract similar student populations. Both courses are taught in the traditional order (thermodynamics first) and the course content is about 2/3 in common. The 'chem majors' course used peer instruction (in-class concept tests administered via clicker) together with an adaptation of 'just-in-time teaching" in which open-ended questions are posed to students online before each class, the responses to which are used to develop that day's lecture. In the 'biochem majors' course, each class period included a breakout session in which students worked through context-rich activities in small groups. Assessment was carried out with a concept survey developed specifically for the common course content, together with the CLASS (Colorado Learning Attitudes about Science Survey), and student interviews. The poster will include selected results from these assessments, together with a discussion of practical aspects of implementing these strategies in the classroom and sustaining their use when a course is handed off to a new instructor.

P575: What is fresh meat's true color? An upper-level undergraduate laboratory investigating the effects of ligand binding using optical and paramagnetic resonance spectroscopy

Kim Linenberger (Miami University, USA), Stacey Lowery Bretz (Miami University, USA), Michael Crowder (Miami University, USA), Gary Lorigan (Miami University, USA), Robert McCarrick (Miami University, USA), David Tierney (Miami University, USA)

With an increased focus on integrated laboratories and a lack of integrated experiments, we

present an experiment integrating concepts from inorganic, biological, and physical chemistry content areas. The experiment sets out to investigate the chemical reason behind companies packaging meat under CO conditions by looking at the effects of ligand strength on the spectroscopic properties of myoglobin. Students use several spectroscopic techniques including 1H NMR, UV/Vis, and EPR. The experiment is meant for an upper-level undergraduate laboratory and can be completed in two 3-4 hour laboratory periods.

P576: Differential thermal analysis in the physical chemistry laboratory
Kristina Lantzky (St. John Fisher College, USA)
Differential thermal analysis (DTA) is often not covered in the physical chemistry Laboratory. This instrument is often fiscally out of reach for small schools. DTA was implemented in the physical chemistry laboratory at St. John Fisher College by building an inexpensive DTA. This instrument was used to study binary alkali nitrate systems. Details of the DTA and phase diagrams of binary alkali nitrate systems determined from DTA and differential scanning calorimetry (DSC) will be presented.

P577: Modifying the bomb calorimetry experiment for physical chemistry laboratory
John Dudek (Hartwick College, USA)
We have modified the traditional bomb calorimetry experiment which measures combustion reaction energies in an oxygen bomb. In our experiment, students investigate the enthalpy of combustion of a variety of different brands and types of potato chips. Through this work, they discover that regular potato chips and non-fat potato chips have the same enthalpy of combustion even though the reported caloric content differs by about 40 %. The difference is due to additives found in non-fat potato chips, such as Olestra. This experiment gives meaningful insight to how calories are measured and reported. As with the traditional experiment, the bomb calorimeter is calibrated by combusting benzoic acid and the accuracy is tested by measuring the enthalpy of combustion of naphthalene.

9:00 AM - 12:00 PM U-411

S64: Research in Chemistry Education – Instructional Design

Bill Robinson (Purdue University, USA)
This symposium provides a forum for chemical education research. A submitted presentation should briefly address 1) the motivation for the research and type of problem investigated and 2) the methodology chosen to both gather and interpret the data collected. The presentation should focus primarily on the findings and the interpretation of the data. This symposium is sponsored by the ACS DivCHED Committee on Chemistry Education Research.

9:00		introduction
9:05	Kermin Joel Martinez-Hernandez	P578: Comparing lecture-based vs. video game-based learning environments to assess student understanding of chemistry concepts
9:25	Dustin Hillman	P579: Comparing active game-based learning environments with passive media learning environments
9:45	Cianán Russell	P580: Evaluation of the impacts of implementation parameters on a research-based laboratory curriculum
10:05	Gabriela Szteinberg	P581: Tracking student retention in science: Effects of the CASPiE

	curriculum at Purdue University
10:25	break
10:40 Emily Moore	P582: Effectiveness of an online short preparatory course for general chemistry
11:00 Adessa Butler	P583: Success and retention in general chemistry before and after implementation of a mathematics prerequisite
11:20 Ryan Sweeder	P584: Quantitative impact of general chemistry on organic chemistry performance
11:40 Karen Christian	P585: Study groups in organic chemistry

P578: Comparing lecture-based vs. video game-based learning environments to assess student understanding of chemistry concepts

Kermin Joel Martinez-Hernandez (Purdue University, USA), Dustin Hillman (Purdue University, USA), Carlos R Morales (Purdue University, USA), Gabriela Weaver (Purdue University, USA)

A need to provide sound empirical research using computer video games as educational tools is evident as games are becoming more popular for educational purposes. To address this need, a chemistry-based computer video game was developed to assess its potential as an educational tool. A comparison study has been conducted to determine if students' level of understanding of chemistry concepts changes after participating in a game-based learning environment versus a lecture-based learning environment. A cohort of 40 students participated in the study and each student was assigned to one of the learning environments. Students experienced the chemistry concepts according to their learning environment and completed pre and post open-ended chemistry content surveys and a semi-structured interview to assess their understanding of chemistry concepts prior to and after the learning intervention. Previous studies conducted in our research group found that students' learning increased after video game-play intervention. However, these trends were not compared with a traditional learning environment such as a lecture. This presentation will elucidate the comparison results of the open-ended content surveys for both groups in their respective learning environments.

P579: Comparing active game-based learning environments with passive media learning environments

Dustin Hillman (Purdue University, USA), Kermin Joel Martinez-Hernandez (Purdue University, USA), Gabriela Weaver (Purdue University, USA)

Video games have made inroads in many applications, including military simulations, industrial training, and new educational tools. The incorporation of video games for teaching has been led primarily by the development of tools that mimic classroom or homework activities. We developed a video game that incorporates chemistry concepts but is designed to have the game-play engagement level of a commercial game. This study seeks to examine our in-house game as a learning environment by comparing three levels of interactivity in the media learning environments (MLEs) with identical chemistry content: active game-play, viewing of a game-play video, and reading descriptions of the game. Qualitative assessment instruments, including open-ended surveys and semi-structured interviews, were used to evaluate the students' understanding of the chemistry content presented in their media learning environment as well as

their preference for their respective MLE. The results of the analysis of student understanding of chemistry content, preference in the MLEs, and relationship to the students' preferred method(s) of learning will be presented.

P580: Evaluation of the impacts of implementation parameters on a research-based laboratory curriculum

Cianán Russell (Georgia Institute of Technology, USA), Gabriela Weaver (Purdue University, USA)

In the evaluation of novel curricula, early implementation issues are often relevant factors in determining the successes or failures of a program. The Center for Authentic Science Practice in Education (CASPiE) is a research-based undergraduate laboratory curriculum focused on general and organic chemistry. This research evaluates implementations of this curriculum at four institutions using student surveys and interviews with the students, faculty, and teaching assistants. The findings of this study, including discussions of the assignments, group size, and implementation of peer-led team learning, will be discussed. An optimization scheme for implementation will also be presented.

P581: Tracking student retention in science: Effects of the CASPiE curriculum at Purdue University

Gabriela Szteinberg (Purdue University, USA), Kathleen Quardokus (Purdue University, USA), Gabriela Weaver (Purdue University, USA)

The Center for Authentic Science Practice in Education (CASPiE) developed a research-based educational model that has been used in laboratory courses at several colleges and universities over the past 5 years. To investigate the effects of the CASPiE curriculum, a longitudinal study was initiated at one of the participating institutions. The study examines student retention in science majors and their plans for future careers, in relation to their participation in either the CASPiE or traditional course. Academic record information was obtained on CASPiE and traditional students. Students were given a survey with questions of research involvement and future career plans, and a subset of survey respondents was invited for semi-structured oral interviews to discuss in depth about their experiences in CASPiE or the traditional course. Results showing the relationship between retention in science, participation in research, and student accounts of their experiences will be discussed.

P582: Effectiveness of an online short preparatory course for general chemistry

Emily Moore (University of Utah, USA)

Students who enroll in General Chemistry I have a wide range of backgrounds and for some students, General Chemistry I is their initial introduction to chemistry. Many students that could potentially benefit from a slower paced, fundamental introduction to chemistry prior to taking General Chemistry I forgo the option because an extra semester of chemistry would put them behind in their programs. To address this issue, the Department of Chemistry at the University of Utah implemented an online self-paced, short preparatory course for General Chemistry. The effectiveness of the online short prep course for the 2009-2010 academic year is assessed based upon the success of students in General Chemistry I. From student surveys, prior chemistry and math experience was determined. This was used in data analysis to control for prior chemistry and mathematical aptitude and experience. Student success in General Chemistry I is compared between high achieving students (who would be expected to be successful in general chemistry

regardless of having taken a prep course or not), and between students that will most likely struggle in general chemistry.

P583: Success and retention in general chemistry before and after implementation of a mathematics prerequisite
Adessa Butler (The University of Akron, USA), **William Donovan** (The University of Akron, USA), Ethel Wheland (The University of Akron, USA)
We studied the relationships between mathematical ability and success and retention in a general chemistry course at an open-enrollment university whose mission is to provide a quality education to a culturally and economically diverse student body. We studied the correlation between the demonstrated level of mathematical ability and success in chemistry and the correlation between the demonstrated level of mathematical ability and retention in chemistry. Four years of data from after the chemistry department implemented a mathematics prerequisite for the chemistry course were examined to compare success and retention prior to and after the adoption of the prerequisite. Analysis showed that success and retention in chemistry increased after the adoption of the mathematics prerequisite.

P584: Quantitative impact of general chemistry on organic chemistry performance
Ryan Sweeder (Michigan State University, USA)
Statistical analysis of the performance of students in organic chemistry from 2003-2008 indicate that a general chemistry course can significantly impact student performance in a subsequent organic chemistry class (N=7165). An active student-centered general chemistry classroom is shown to improve student performance in organic chemistry. We will also highlight the gender performance difference in organic chemistry and the decrease in this gender gap depending on the nature of the general chemistry course.

P585: Study groups in organic chemistry
Karen Christian (University of Arizona, USA)
Students often use study groups to prepare for chemistry class or exams; yet to date, we know very little about how these groups actually function. This study looks at the ways in which organic chemistry students prepare for class through self-directed collaborative study groups. We made observations of 17 groups of students throughout their first semester of organic chemistry and conducted interviews with students from each of the groups that were observed. These first-hand observations gave us a means to qualitatively understand how students interact and collaborate, and how this affects their engagement with the subject of organic chemistry. Our analysis has shown that groups engage in predominantly three types of interactions when discussing chemistry content, which include a co-construction, teaching, and a tutoring interaction. Although each group demonstrated using all of the interactions, the ratio of these interactions varied between groups and group members. We suspect that the types of interactions that are used are a function of the relative preparation of the group members as well as the difficulty of the cognitive tasks that are being attempted. Overall, results from this study may help instructors to construct appropriate tasks to guide how and what students study outside of the classroom.

9:00 AM - 12:00 PM WH-214

S48: Science and Civic Engagement: A Curriculum for the 21st Century

Richard Sheardy (Texas Woman's University, USA)
Science Education for New Civic Engagement and Responsibilities (SENCER) began with the support of the NSF in 2001. At Colleges and Universities across the United States, this program continues in developing a community of learners and scholars who demonstrate the connection between science and civic engagement. Come learn how the application of SENCER goals and ideals impacts student retention by learning across the curriculum and engaging them beyond the classroom.

9:00		introduction
9:05	Richard Sheardy	P586: Science education and civic engagement: The SENCER approach
9:25	Steve Bachofer	P587: Exploring three civic engagement issues through XRF spectroscopy
9:45	Cynthia Maguire	P588: Chemistry, water and civic engagement
10:05	William Donovan	P589: Development and implementation of a SENCER learning community for non-declared majors
10:25		break
10:40	Richard Jones	P590: Who owns the rain? - Water wars in Texas and the American southwest
11:00	Ron Chandler	P591: Psychology of sustainability
11:20	Jennifer da Rosa	P592: Climate change and natural disasters: The SENCER approach to earth science
11:40	Stephen Carroll	P593: Learning boot camp: Teaching students HOW to learn

P586: Science education and civic engagement: The SENCER approach
Richard Sheardy (Texas Woman's University, USA)
This presentation will introduce the SENCER (Science Education for New Civic Engagements and Responsibilities) approach to teaching science. The primary goal of SENCER, a program funded by the National Science Foundation, is to improve education in STEM areas by connecting science learning to critical civic issues. This presentation will describe the goals and strategies of SENCER and how to assess student learning through SALG (Student Assessment of Learning Gains). Specific examples of applying SENCER to undergraduate chemistry courses for both majors and non majors will be provided.

P587: Exploring three civic engagement issues through XRF spectroscopy
Steve Bachofer (Saint Mary's College of California, USA)
XRF spectroscopy readily reveals elemental analysis (Na to U) of samples through a non-destructive methodology and with the development of portable instruments, many community civic issues can be explored outside of the lab. XRF is a surface sensitive method, so painted surfaces, particles on filters, and homogenous soils are ideal samples. U.S. EPA has a method to screen soils for elements including lead, arsenic, and chromium, so exposure to these hazardous elements can be minimized with various regulatory actions. This presentation has XRF data on highway soils, children's toys, and painted surfaces. The civic engagement aspects raise student

awareness to these exposure issues. Students are typically more committed to collect high quality data and consider the impacts on the community.

P588: Chemistry, water and civic engagement
Cynthia Maguire (Texas Woman's University, USA)
Fall 2007 marked the beginning of the SENCER program at Texas Woman's University with the introduction of a new core science course, Introduction to Environmental Chemistry. Offered primarily for non-science majors, this course has evolved in its use of civic engagement as a tool for making science learning relevant to students. Currently, a community surface water monitoring program is being developed as an extension of the course.

P589: Development and implementation of a SENCER learning community for non-declared majors
William Donovan (The University of Akron, USA), Justin Brantner (The University of Akron, USA), Robert Crowley (The University of Akron, USA), John Thomas Dukes (The University of Akron, USA), Annabelle Foos (The University of Akron, USA), Jennifer Hodges (The University of Akron, USA), Helen Qammar (The University of Akron, USA), Kathleen Ross-Alaolmolki (The University of Akron, USA), Gregory Smith (The University of Akron, USA), Shane Strnad (The University of Akron, USA), Ethel Wheland (The University of Akron, USA), Bonita Williams (The University of Akron, USA)
The principles of SENCER pedagogy were used to develop an integrated, thematic SENCER learning community for first-year, non-declared majors. Biology, chemistry, mathematics, nursing and public health, geology, environmental science, rhetorical, and engineering concepts were integrated into student writing, speaking, and teamwork assignments. The learning community courses focused on science inquiry, applied data analysis, discovery, service learning, and information literacy in the context of water quality and its health consequences in the Cuyahoga River valley as a civic issue. This presentation will discuss the logistics, challenges, pitfalls, and successes in the development and implementation of the learning community and the impact of the learning community on students, including results of the Attitudes Toward Science Inventory, Spielberger's State Trait Anxiety Instrument, pre- and post-surveys, and student and faculty focus groups.

P590: Who owns the rain? - Water wars in Texas and the American southwest
Richard Jones (Texas Woman's University, USA)
SENCER (Science Education for New Civic Engagement and Responsibilities) is an NSF supported program connecting learning to critical 21st century issues. Texas Woman's University supports this initiative by developing courses with this classic liberal arts perspective. Learn how SENCER courses are more engaging than traditional curricula and "Science 101" courses.

P591: Psychology of sustainability
Ron Chandler (University of South Florida, USA)
When asked why we behave as we do toward Earth and more specifically toward the ecosystem services that sustain us two typical explanations are proffered, 'Well it's obvious isn't it we're greedy' or 'We can't help it we are hardwired to self-destruct'. In the "Psychology of Sustainability" Chandler will demonstrate why neither explains our relationship with our natural life support systems, that we are actually hardwired that is genetically disposed to survive, and

how this innate propensity has been socioculturally mistranslated and misapplied leading to the symptomatic behavior referred to as "immortality projects" (Becker, 1975; Wilbur, 1981; Dickinson, 2009). Drawing from fields of study in psychology, sociology, anthropology and natural history Chandler will discuss the surprising yet basic source of this behavior and some of the psychological mechanisms that we employ to maintain it such as group think, externalization of responsibility, magical thinking, belief perseverance and worldview. To close he will explore some of the fields, especially Future Scenarios (Holmgren, D., 2009; Wollenberg, E., Edmunds, D, & Buck, L., 1998) and positive psychology (Seligman, M., & Csikszentmihalyi, M., 2000), that offer the most potential for communicating the essential aspects of sustainability and that re-engage our natural disposition in support of the foresight and planning necessary to design and implement the changes necessary to develop sustainable societies.

P592: Climate change and natural disasters: The SENCER approach to earth science
Jennifer da Rosa (Texas Woman's University, USA)
The SENCER program at Texas Woman's University has grown with the development of a new science course, Climate Change: A Human Perspective, and the transformation of a preexisting course, Earth Science in the Context of Natural Disasters. Each course prepares students to perform their own assessment and champion civic engagement in response to a community's needs. For Climate Change: A Human Perspective, students construct a climate change and culture evaluation and are civically engaged as citizen scientists monitoring local plant and bird variations in response to climate fluctuations. For Earth Science in the Context of Natural Disasters, students execute risk analysis for a variety of simulated natural disasters, participate in disaster and SKYWARN Storm Spotter training, and become civically engaged in disaster preparation and response organizations like the American Red Cross.

P593: Learning boot camp: Teaching students HOW to learn
Stephen Carroll (Santa Clara University, USA)
Although teaching has become increasingly learning-centered, we do little to help our students learn how to learn. Leveraging discoveries about the brain to teach students how to read, listen, take notes, study, etc., learning boot camp provides students strategies that significantly accelerate their learning, making them more metacognitive, intentional learners. The contemporary learning-centered classroom makes sophisticated demands on students. We aim to produce self-motivated, critical thinkers. Yet most of our students come to us from learning environments that offer a narrow range of learning opportunities, demand mostly lower-order thinking skills, and reward a limited set of study skills and classroom behaviors. Moreover, most of our students have never been taught how to learn. Rather, their ways of learning have developed randomly. Learning boot camp aims to correct this by teaching students methods of learning based on recent discoveries in cognitive science and neurobiology. Teaching students a variety of reading strategies optimized for different purposes, how to take notes that help them retain more in less time, and how to think about what they are learning in metacognitive ways, helps students not only learn the material better and retain it longer, but also become the kinds of learners we want them to become. Data from four years of studies shows that learning boot camp helps students learn faster, retain what they learn better, and become more sophisticated, more intentional learners. This interactive workshop will provide participants with ideas and materials that will allow them to create their own learning boot camps.

9:00 AM - 12:00 PM U-409

S49: Student-Centered Learning in Chemistry

Gloria Brown Wright (Central Connecticut State University, USA)

Mary Ellen Weimer identifies five key areas where changes are necessary in order to facilitate learner-centered teaching: balance of power, use of content, encouraging student responsibility, the role of the teacher, the purpose and process of evaluation. Presentations will describe curricular innovations that answer to any of the above areas, how they were received by students, and the cognitive and/or affective results.

9:00		introduction
9:05	Gloria Brown Wright	P594: Student-centered versus teacher-centered college classrooms
9:25	Gloria Brown Wright	P595: Learner-centered teaching in college chemistry
9:45	Chad Bridle	P596: Using guided inquiry, particulate-level instruction to strengthen students' conceptual understanding of chemistry.
10:25		break
10:40	Lisete Fischer	P597: New possibilities for teaching-learning in electrochemistry: Who does not like to be an artist?
11:00	Ray Lesniewski	P598: Inspire your students with the TI-Nspire
11:20	Andrew Grall	P599: Using laptop/cell phone student response systems to enhance group learning activities
11:40		discussion

P594: Student-centered versus teacher-centered college classrooms

Gloria Brown Wright (Central Connecticut State University, USA)

Elaborations and illustrations taken from Maryellen Weimer's "Learner-Centered Teaching" will illustrate the five criteria of learner-centered teaching by contrasting student-centered and teacher-centered college classrooms. She gives suggestions on ways to create more learner-centered college classrooms.

P595: Learner-centered teaching in college chemistry

Gloria Brown Wright (Central Connecticut State University, USA)

Articles published in the chemical education literature provide examples of student-centered college chemistry classrooms that answer to Maryellen Weimer's five criteria for learner-centered teaching.

P596: Using guided inquiry, particulate-level instruction to strengthen students' conceptual understanding of chemistry.

Chad Bridle (Grandville High School, USA)

Students in traditional college-preparatory chemistry courses often become masters of mathematical equations without an understanding of the conceptual basis for the mathematical

relationships. An inquiry-based curriculum was designed and implemented that utilized particulate-level representations of matter to establish concepts such as describing and categorizing matter, understanding density, and differentiating between physical and chemical changes. Changes in student performance were measured through the ParNoMa and student interviews. Results and implications for instruction will be discussed.

P597: New possibilities for teaching-learning in electrochemistry: Who does not like to be an artist?
Lisete Fischer (FACCAMP Faculdade Campo Limpo Paulista, Brazil), Julia Bucci (FACCAMP Faculdade Campo Limpo Paulista, Brazil)
Herein is described the experience carried out in the corrosion module of the electrochemistry discipline with chemistry teaching and BA students at FACCAMP.- Faculdade de Campo Limpo Paulista. This project initiated in 2009 and its main goals are to design new strategies for learning chemical concepts in an informal environment. Image's compositions were obtained using corrosion reaction products instead of commercial paints. Among the pedagogical interventions applied are: student centered more active strategies, evaluation tools focused not only on specific competences, organizing the activity programs based on the student's results, and taking into account the time need for their appointed work. The main concepts were verified before and after the activities. Comparing the results from these two moments is possible to conclude that the students obtained autonomy during the construction of their knowledge and were able to use more of their cognitive potential, showing the improvement of their ability to study and work, as individuals or in group.

P598: Inspire your students with the TI-Nspire
Ray Lesniewski (Jones College Prep, USA)
This session will highlight how a former teacher-centered lesson on the heating curve of water was redesigned using TI-Nspire technology to give students control of their own learning in the chemistry classroom. Participants will use the TI-Nspire to experience a portion of the student-centered lesson. This session is appropriate for both high school and university educators.

P599: Using **laptop/cell phone student response systems to enhance group learning activities**
Andrew Grall (University of Arizona, USA)
Student response systems, or 'clickers', have been used for several years to further engage the students and to get feedback on practice problems. Students having to purchase an independent device which may be only used for one class, however, can be difficult to justify. The technology is now available so that students can use their own laptop computers, net books, and/or smart phones (iPhone, Blackberry, Windows Mobile, etc.) as their student response devices. In addition, these devices can be used, not only for practice problems and immediate feedback, but also as a means to enhance group activities in large lectures - for students to work together on a problem and to have a 'spokesperson' for their group ready to answer questions.

9:00 AM - 12:00 PM BIOL-106

S50: Teaching with Discrepant Events

John Eix (Upper Canada College - Retired, Canada)
Not one but five conference headliners will demonstrate how to present discrepant events to

students. Their goal is that everyone experience at least one true discrepant event during this session. In order that participants can get up close and personal with these presentations the room will be arranged with five large tables each with one of Irwin Talesnick, Patrick Funk "Funky", Al Hazari, Andy Cherkas, or John Eix. Each presenter will present 2 or 3 discrepant events. This session is dedicated to Tik Liem who introduced and popularized the use of discrepant events in science education.

9:00		introduction
9:25	Irwin Talesnick	P600: Misconceptions
9:45	Andrew Cherkas	P601: Pressure discrepancies
10:05	Patrick Funk	P602: I see it but I cannot believe it!
10:25		break
10:40	Al Hazari	P603: The gray and white block : A critical thinking activity
11:00	John Eix	P604: Discrepant events

P600: Misconceptions
Irwin Talesnick (Queen's University, Canada)
I will present the following misconceptions: 1) Air may not have weight, but certainly has mass. 2) Two aquarium equilibrium demo. 3) Supersaturated solutions are never stable

P601: Pressure discrepancies
Andrew Cherkas (Stouffville DSS, Canada)
A series of problems will be presented which results in an unexpected event which leads to a better understanding of the concept of pressure its causes and effects.

P602: I see it but I cannot believe it!
Patrick Funk (Pickerington High School Central, USA)
In this portion of the Symposium, participants will first view several discrepant events and then participants may elect to try the various demonstrations. Presentations will include: "Don't Break My Coffee Cup!"; "My Silo Is Short and Fat." and "Are You a Good Observer?. These events stress the science background for the demonstrations and all are strongly encouraged to try the demonstrations.

P603: The gray and white block : A critical thinking Activity
Al Hazari (University of Tennessee, USA), **Al Hazari** (University of Tennessee, USA), Hans-Dieter Barke (University of Muenster, Germany)
Check out this intriguing activity that could be used to talk about the various science disciplines and about the scientific method. Alternately, it can be used when discussing light, transparent, translucent, opaque, shadows, clouds, weather, etc.

P604: Discrepant events
John Eix (Upper Canada College - Retired, CA)
I will present the following physical science discrepant events: The Pressure Power Tower, The OJ Roller and The Drop Zone

9:00 AM - 12:00 PM WH-213

S51: The Science Writing Heuristic in Laboratory Instruction - The Science Writing Heuristic in Laboratory Instruction

Dawn Del Carlo (University of Northern Iowa, USA)

The Science Writing Heuristic is a pedagogical process incorporating collaborative inquiry activities, cooperative negotiation of conceptual understanding, and individual writing and reflection within the context of laboratory inquiry. Each component is equally as important as the next in successfully achieving the intended goals and outcomes of the process. This symposium serves as a forum for presentations on the development, implementation, and assessment of the use of the SWH at all levels of science education.

9:20		introduction
9:25	Tom Greenbowe	P605: Does quality writing in laboratory notebooks promote a better understanding of chemistry concepts and the ability to design an experiment?
9:45	Norda Stephenson	P606: Implementing the Science Writing Heuristic in an introductory general chemistry course: The challenges, successes and lessons learned
10:05	Cynthia Powell	P607: Adventures in implementing the Science Writing Heuristic
10:25		break
10:40	Vasiliki Lykourinou	P608: Implementing SWH in large enrollment laboratory courses
11:00	Dawn Del Carlo	P609: Making the SWH work
11:20		discussion

P605: Does quality writing in laboratory notebooks promote a better understanding of chemistry concepts and the ability to design an experiment?

Tom Greenbowe (Iowa State University, USA), Kathy Burke (Iowa State University, USA)

This presentation explores the question, "Does quality writing in laboratory notebooks promote a better understanding of chemistry concepts and the ability to design an experiment. In this study, we analyzed the quality of writing in student laboratory notebooks in two groups. One group used guided-inquiry and the Science Writing Heuristic (SWH) approach, the other group used a traditional approach to the laboratory. The laboratory notebooks were analyzed for several characteristics. Both groups were administered the same lecture exams and the same lab practical examination. The guided-inquiry SWH group showed a better understanding of chemistry concepts and a better ability to design experiments.

P606: Implementing the Science Writing Heuristic in an introductory general chemistry course: The challenges, successes and lessons learned

Norda Stephenson (University of the West Indies, Mona, Jamaica), **Novelette Sadler-McKnight** (The University of the West Indies, Mona, Jamaica)

Having students engage in laboratory work has always been considered important in the teaching and learning of chemistry. However, the format that the laboratory work should take has been a

matter of much debate. Recent advances in science education research have prompted a shift from traditional to more inquiry-based approaches to laboratory work. The Science Writing Heuristic, a tool which allows students to develop their own beginning questions, claims and evidence, is one inquiry-based approach suited to use in the laboratory. The heuristic was implemented during the first semester of the academic year, in one laboratory section of a first year chemistry course at a tertiary level institution in Jamaica. The challenges, successes, and lessons learned are discussed.

P607: Adventures in implementing the Science Writing Heuristic
Cynthia Powell (Abilene Christian University, USA)
Over the past several years we have implemented curriculum in our general chemistry laboratory course that is strongly influenced by the Science Writing Heuristic. Since our laboratory schedule requires that two laboratory sections (56 students) meet together for pre-lab and post-lab activities, adjustments have been made in the discussion of experiment planning and in reporting of results at the end of the laboratory session. Our students electronically submit group lab reports in the Science Writing Heuristic format before leaving the laboratory session and then electronically submit individual "reflections" on the laboratory activities 3-4 days after the weekly laboratory meeting. The shift to a more open-ended approach to teaching general chemistry laboratory has been exciting. This presentation will include a description of the lessons learned in helping students, teaching assistants, and instructors negotiate the new format.

P608: Implementing SWH in large enrollment laboratory courses
Vasiliki Lykourinou (University of South Florida, USA)
This presentation will outline the methods used and the insight gained from the implementation of the Science Writing Heuristic (SWH) as an instruction method in a large enrollment multi-section course of general chemistry labs. Emphasis will be placed on the role of teaching assistants by summarizing a) the training practices implemented as means of establishing formal training of graduate students involved in the laboratory instruction b) the outcome of class observations conducted as means of assessing the effectiveness of the SWH implementation.

P609: Making the SWH work
Dawn Del Carlo (University of Northern Iowa, USA)
Educators often try to implement new methods and approaches into their teaching, but when faced with inevitable challenges, tend to either abandon the new approach or "tweak" it to something more comfortable but yet also, not unlike what they were doing before. This presentation will discuss the basic tenets of the Science Writing Heuristic which make it what it is (and consequently, should not be "tweaked"), what elements afford a bit more flexibility, and how they fit together. Specific strategies for modifying existing lab experiments, report format, and student tasks while in laboratory will be presented.

9:40 AM - 12:00 PM WH-113

S52: Mentoring Faculty: Lengthening and Strengthening the Chain

Luis Montes (University of Central Oklahoma, USA)
Every member of the academic unit is involved in mentoring faculty. In the most traditional situation, new faculty are mentored by more senior colleagues, but there are many variations of this theme. Senior faculty are mentored by their emeritus colleagues. Women and minority

faculty or faculty with non-traditional lifestyles often mentor each other. In each case, the chain of formal and informal knowledge about teaching and survival in academia is lengthened and strengthened. In this symposium we seek input from all levels of faculty on their mentoring successes and experiences.

9:40		introduction
9:45	Amina El-Ashmawy	P610: Professional development challenges and opportunities
10:05	Cheryl Frech	P611: The multifaceted role of the department chair in mentoring
10:25		break
10:40	Julie Abrahamson	P612: Mentoring for non-tenure track positions: Helping persons in these positions avoid becoming vulnerable
11:00	Luis Montes	P613: The many types of mentoring: Review and experiences
11:20		discussion

P610: Professional development challenges and opportunities
Amina El-Ashmawy (Collin College, USA), C. Frederick Jury (Collin College, USA)
Collin College is a rapidly growing 2-year institution in the Dallas area. There are various challenges and expectations of professional development at 2-year colleges. This talk will provide a candid look at these challenges, expectations and opportunities for faculty at Collin, both full- and part-time, veteran and rookie.

P611: The multifaceted role of the department chair in mentoring
Cheryl Frech (University of Central Oklahoma, USA)
Department chairs are in an important and unique position to mentor faculty in a variety of ways. A primary role is to mentor new faculty from recruitment to tenure and promotion and throughout various stages of an academic career. Chairs also mentor adjunct faculty who may be making a career transition to academia or who are full-time faculty easing into retirement. Chairs should be involved in developing leadership among the faculty in a department and to provide for succession planning. In addition, department chairs can mentor chairs of other departments or at other universities.

P612: Mentoring for non-tenure track positions: Helping persons in these positions avoid becoming vulnerable
Julie Abrahamson (University of North Dakota, USA)
Colleges and universities have programs established to mentor and encourage new faculty from a variety of disciplines. There are many positions that are neither tenure track nor full time which do not get the benefits of mentoring relationships. Assumptions about informal mentoring fall short in recognizing or rewarding the efforts of the mentor, and in ensuring the benefits to the new faculty member. When non-tenure positions evolve into a more permanent status, there is an expectation of adequate understanding of teaching and survival in academia. Opportunities for professional development might not be encouraged for new faculty without a mentor to serve as an outside advocate of academic survival. Observations from personal experiences in moving from a part-time temporary position to a full-time but not tenure track position will be used to suggest means to encourage appropriate mentoring for faculty of all categories.

P613: The many types of mentoring: Review and experiences

Luis Montes (University of Central Oklahoma, USA)

Mentoring if most often associated with introducing and informing individuals of the culture of an organization. Within academia there are many different organizational cultures that must be navigated by faculty members. This presentation will review some of the literature on mentoring, and then describe what has been learned as both a mentee and mentor in a university setting.