**WEDNESDAY, JANUARY 7**

<table>
<thead>
<tr>
<th>Field Trip</th>
<th>Wednesday 7:30 AM-6:00 PM</th>
<th>Hotel Lobby</th>
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<tbody>
<tr>
<td><strong>Science and Cultural Intersections of the Oregon Coast - ASTE Environmental Education Forum</strong>&lt;br&gt;Sponsored Field Trip</td>
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<td>Explore the science and cultural development of the Pacific Northwest. Topics include ecology, resource usage, coastal hazards, and cultural maritime events relevant to the Columbia River System and the waters of the North Pacific. Workshop includes Columbia River Maritime Museum and Ft. Clatsop access, lunch and transportation. Cost is $59</td>
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<thead>
<tr>
<th>ASTE Executive Board Meeting</th>
<th>Wednesday 12:00-2:00 PM</th>
<th>Pearl</th>
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<tr>
<th>Workshop</th>
<th>Wednesday 12:00-3:00 PM</th>
<th>Salon A</th>
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<tr>
<td><strong>Supporting Newly Hired Teachers of Science: Current Work in the Field</strong>&lt;br&gt;The science teaching workforce in the United States is changing, and consists primarily of newly hired teachers of science (NHTS). This workshop is for ASTE members who are interested in learning more about how to support or how to conduct research on NHTS. Participants will have ample opportunities to engage with experts who work with NHTS in order to enhance or develop their own programs. Julie A. Luft (University of Georgia) Shannon L. Dubois (University of Virginia)</td>
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<thead>
<tr>
<th>Workshop</th>
<th>Wednesday 1:00-3:00 PM</th>
<th>Portland</th>
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<tr>
<td><strong>Reading, Writing, and Talking Science: Preparing Secondary Science Teachers to use Next Generation Science Standards and Common Core State Standards in Linguistically Diverse Classrooms</strong>&lt;br&gt;SSTELLA is designed to prepare science teachers to better serve English learners (ELs) by integrating disciplinary language and literacy development with contextualized scientific sense-making. SSTELLA instructors highlight how SSTELLA instructional practices, communicated through science methods activities, help preservice teachers promote argumentation and model-based inquiry for EL students. Sara Tolbert (University of Arizona) Barry Roth (University of Arizona) Kimberly Bilica (University of Texas-San Antonio)</td>
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<tr>
<th>Workshop</th>
<th>Wednesday 3:00-5:00 PM</th>
<th>Salon B</th>
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<tr>
<td><strong>Reviewing for ASTE (Sponsored by the Publications Committee)</strong>&lt;br&gt;Reviewing for the journal – This session offers new and experienced conference attendees a chance to learn the &quot;ins and outs&quot; of being an editorial reviewer for the journal. Participants will have the opportunity to see actual reviews of manuscripts and discuss the good, bad, and helpful (to authors) of various reviews. It is hoped that participants will eventually become editorial reviewers for the journal. Norman G. Lederman (Illinois Institute of Technology) Judith S. Lederman (Illinois Institute of Technology) Deborah Hanuscin (University of Missouri)</td>
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**Workshop**

**Wednesday 3:00-5:00 PM**

**Portland**

**STEM Integration in Life Science Education**

There is a growing need to teach science through integrated approaches so that students learn concepts from STEM disciplines and make coherent connections among them. In this workshop, we will present several STEM integration approaches and then improvement a STEM unit that focuses on evolution, data analysis, and engineering design. Siddika Selcen Guzey (Purdue University) Wendy Niesl (University of Minnesota) Tamara J Moore (Purdue University) Gillian H. Roehrig (University of Minnesota)

**ASTE Board Meeting**

**Wednesday 5:00-9:00 PM**

**Pearl**

**Presider Training**

**Wednesday 5:30-6:30 PM**

**Salon B**
### THURSDAY JANUARY 8

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
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<tr>
<td>STS Fun Run/Walk</td>
<td>Thursday 6:45 AM</td>
<td>Hotel Lobby</td>
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<td>Get out and exercise here in Portland where running (or walking!!) is king!</td>
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<tr>
<td>Mentor Meeting</td>
<td>Thursday 7:00-8:00 AM</td>
<td>Willamette</td>
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<tr>
<td>BREAKFAST</td>
<td>Thursday 7:00-8:30 AM</td>
<td>Salon E-F</td>
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<tr>
<td>Experiential Session</td>
<td>Thursday 8:00-9:00 AM</td>
<td>Salon B</td>
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<tr>
<td><strong>CCSS + NGSS = STEM + ELA</strong></td>
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<td>This experiential session will engage science educators and methods instructors in a hands-on engineering design lesson based on the classic children's book <em>The Wind in the Willows</em> to assist educators on the integration of the Common Core State Standards and the Next Generation Science Standards. Jamie Rumage (Oregon Department of Education) Nicole Dalton (Oregon Department of Education)</td>
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<tr>
<td>Presider Training</td>
<td>Thursday 8:00-9:00 AM</td>
<td>Willamette</td>
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<tr>
<td>Traditional Paper Set</td>
<td>Thursday 8:00-9:00 AM</td>
<td>Medford</td>
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<tr>
<td><strong>Thread: Curriculum, Pedagogy and Assessment</strong></td>
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<td>Presider: John Pecore</td>
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<td><strong>Food Discourse in Science Read-Alouds</strong></td>
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<td>This study examines food discourse - discussions about food led by three elementary teachers while reading aloud. Our findings underscore the many benefits and potential challenges of engaging students in talk about food in science, and reveal the need to take into account children's complex relationships with food. Ingrid Weiland (Metropolitan State University of Denver) Alandeom Oliveira (SUNY-Albany) Ting-Fang Hsu</td>
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<tr>
<td><strong>Evaluation of Representations in General Chemistry Textbooks: Affordances and Challenges</strong></td>
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<td>Using an adapted form of the Graphical Analysis protocol (GAP) this study looked at representations in general chemistry textbooks for elements likely to enhance or hinder learning such as physical integration with associated text, captions, indexing of representations, and number of representations requiring conceptual integration on a page. James M. Nyachwaya (North Dakota State University) Merry Gillaspie (Wartburg College)</td>
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<td><strong>Using Scientific Humor to Help Students Remember, Understand, and Apply Knowledge</strong></td>
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<td>This study examined of the manner in which an educator used scientific content humor and how that humor was perceived by her students. Content humor is a useful for cognitive processes intended to achieve factual, conceptual, procedural, and metacognitive knowledge. Students perceived that the teacher did use humor toward instructional objectives. Francine Wizner (University at Albany)</td>
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Critical Science Education and Student Interest in a Suburban Chemistry Class

This pilot study reports preliminary findings of a successful method for implementing critical science education in a suburban high school chemistry class as well as documents student interest in a critical approach. Patrick D Ashby (Teachers College, Columbia University) Felicia Moore Mensah (Teachers College, Columbia University)

Developing conceptual understanding and academic language for English language learners

We studied ELL content and language as they engage in inquiry-based instruction using the 5R Instructional Model. Data collected as interviews were submitted to a series of 2-way repeated-measures ANOVAs with topic as a between-subjects factor and time as the within-subject factor. Results show positive learning with ELLs. Molly H Weinburgh (Texas Christian University) Cecilia Silva (Texas Christian University) Kathy H Smith (Tarleton State University)

Supporting environmental literacy in elementary classrooms: Obstacles and solutions

Elementary school teachers seem to face significant barriers to including EL in their instruction. This exploratory study surveyed 627 randomly selected elementary school teachers. Survey results report teacher needs such as in person PD, integration with children's literature, and curricula and potential solutions are discussed. Sarah J Carrier (North Carolina State University) Kathryn T Stevenson (NCSU) M. Nils Peterson (NCSU)

Triumphs and Tensions—What We have Learned from Four Years of Single Sex Classes for At-risk Boys

We report upon 4 years of work with single-sex male classes in 9th and 10th grades for science and mathematics in a Canadian public secondary school. A strong active-learning approach was found to be most successful, as students saw meaning in their mathematics and science classrooms. Built relationships from 9th and 10th grade were vital factors. Anthony W Bartley (Lakehead University) Molly Weinburgh (Texas Christian University) Douglas Jones (Lakehead Schools) Heather Campbell (Lakehead Schools) Andrea Lampo (Lakehead Schools) Nicholas Sacevich (Lakehead Schools)

Underrepresented Minority Students Find Balance in Science: Implications for Science Teacher Education

This study explored underrepresented minority (URM) college students' perspectives of the challenges, support, and success they experienced through participation in a STEM minority student support program while being enrolled in a science major. Based on the findings, implications for science teacher education are discussed. Aaron J. McKim (Oregon State University) Tyson J. Sorensen (Oregon State University) Jonathan J. Velez (Oregon State University) Kate G. Field (Oregon State University) Wanda K. Crannell (Oregon State University) Larry R. Curtis (Oregon State University) Penelope L. Diebel (Oregon State University) Dave L. Stone (Oregon State University)
A Modern Measurement of K-12 Teachers Understanding of NGSS Astronomy Concepts

Tightly aligned with various national education reform documents, the Test Of Astronomy STandards (TOAST) assessment instrument is a multiple-choice survey being used to assess K-12 teachers' conceptual understanding of astronomy in the service of creating more effective curricula and professional development. Debra J. Stork (University of Dubuque) Stephanie J. Slater (CAPER Center for Astronomy & Physics Education Research) Timothy F. Slater (University of Wyoming) J. Christopher Haynes (University of Wyoming)

Traditional Paper Set Thursday 8:00-9:00 AM Salon H

Thread: Student Learning P-12

Presider: Charles Eick

A cross-cultural examination of U.S. and Turkish preschoolers' ideas about objects in the sky

This cross-cultural study describes young children's (ages 48-60 months) observational knowledge of day and night cycles, which is foundational in the development of mental models. The purpose was to compare U.S. and Turkish children's knowledge to identify similarities predicted by framework theory. Mandy McCormick Smith (The Ohio State University) Mesut SaAŞkes (Balikesir University) Kathy Cabe Trundle (North Carolina State University)

A Study of the Implementation of Student-Centered Scientific Research in K-12 Education

Implementing student-centered scientific research in k-12 education is essential in preparing students for the current global workforce. This study proposed a professional development that directly benefited novice teachers (115-117% growth) in guiding students through the process of self-guided scientific research and presentation of the research. Christina L McDaniel (Mississippi State University) Ryan M Walker (Mississippi State University) Nathan Eric Heiselt (Mississippi State University)

The Chasing Aurora Project: Teaching and Learning Secondary Level Astronomy in a New Way

Join us as we share aspects and findings of the Chasing aurora Project that was designed to develop a multi-disciplinary curriculum resource that integrated STEM-based elements for studying Manitoba's unique geographic and cultural relationship with the aurora borealis, and was subsequently introduced in a secondary level science classroom. Richard P. Hechter (University of Manitoba) Elliot Macdonald (West Kildonan Collegiate)

Traditional Paper Set Thursday 8:00-9:00 AM Salon I

Thread: Educational Technology

Presider: Karen Irving

Effects of Serious Educational Game Design Process on Student Content Knowledge and Interest.

This study examines the role of the design process in creating student understanding of content knowledge and interest in science. Building upon previous work that demonstrated between-group differences for students completing a Serious Educational Game project, this study focuses on subjects' participation in the design process as an explanatory m David B Vallett (University of Nevada
Las Vegas) Richard L Lamb (Washington State University) Leonard A Annetta (George Mason University) Rebecca Cheng (George Mason University)

Salon I: The UVA Bay Game Simulation: Striving to Improve Student Understanding of the Chesapeake Bay Watershed Ecosystem
We will describe a participatory simulation built from authentic data and its potential teaching applications. Initial research on pre/post-simulation 32 students' Chesapeake Bay ecosystem understandings also will be presented. Bridget K. Mulvey (Kent State University) Christopher A. Rates (University of Virginia) David F. Feldon (Utah State University)

Use of Game-Based Learning to Teach Next Generation Science and Engineering Practices
This study examines the efficacy of a scenario-based educational game, Water Gauge Warrior, designed to teach climate change science and engineering practices. Fifty-one students at two high schools participated in the study. The game design, theoretical framework, the design features and the preliminary results will be presented in this paper. Ora Tanner (University of South Florida) Yiping Lou (University of South Florida) Ping Wang (University of South Florida) Allan Feldman (University of South Florida) Denise Davis (University of South Florida) Lucille Moon-Michel (University of South Florida) Glenn Smith (University of South Florida) Molly Trendell Nation (University of South Florida)

Embedded Workshop Thursday 8:15-10:15 AM Salon C
Secondary Science and English Learners
Workshop will focus on ideas for increasing science and English learning for middle and high school students. Participants will watch, practice and gather proven strategies. Malcolm B. Butler (University of Central Florida), Nazan U. Bautista (Miami University), and Jelitza Rivera (University of Central Florida)

Embedded Workshop Thursday 8:15-10:30 AM Columbia
How to Utilize Participatory Action Research (PAR) as a Way of Teacher Education
This workshop offers an opportunity to explore PAR as a way of teacher education. Attendees will learn characteristics of PAR in comparison with mentoring, teacher action research and self-study. Based on the testimonials and experiences of presenters, attendees will engage in developing ideas about applying PAR in their own context(s). Kelsey Gilstrom (Lawson Elementary School) Deborah L Hanuscin (University of Missouri) Eun Ju Lee (University of Missouri)

Embedded Workshop Thursday 8:15-10:30 AM Salon G
The Steps of the Scientific Method: If Only It Were That Simple
In this workshop, participants will experience science as a creative endeavor by comparing several models that describe the practices of science as they maneuver through a variety of pathways showcasing these scientific practices during a case study on experimental design. Carrie J. Miller-DeBoer (University of Oklahoma) Wendy M. Martin (University of Oklahoma)
### Experiential Session  
**Beyond Just Learning Science: Let's Imagine and Invent**  
Trend lines show that we are not supporting creative thinking and innovativeness at any level near where we should. Overemphasis on standards and testing is driving creative development from the curriculum. This session suggests the use of "Imagineering" techniques to encourage creativity of both K-12 students and prospective teachers. Alan J McCormack (San Diego State University)

### Experiential Session  
**Implementing Inclusive STEM across a Rural K-12 District**  
This session will report the mid-year perspectives of various stakeholders involved in the inception year of a rural, K-12, district-wide STEM initiative. Participants will hear from and participate in roundtable discussions with teachers, administrators, researchers, a STEM Coach and others. Michael Giamellaro (Oregon State University-Cascades) Julie Gess-Newsome (Oregon State University-Cascades) Debbie Siegel (Oregon State University-Cascades) Natalie Dollar (Oregon State University-Cascades) Margaret Prevenas (Oregon State University-Cascades) Brad Kudlac (Culver School District) Stefanie Garber (Culver School District) Naomi Little (Culver School District)

### Graduate Student Forum  
**Thread: Informal Science Education**  
**Presider: Sherri Brown**

**Addressing Inquiry during Professional Development at an Informal Science Institution**  
This study looked at content courses that were offered at and taught by education staff of a large Informal Science Institution (ISI) located in the Midwest USA. Aside from these courses being broad based and interdisciplinary, it explored how to further the incorporation of inquiry-based teaching methods into the classroom. Gary M. Holliday (The University of Akron) Judith S. Lederman (Illinois Institute of Technology) Norman G. Lederman (Illinois Institute of Technology)

**Evaluating a Professional Development Program Consistent with Learning Science in Informal Environments: People, Places, and Pursuits (NRC, 2009)**  
We report a case study, part of a larger program evaluation, of one experienced informal science educator's (ISE) journey completing an online graduate certificate specifically designed to provide professional development for ISEs consistent with the 2009 NRC Report, Learning Science in Informal Environments; People, Places, and Pursuits. Jeremy P. Lake (University of South Florida) Barbara S. Spector (University of South Florida)

**The Value-Added Benefit of Distance-Based Instructional Coaching on Science Teachers’ Inquiry Instruction and Student Achievement**  
This is a case study of a science teacher who participated in two professional development programs with distance-based instructional coaching for two consecutive years. The results revealed value-added benefits of distance-based instructional coaching on science teachers’ instructional changes, confidence in inquiry and student achievement. SoonChun Lee (Wichita State University)
Energy as a Unifying Concept for Science Teaching: A Hybrid Course for Teachers in Grades 4-8
This presentation will share the design and results of an online/onsite hybrid course focusing on teachers' understanding of energy in grades 4-8 as defined by the NGSS. Pre and post data from the Energy Concept Inventory show an increase in all participants' test scores. Data also show an increase on individual item scores on the post-test. Jeffrey R Peake (University of Kentucky) Jeffery S Townsend (Eastern Kentucky University)

Fostering Pre-Service Science Teacher Engagement in the Practices of Science with Team-Based Learning
This research concerns the implementation Team-Based Learning (TBL) in a large introductory lecture course for biology majors, including all pre-service science teachers, as a means of fostering engagement in the Practices of Science, promoting team work, and promoting higher-order thinking skills. Sandra L Westmoreland (Texas Woman's University)

Integrating Elementary Preservice Teachers Learning of Science Content with Application to Classroom Practice
This study explores a redesign of an electricity unit within a science course designated for elementary education majors, showing connections between the content being learned and participants' future teaching of the content. Discussion of the participants learning of the content and sequencing of ideas for teaching the content will be shared. Meredith Park Rogers (Indiana University - Bloomington) Stacy McCormack (Indiana University - Bloomington)

Urban Science Education: A Study of Equitable Education for Girls in Urban Schools
An examination of culturally relevant approaches to educating girls in urban school districts. Various research points to the marginalization of girls in science education. Many treat the equitable education of girls in urban schools as an issue of social justice, however, the problem extends beyond the scope of social injustices. Kim C Cherry (George Mason University) Robert W Simmons III (Loyola University)

Using Scaffolding to Promote Meaningful Instruction for English Language Learners in a Sheltered Instruction Classroom
This study investigates a high school science teacher's practice of using scaffolding with ELLs. Six indicators are identified from empirical data for promoting meaningful science instruction for ELLs, including scientific knowledge base, English language emphasis, student thinking, discourse, assessment, and differentiated instruction. Jingjing Ma (Texas Christian University) Tanya Warren (International Newcomer Academy)
What Factors Influence African American Males' Enrollment in Advanced Science Courses?
This qualitative study investigates why twelve African American males enrolled in advanced science courses in an urban, high poverty high school. These young men describe the relative costs and benefits of taking these courses, the social factors that influence their choices and future goals, and how they identify with science. Diane W Johnson (North Carolina State University) Margaret Blanchard (North Carolina State University)

Traditional Paper Set Thursday 9:15-10:15 AM Salon H
Thread: Student Learning P-12 Presider: Heidi Wiebke

Science Notebooks in the 21st Century
Science notebooks are fixtures in elementary classrooms. With the influx of tablet devices, there is potential for a digital science notebook. We examined how fourth and fifth graders incorporated notebook elements in paper and digital notebooks, and found a higher incidence of drawing and writing in the paper notebook than in the digital notebook. Lori A Fulton (University of Hawaii at Manoa) Seungoh Paek (University of Hawaii at Manoa)

The Effectiveness of the Blended/Tiered Vocabulary Approach in Teaching Science in English Only Compared to English with Spanish Supports
This study used the Blended/Tiered Approach to Vocabulary Instruction to find out if there was a difference in learning between English Language Learners and English speakers when Spanish supports were used versus only English. The results supported the use of the approach and suggested that Spanish supports may positively affect retention. Kelsey Conklin (University of Nevada, Reno) David Crowther (University of Nevada, Reno)

Visually Rich Integrated Science and Language Instruction to Strengthen Science Attitudes for Newcomer Middle School English Learners
Mastery of the language of science is particularly daunting for newcomer (newly arrived) English learners (EL), and developing positive science attitudes can be challenging. This study explored the efficacy of 3 instructional supports on 90 EL for half a year. Results document positive attitude growth and judgments of experience quality. Tom Tretter (University of Louisville) Yuliya Ardasheva (Washington State University Tri-Cities) Judy Morrison (Washington State University Tri-Cities)

A Design Study for a Text-To-Speech Tool in a Digital Science Notebook: The CyberPad
This study investigates the degree to which the CyberPad, a digital science notebook, was able to apply the Universal Design for Learning (UDL) framework in an effective text-to-speech (TTS) tool for 4th grade students. Part of an ongoing project, the tool was analyzed in its utilization across curricular units and by different groups of students. Courtney Behrle (North Carolina State University) Ruth Sirkin (North Carolina State University) Angi Shelton (North Carolina State University) Eric Wiebe (North Carolina State University)
Preparing Elementary and Middle School Pre-Service and In-Service Teachers to Effectively Use Digital Technologies for Science Instruction

This presentation explores the use of iPad and Web 2.0 technologies for pre-service and in-service teachers. Evidence from both research populations supports a significant positive change in their Technological Pedagogical Content Knowledge (TPACK). Implications include intentionally linking the constructs of TPACK with edTPA. Leslie A. Suters (Tennessee Technological University) Melissa J. Comer (Tennessee Technological University)

Student-Teacher Interaction Through Online Reflective Journals in a High School Science Classroom: What Have We Learned?

The findings of this exploratory study describe the integration of technology, reading and writing, and differentiation of instruction in a high school science classroom implementing asynchronous electronic journals. The students' and the teacher's perspectives on the dialogue, the journaling process, and benefits to both of them are reported. Megan E Ehlers (Sarasota High School) Barbara S. Spector (University of South Florida)

Coffee Break Thursday 10:15 – 10:30 AM Lower Level 1

KEYNOTE Thursday 10:30 AM-12:00 PM Salon E-F

Jim Clark is the creative overseer of HIVE-FX, a visual image studio that integrates STEM with animation and Visual FX for the production of numerous television, film and commercial projects. His creative team is currently engaged in key creature sequences for the NBC TV series Grimm and photo-real 3D visualizations for Nike's retail division. Jim will expose you to unique STEM processes that bridge art, science, math and technology to create entertaining and engaging stories. Learn how this creative application of STEAM can help us motivate while we educate.

LUNCH Thursday 12:00 PM

On your own

Experiential Session Thursday 12:30-1:30 PM Salon I

Helping California Transition to NGSS

Recognizing the enormous shift required by California's adoption of NGSS, several science professional development providers joined forces to jointly develop/deliver a NGSS 2-day professional development program. This session will provide an overview of CA's plan to adopt/implement NGSS and this PD program including an abbreviated experience with them. Susan Gomez Zwiep (CSU Long Beach) Laura Henriques (CSU Long Beach)
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<tr>
<th>Publication Committee Session</th>
<th>Thursday 12:30-1:30 PM</th>
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<tr>
<td><strong>Meet the Editors/Submitting to the Journal</strong></td>
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<tr>
<td>This session offers new and experienced conference attendees an opportunity to meet and talk with the editors of the ASTE journal. Editors will provide information about acceptance rates, submission guidelines, and upcoming monographs and journal issues. Norman G. Lederman (Illinois Institute of Technology) Judith Lederman (Illinois Institute of Technology) Deborah L. Hanuscin (University of Missouri)</td>
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<th>Roundtable</th>
<th>Thursday 12:30-1:30 PM</th>
<th>Salon C</th>
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<tr>
<td><strong>Educating Science Teachers for Sustainability: Lessons Learned in the Production of an ASTE Sponsored Volume</strong></td>
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<td>&quot;Educating Science Teachers for Sustainability&quot; is an upcoming ASTE sponsored book that focuses on education for sustainability content and pedagogy in science teacher preparation. This roundtable will share the components of the volume, allow contributing authors to share their research, and describe the process of editing an ASTE sponsored book. Mark Bloom (Dallas Baptist University) Susan Stratton (SUNY Cortland) Rita Hagevik (University of North Carolina, Pembroke) Allan Feldman (University of South Florida) Hui Jin (Ohio State University) George O'Brien (Florida International University) Deborah Tippins (University of Georgia) Yael Wyner (City College of New York)</td>
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<th>Themed Paper Set</th>
<th>Thursday 12:30-1:30 PM</th>
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<tr>
<td><strong>STEM Schools and Curricula: Research at the Elementary, Middle, and High School Levels</strong></td>
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<td>The three papers will include work focused on a new elementary school and its interdisciplinary STEM curriculum; three middle schools where teachers are implementing STEM curricula, project-based learning, and STEM practices; and a high school where the science and engineering teachers collaborate on interdisciplinary projects. Judith A Morrison (Washington State University Tri-Cities) Jonah Firestone (Washington State University Tri-Cities) Tamara Nelson (Washington State University Vancouver) Kristin Lessig (Washington State University Vancouver) David Slavit (Washington State University Vancouver)</td>
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<tr>
<th>Embedded Workshop</th>
<th>Thursday 1:00-3:00 PM</th>
<th>Columbia</th>
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<td><strong>Employing the Scan &amp; Post Technique for Continuous Formative Assessment of Student Problem-Solving Skills in Science Classes</strong></td>
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<td>Using the scan &amp; post technique, science instructors can now collect photographs, scans, and movies of student diagrams, multi-step solutions, observations and experimental results in real-time to make formative assessments of student skills. Participants will learn to use mobile devices and cloud-based file synchronization systems to perform continuous formative assessment. Norman E. Herr (California State University Northridge) Tae Chang (California State University Northridge) Mike Rivas (California State University)</td>
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Experiential Session  Thursday 1:30-2:30 PM  Salon G

Ready, Set, Grow!
The focus of this hands-on session is to facilitate an inquiry-based course module to teach Life Science concepts. This lesson is one of thirty-five innovative course modules developed by a Tuskegee University led partnership to teach 6th through 8th grade Science in the educationally disadvantaged Alabama Black Belt with promising learning outcomes. Mohammed A. Qazi (Tuskegee University) Gerald Griffin (Tuskegee University) Adrinece Beard (Tuskegee University) De'Shayla Chappell (Tuskegee University) Angela Player (Tuskegee University) Carol Banks (Tuskegee University) Shaik Jeelani (Tuskegee University)

Traditional Paper Set  Thursday 1:30-2:30 PM  Eugene
Thread: Informal Science Education  Presider: Vanessa Klein

Building a Rube Goldberg Machine: How Youth Use Evidence-Based Argument to Identify the Best Solution to a Problem
In an out-of-school setting that youth formed a team to participate a Rube Goldberg machine (RGM) contest. The study focused on how youth use evidence-based argument to identify the best solution to a problem. They study provided information for educators who are interested in how youth use evidence-based argument in an engineering project. Hui-Hui Wang (University of Minnesota) Engin Karahan (University of Minnesota)

Exploring Science Communication in Panels of Exhibitions and Proposing its Development Direction in Exhibition Education: The Cases of Dinosaur Exhibitions of UK, USA, Korea, and Taiwan
The purposes of this study were to explore what components of science communication and its level are contained in text panels of exhibitions in natural history museums and to propose its development direction of exhibition education. It is suggestible for exhibitions to be designed through various type of ‘media’ to enhance science communication. Young Shin Park (Chosun University) Jenny de la Hoz (Oregon State University) Laia Cari Robichaux (Oregon State University) Angie Chen (National Science and Technology Museum of Kaohsiung)

Students' Learning at Science Exhibits of Light, Waves, and Gravity
It presents the current findings of a study that was conducted with 1,000 students (5th through 9th) who freely explored exhibits at a science education center as their field trip. When the purpose and its variables of exhibits were clearly given and easily recognizable, students came to a better understanding of what the exhibit presented. Hyunju Lee (University of South Florida) Allan Feldman (University of South Florida)

Traditional Paper Set  Thursday 1:30-2:30 PM  Medford
Thread: Curriculum, Pedagogy and Assessment  Presider: Kimberly Bilica

Assessing High School Science Teachers' Conceptions of Inquiry through Scenarios and Lesson
Narratives
This study examined teachers' conceptions of inquiry. Teachers viewed inquiry as putting more priority on gathering evidence, and engaging students in questions that can make them explain the evidence. They didn't think students should go further to communicate, justify and connect their explanations to scientific knowledge. Nathan Dolenc (University of Virginia) Frackson Mumba (University of Virginia) Vivien M Chabalengula (University of Virginia)

Science Teachers' Strategies and Actions for Motivating Science Learners in Planting Science
Science teachers often struggle finding ways to motivate students in classroom learning. This presentation reveals field-based strategies and actions that have successfully motivated and engaged high school science learners in Planting Science, an innovative inquiry-based curriculum developed by the Botanical Society of America. Stephen C. Scogin (Hope College)

A Case Study of a Kindergarten Teacher's Beliefs about Teaching Science through Inquiry Before, During and After Professional Development
This case-study investigates a Kindergarten teacher's beliefs about teaching science before, during and after a professional development project on teaching literacy and math through scientific inquiry. The teacher's instructional models for teaching science as well as student outcomes were examined. Kimberly H Lott (Utah State University)

Traditional Paper Set Thursday 1:30-2:30 PM Portland
Thread: College and University Science
Presider: James Nyachwaya

Science Education Faculty Vexations and Ventures with Standardized Testing
This study characterized perceptions of science education faculty about issues surrounding standardized testing. Participants' individual solutions to these issues were analyzed as well as how a professional development experience focused on sharing ideas about standardized testing changed participants thinking around these issues. Tyler L St. Clair (Oregon State University) Jennifer L Maeng (University of Virginia) Randy L Bell (Oregon State University) Lindsay B Wheeler (University of Virginia)

What Happens after the Funding Ends? Examining the Persistence of Professional Development Outcomes in Elementary Science Education
In this session, we discuss findings from research that extended over a five-year period and investigated the extent to which a three-year, state-funded teacher professional development program designed to improve elementary science education led to changes that persisted beyond the funding period. Judith H. Sandholtz (University of California, Irvine) Cathy Ringstaff (WestEd)

Traditional Paper Set Thursday 1:30-2:30 PM Salon A
Thread: Equity & Diversity
Presider: David Sparks

An Outreach Program to Prepare our Future K-8 Teachers for Culturally Relevant and Literacy Integrated Science Teaching for English Language Learners
In effort to provide our future teachers with skills for and confidence in being effective and welcoming science teaches for ELLs, we created an outreach program in which preservice teachers design and implement engaging science experiences that integrate literacy objectives and the cultures with which the ELLs and their families identify. Kerry O Cresawn (James Madison University) Diane Secord (James Madison University)

**Developing Pre-service Teachers’ Pedagogical Content Knowledge for teaching Science to English Language Learners**

With increasing numbers of English Language Learners (ELLs) and few teachers especially trained to meet their needs, particularly in science, our study on the development of preservice teachers' pedagogical content knowledge (PCK) contributes critically to the field. PCK is the knowledge developed by teachers to help others learn specific content. Vanashri Nargund-Joshi (New Jersey City University)

**Secondary Biology Textbooks and Standards for Teaching English Learners: A Content Analysis**

This content analysis explored how the textual tools designed to provide support for ELLs found in three secondary biology textbooks align with national pedagogical (CREDE, 2002), linguistic (WIDA, 2007), cognitive (TIMSS, 2011), and content (AAAS, 2009) standards. Implications for science teacher educators, teachers, and ELs are discussed. Leigh K. Smith (Brigham Young University) Joseph H. Hanks (Brigham Young University) Lynnette B. Erickson (Brigham Young University)

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**Examining STEM in Early Childhood Education: Action Research in a Pre-Kindergarten Classroom**

We take an action research approach to investigate how STEM can be effectively implemented in early childhood (EC) settings, with a Pre-K case study. Objectives include the design and validation of various data collection tools, an exploration of the benefits and challenges of EC STEM, and the development of suggestions for EC STEM implementation. Todd M Milford (University of Victoria) Christine D Tippett (University of Ottawa) Susan Middlemiss (St. Margaret's School) Reesa Vermeulen (St. Margaret's School)

**Lessons Learned from Teachers Implementing STEM Integration in their Elementary Classrooms**

Despite increasing emphasis on the integration of STEM disciplines, little is known about the nature of this integration in elementary classrooms. This study explores how teachers are implementing STEM integration to gain a better understanding of what factors and supports are important in fostering the teaching and learning of integrated STEM. Tamara J Moore (Purdue University) Kristina M Tank (Iowa State University) Karl Jung (University of Minnesota)

**Teachers as Designers: The Iterative Process of Curriculum Design Focused on STEM Integration**

This research presentation will provide insights into the curriculum design process of elementary teachers and graduate students working in design teams while developing a STEM-integrated curricular unit. Topics of discussion will include research results that highlight the common challenges
that were encountered and strategies for success. Justin McFadden (University of Minnesota) Gillian Roehrig (University of Minnesota)

**Traditional Paper Set**

**Thread: Educational Technology**

**APP-SO-LUTELY TOO2-Review of STEM/Interdisciplinary APPS Following a Designed and Tested Evaluation System**

Ipad usage in classrooms is increasing with little professional development. Current reviews of science APPs identified as "top Apps" provide no evidence of any evaluation process. Last year, we designed and implemented an evaluation process for a Biology/Mathematics topic list. This year, we expanded our research to include a STEM topic list. Judith A Bazler (Monmouth University) Letitia Graybill (Monmouth University) Meta Van Sickle (College of Charleston) Dorothy Varygiannes (Monmouth University)

**Designing Online Courses in Science Education: Tips from a Blackboard Catalyst Exemplary Course Award Winner**

This session will present an online course designed to improve K-8 teachers' understandings of engineering education. Presenters will focus on types of technology integrated throughout the course. They will further share features allowing it to win a Bb Catalyst Award for Exemplary Courses and a Directors' Choice for Course of Distinction. Jeffery S Townsend (Eastern Kentucky University) Jennifer C Perkins (Eastern Kentucky University)

**Experiential Session**

**Examining Bias and Sensitivity in NGSS: Perspectives from WA State**

Join us for a discussion about equity and the NGSS. NGSS calls for new ways of teaching science - including placing equity at the center. In Washington State, we engaged stakeholders from across the education system to identify the needs of diverse student groups to learn about successful teaching models that address these needs. Jose M. Rios (University of Washington, Tacoma) Ellen K. Ebert (Office of the Superintendent of Public Instruction) Gilda Wheeler (Office of the Superintendent of Public Instruction)

**Experiential Session**

**Electric Art**

Electric Art is a challenging and practical application of electricity and creativity. Participants will be presented with a cross-curricular application of Physics and Art using recycled materials. Art from the global scrap heap is the focus of this endeavor. Workshop includes goals, lesson plans, grading rubrics, and a hands-on portion. Victoria Eng (Pine Crest School)

**Equity Committee**

Thursday 2:45-3:45 PM  Willamette
**Themed Paper Set  Thursday 2:45-3:45 PM  Eugene**

**21st Century Informal Science Education: Building Moral Compasses, Engaging the Past, and Making Pragmatic Connections in Science Teacher Preparation through Informal Education**

This paper set explores informal education and science teacher preparation from three distinct perspectives: moral/ethical; expanding integrated STEM; and pragmatic science teacher preparation. This braided discourse provides avenues of critical inquiry for 21st century science teacher preparation. Rachel A Luther (University of Southern Mississippi) Michael P Mueller (University of Alaska, Anchorage) Stacey A Britton (University of Mississippi) Kimberly Havorkos (Thomas More College)

**Traditional Paper Set  Thursday 2:45-3:45PM  Salon C**

**Thread: Science Teacher Professional Development  Presider: Todd Campbell**

**Assessing Elementary Teachers' PCK for Magnetism: Challenges and Insights**

Assessing teachers' pedagogical content knowledge (PCK) remains a challenge, as no single instrument may fully capture the complexity of teachers' knowledge. In this NSF-funded project, we develop a three-part data collection strategy for probing elementary teachers' PCK for magnetism prior to their participation in professional development. Kathryn A Arnone (University of Missouri) Zandra de Araujo (University of Missouri) Deborah Hanuscin (University of Missouri)

**High School Teacher and Student Understanding and Views of Climate Change**

This study examined high school teachers' and their students' understanding and views about climate change. T-tests showed that students demonstrated higher climate change science knowledge after participation in lessons taught by teachers involved in a NASA-funded professional learning project. Robert E Bleicher (California State University Channel Islands) Julie L. Lambert (Florida Atlantic University)

**Engaging Preservice Teachers in Guided Inquiry through Digital Video Production**

Digital video projects developed through guided inquiry, help learners shift from abstract, scientific concepts to practical applications. This study investigates the development of a guided inquiry unit integrating digital video technologies. Delivered to preservice teachers, it models 21st century learning of physical science concepts. Karen D. Chassereau (Georgia Southern University) Lucy S. Green (Georgia Southern University)

**Traditional Paper Set  Thursday 2:45-3:45PM  Medford**

**Thread: Curriculum, Pedagogy and Assessment  Presider: Nazan Bautista**

**Assessing Validity of Multiple Choice Questions in Measuring Fourth Graders Ability to Interpret Graphs about Motion and Temperature**

The purpose of this paper was to assess the validity of multiple-choice questions in measuring fourth
graders' ability to interpret graphs about motion and temperature. We found that there can be a mismatch between students' multiple-choice answer selection and their explanations for their multiple-choice answers. Mehmet Dulger (University of Nevada Las Vegas) Hasan Deniz (University of Nevada Las Vegas)

**Elementary Student Understandings of Scientific Inquiry: Using the Views About Scientific Inquiry (VASI) Questionnaire to Inform Instruction in an Elementary Science Classroom**
The purpose of this study was to examine how a teacher used the Views About Science Inquiry questionnaire (VASI) as a reflective tool to discern the impact of her practice when helping elementary students develop understandings of scientific inquiry. Jennifer C. Parrish (Middle Tennessee State University) Kim C. Sadler (Middle Tennessee State University) Stephen A. Bartos (Middle Tennessee State University)

**Evaluation of Clicker Use and Student Success**
With this presentation, we discuss findings from two studies in which we examined the effect of clicker questions at varying levels of cognitive difficulty as well as the depth of feedback that is practical and sufficient to improve student learning in the college science classroom. Christina S Melki (Indiana University) Meredith A. Park Rogers (Indiana University)

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<th>Traditional Paper Set</th>
<th>Thursday 2:45-3:45PM</th>
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<tr>
<td><strong>Thread: College and University Science</strong></td>
<td>Presider: Sandra Westmoreland</td>
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<tr>
<td><strong>Investigating a Developing University Faculty-Teacher Partnership in a Second Grade Classroom</strong></td>
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<td>This paper will describe the developing partnership between two elementary science educators and a second grade classroom teacher. The discussion will focus on the challenges encountered and opportunities afforded to all participants by these types of university/K-12 partnerships. Leslie U Bradbury (Appalachian State University) Rachel E. Wilson (Appalachian State University)</td>
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<td><strong>Science College Professors Managing Multiple Identities</strong></td>
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<td>This study details findings from exploring the multiple identities of college science professors and its relation to their teaching practice. Luronne Vaval (Teachers College, Columbia University) Felicia Moore Mensah (Teachers College, Columbia University)</td>
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<td><strong>The Impact of SoTL Conferences on University STEM Faculty Teaching Practices</strong></td>
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<td>This study examines how attending a statewide SoTL (scholarship of teaching and learning) conference focused on university-level STEM (science, teaching, engineering, and mathematics) education impacted faculty attendees' pedagogical practices. To assess impact, we conducted interviews and on-site observations with selected faculty attendees. Katie Brkich (Georgia Southern University) Tom Koballa (Georgia Southern University) Christopher Andrew Brkich (BASE-2 Group)</td>
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<th>Traditional Paper Set</th>
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<tr>
<td><strong>Thread: STEM Education</strong></td>
<td>Presider: Justin McFadden</td>
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<td><strong>Can I see myself in this STEM Career? How Middle School Students Talk about their Motivation and Values when Making Career Choices</strong></td>
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This study examines how personal and social identity influence the motivation and achievement values of eighth grade students in a rural, middle school in the Southeastern US. Motivational values and identity constructs are examined and operationalized by students in a STEM career video intervention. Meredith W. Kier (Howard University) Margaret R. Blanchard (North Carolina State University)

**Exploration of an Elementary STEM program**
This study examines the effectiveness of an elementary STEM program on student cognitive and affective outcomes in an urban elementary school environment. Rebekah E. Lamb (Washington State University) Richard L. Lamb (Washington State University) Kaylan B. Petrie (Washington State University)

**Using the Next Generation Science Standards (NGSS): Some Unexpected Findings**
This self-study reports some unexpected findings from an examination of teaching and learning experiences in a secondary chemistry, engineering, geometry, and statistics classroom through the lens of the conceptual framework for science education and the Next Generation Science Standards (NGSS). Arthur F Corvo (Teachers College, Columbia University) Felicia Moore Mensah (Teachers College, Columbia University)

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<th>Traditional Paper Set</th>
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<tr>
<td><strong>Thread: Educational Technology</strong></td>
<td>Presider: David Vallett</td>
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<tr>
<td><strong>Adventure: Mississippi River (AMR)—An Approach to Engaging Audiences around an Adventure Narrative to Teach Science.</strong></td>
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<td>AMR is an annual education series that is based on a source to sea expedition down the Mississippi River. AMR blended real-life adventure with technology to reach students. The curriculum was designed around the research-based Adventure Learning approach and was delivered direct to classrooms via the latest cloud-based technologies. Brant G. Miller (University of Idaho) R. Justin Hougham (University of Wisconsin - Madison)</td>
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<td><strong>An Online Instructional Unit for Understanding Biological Evolution</strong></td>
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<td>The implementation of a Web-based instructional unit that includes substantial educative materials designed to promote the development of skills and content knowledge associated with the Next Generation Science Standards among high school biology students and teachers is presented. Robert B Marsteller (Lehigh University) Alec M Bodzin (Lehigh University)</td>
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<td><strong>Media-Driven Inquiry to Promote Environmental Education</strong></td>
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<td>The Great Smoky Mountains Institute at Tremont developed a program to promote student-centered inquiry through the use of media and technology-driven instruction. Participating school groups produced music videos parodying popular songs to deliver accurate scientific content. Program evaluation revealed areas of growth for students and teachers. Ryan M Walker (Mississippi State University) Avery Ezell (Mississippi State University)</td>
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Preventing Secondary Science Teacher Candidates for the EdTPA: Implementing Parallel EdTPA Assignments in an Existing Curriculum and Instruction Course within a Residency Program

In this workshop teacher educators will examine three assignments focused on planning, instruction, and assessment from a graduate-level, secondary science, curriculum and instruction course within a residency program. These assignments provide teacher candidates with formative experiences to prepare for the edTPA, a performance-based assessment required for teacher certification in NYS.

Julie Contino (American Museum of Natural History) Jim Short (American Museum of Natural History) Elaine Howes (American Museum of Natural History)

Using the NSTA Learning Center as an e-Textbook for Teaching Science Pre-service Teachers

Learn about the Learning Center, NSTA’s online portal, and how it can be used to create a customized e-textbook to teach science pre-service teachers. Create a free account, make a course page, add resources to library, assemble collections, and explore the instructor’s dashboard. Ask questions to professors using the portal.

Flavio J. Mendez (National Science Teachers Association) Al Byers (National Science Teachers Association) Kate Baird (Indiana University-Purdue University Columbus) William Veal (College of Charleston) Wendy Ruchti (Idaho State University) Kathy Sparrow (Florida International University) Susan Blunck (University of Maryland, Baltimore County)

Using TeachLivE TLE Virtual Teaching Avatar Simulation in Science Teacher Preparation and Professional Development

TeachLivE TLE is a virtual teaching simulation, used in our science teacher preparation program to assess for, and develop, specific teaching skills. See how it works, hear how it is used in our program, and the evidence indicating it changes teaching. Also get the opportunity to try it out by teaching or talking to five avatar students.

Craig Berg (The University of Wisconsin-Milwaukee) Raymond Scolavino (The University of Wisconsin-Milwaukee)

Applications of Visual Data in the Science Classroom

This is a themed paper set representing science education research about effective utilization of visual data within PK-16 science classrooms. Five representative projects out of 18 will be the framework of the set. The session will focus on addressing 6 foundational questions about visual data for classroom use.

Kevin D. Finson (Bradley University) Joanne K. Olson (Iowa State University) Brandon Emig (North Carolina State University) Miller T. Miller (University of South Carolina) Gerald H. Krockover (Purdue University)
From Professional Development to Classroom Implementation: Exploring STEM Integration in K-12 Science Education

This paper set presents various research surrounding STEM integration in grades 4 ““8 science classrooms. This presentation will explore teachers' experiences with professional development that includes instructional coaching, teacher and student discourse, and science teachers' experiences with incorporating STEM into their curriculum. Emily A Dare (University of Minnesota) Lisa Ortmann (University of Minnesota) Tasneem Anwar (University of Minnesota) Joshua A Ellis (University of Minnesota) Justin McFadden (University of Minnesota) Sousada Chidthachack (University of Minnesota) Tamara J Moore (Purdue University) Gillian H Roehrig (University of Minnesota) S. Selcen Guzey (Purdue University)

The Value of Childhood Experiences with Nature

This study explores the use of environmental socialization (ES) measures in conjunction with the New Ecological Paradigm (NEP) as a means to explain children's attitudes about their natural environment. Resulting typologies are introduced and then used to explore how participants responded to learning experiences conducted in the outdoors. Lisa A Gross (Appalachian State University)

Understanding the Delivered Curriculum at a Residential Environmental Learning Center

Stakeholders' perceptions of the delivered curriculum inform connections to classroom instruction. Although students, admin, program staff confirmed developing an appreciation for inquiry/discovery as a desired outcome, teachers did not. Researchers identified aspects of the formal/informal relationship that encourage an enthusiasm for learning. Ryan M Walker (Mississippi State University) Cathy Wissehr (University of Arkansas) Lisa Wood (University of Arkansas) Jen Jones (The Great Smoky Mountains Institute at Tremont)

What Middle School Students Want and What Teachers Desire in a Middle School Summer Science Camp

This presentation aims to illustrate research findings of a week-long full-day interactive camp designed to engage middle school age children in the excitement of neuroscience by making learning about the nervous system infectious and fun as well as to increase student confidence in learning about science. John L. Pecore (University of West Florida) Melissa K. Demetrikopoulos (Institute for Biomedical Philosophy) Laura L. Carruth (Georgia State University)

Biology Majors' Misconceptions in Ecology

Presider: Christina Melki
This study investigated biology majors' misconceptions in ecology before and after instruction in a large lecture and lab enhanced ecology class. A pre and post-test assessment revealed many questions showed no significant changes in misconceptions from the beginning of the course to the end. Katherine A. Mangione (Middle Tennessee State University) Angelique M. Troelstrup (Middle Tennessee State University)

High School Biology Teachers' Formative Assessment Practices during Instruction on the Cell Unit
This study examines three high school biology teachers' formative assessment practices during instruction on the cell unit and has implications for science teacher preparation programs and professional development. Melissa A Jurkiewicz (University of Nevada)

Perspectives from College Biology Majors: Is Knowledge of Evolution Useful?
This mixed methods study explores college biology students' evolution acceptance and perceptions of the utility of evolution knowledge. The findings can inform science teacher educators and preservice teachers about how to better engage evolution learners. Lisa A Borgerding (Kent State University)

An Investigation of Student Meaning Making during Instruction about Earthquakes and Plate Tectonics
We observed five undergraduate students as they experienced inquiry rich, historically contextualized instruction in plate tectonics. Record of their conversations reveals instances of arrested model development. We assert that the metaphor, plate, in plate tectonics, and Stent's idea of prematurity can explain these hindrances to learning. Glenn R Dolphin (University of Calgary) Wendy Benoit (University of Calgary)

Aspects of Transformative Learning in a College Preparatory Program
This study reports the findings from a group of 29 high school students of color participating in a two-year college preparatory program and at various points have had positive transformative experiences and achieved some goals of the program. Robin E. Fleshman (Columbia University/Teachers College) Felicia Moore Mensah (Columbia University/Teachers College)

Making Sense of the Modern Synthesis: Investigating How Biology Majors Understand Evolution
The purpose of this presentation is to discuss research on the development of junior and senior level biology majors' perceptions of evolution. Specifically, the biology major's perceptions of the connections between the concepts of evolution, natural selection, speciation and extinction will be presented and discussed. Austin M. Hitt (Coastal Carolina University) Sharon L. Gilman (Coastal Carolina University)

Effects of Epistemological Beliefs on NOS Instruction

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The purpose of this study was to investigate teacher epistemological beliefs and the influence of those beliefs on practice during a nine-week NOS unit. The timing of this study was centered on a nine-week NOS unit. Both quantitative and qualitative data were collected. Milton D Huling (University of South Florida) Dana Zeidler (University of South Florida)

**How Scientists and Preservice Teachers Describe Anomalous Data and Justification in Science**
This study explores (1) scientists' and preservice science teachers' ideas of how scientists know when to make their results public (needs for justification), (2) scientists' and preservice teachers' ideas of how scientists deal with anomalous data; and (3) how preservice teachers think students deal with anomalous data. Renee S. Schwartz (Georgia State University)

This study examined scientific processes in the science portion of the Course of Study of Japan. Also, a comparative study of scientific processes in the US and Japan was conducted among Japanese models, BSCS models, Yager's model, NGSS models, and the W-type problem-solving model developed in 2009. Yoshiisuke Kumano (Shizuoka University) Masakazu Goto (National Research Institution of Educational Policy)

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<th>Poster Session</th>
<th>Thursday 5:00-8:00 PM</th>
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<td>Poster Session with Pre-Dinner Social. Enjoy an array of snacks while interacting with colleagues at this Social Poster Session. Cash bar. Posters will be available for viewing the entire session; presenters will be by their posters for personal interactions from 5:30-6:30.</td>
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1) 'I Walk in Nature More Confidently': Using Photoessays to Understand Ecological Mindfulness in Pre-Service Elementary Teachers
This study investigated evolution of pre-service teachers' eco-mindfulness in an elementary science methods course. Through an eco-mindfulness survey, interviews and photoessays about the role of nature in their lives and their expected classrooms, increased self-awareness about place in nature and shifts toward environmental stewardship were seen. Heather Rudolph (University of Georgia) Gretchen Perkins (University of Georgia) Young Ae Kim (University of Georgia) Deborah Tippins (University of Georgia)

2) Addressing Pre-Service Teachers' Readiness to Teach in Increasingly Diverse Science Classrooms
Many culturally responsive models do exist that in practice remain unsustainable particularly among science teachers. Through their teacher education coursework, pre-service science teachers should be able to embrace multicultural values as a lens through which all students, regardless of background have equal opportunities for success. Kemunto M. Nyaema (University of Iowa) Soonhye Park (University of Iowa)

3) Advancing Science Performance with Emerging Computer Technologies (ASPECT)
This poster chronicles the Year 1 work of ASPECT, a 3-year NSF DRK-12 Exploratory Project. The project leverages advanced technology (game engine and haptic controller) to develop and test
simulations for the teaching and learning of core upper elementary (grade 3-5) science content including forces and matter and its interactions. James Minogue (North Carolina State University) Shengyen Tony Chen (North Carolina State University) David Borland (North Carolina State University) Marc Russo (North Carolina State University) Ryan Grady (North Carolina State University)

This qualitative study explores 10 African-American female students' in two environmental science classrooms at a midwestern suburban high school. It will use discourse analysis as a way to understand the various characteristics of scientific argumentation and lived experiences for these students. Phyllis H Pennock (Western Michigan University) Renee' Schwartz (Georgia State University)

5) An Analysis of Middle School Science Teachers' Topic-Specific Pedagogical Content Knowledge on Astronomy Contents
Pedagogical content knowledge (PCK) is intrinsically domain/topic-specific knowledge for teachers' expertise. In this study, based on this premise, we explored science teachers' PCK specific to astronomy contents through the lens of teacher knowledge and science practices. Ki-Young Lee (Kangwon National University) Seungho Maeng (Seoul National University) Young-Shin Park (Chosun University) Hyungsoo Kim (Kyungpook National University)

6) An Exploration of Students' and Teachers' Perceived Realness of a Remote Electron Microscopy Investigation
This study explored students' and teachers' perceptions of virtual presence during a remote microscopy investigation. Students indicated the remote investigation was very real; however, the teachers were less likely to describe the investigation as being real. Issues of ownership and virtual presence in remote investigations are discussed. Gina Childers (North Carolina State University) M. Gail Jones (North Carolina State University)

7) An Exploration of Systems Thinking among Elementary Pre-Service Teachers: Selection and Use of Multiple Pictorial Representations for a Proposed Lesson on the Water Cycle
Elementary pre-service teachers use many resources to plan and select pictorial representations. There is limited information about the selection process and if it is related to teachers' knowledge of systems thinking. This study investigates the pedagogical perspectives used in the selection process when planning a lesson on the water cycle. Tammy D. Lee (East Carolina University) M. Gail Jones

Assessment of students' content knowledge can provide us with a broader perspective on student learning in science courses. In this study, a 21-item version of the multiple-choice Geoscience Concept Inventory (GCI) was used to assess learning gains pre and post instruction within an Earth Systems Science undergraduate course. Meredith L. McAllister (Butler University) Bob Holm (Auburn University)

9) BACOT - An iPad App for Classroom Observation Data Collection and Teacher Development
Throughout their careers, science teachers are observed, not only by students, but also by methods instructors, cooperating teachers, university supervisors, school administrators, and others. To assist a teacher in enhancing their teaching practice, objective, valid, and reliable data can be useful. BACOT is an iPad App fulfills this need. Scott Ashmann (The University of Wisconsin-Green Bay) Craig Berg (University of Wisconsin-Milwaukee) Raymond Scolavino (University of Wisconsin-Milwaukee) Michael Clough (Iowa State University)

10) Barriers to Student Transfer of the Evolutionary Principle of Variation
The teaching of evolutionary principles is essential to the understanding of biology; however, students poorly understand evolution. To uncover student barriers to understanding the evolutionary principle of variation, students are given a short reading about variation, given a card-sort task, then assessed for in-domain and out-of-domain transfer. James C Marr (Washington State University) Garrett Honke (Binghamton University) Michelle Tao (Binghamton University) Nolan Conaway (Binghamton University) John D Patterson (Binghamton University) Kenneth Kurtz (Binghamton University) Andy R Cavagnetto (Washington State University)

11) Bridging Home and School Literacies through a Food-Based Curriculum
The border city of El Paso, Texas ranks consistently low in literacy rates. Opposing this deficit model, we present a pilot food-based curriculum that allows students’ cultural wealth to connect to different content literacies, and encourages them to explicitly synthesize various funds of knowledge and make connections with science learning. William Medina-Jerez (University of Texas at El Paso) Lucia Dura (University of Texas at El Paso) Meredith Abarca (University of Texas at El Paso) Consuelo Salas (University of Texas at El Paso) Marisela Lopez (Ysleta Independent School District - El Paso, TX) Virginia Hill (The Housing Authority of the City of El Paso (HACEP)) Sonia Legarretta (The Housing Authority of the City of El Paso (HACEP))

12) Bridging the Gap between Research and Practice
A gap between research and practice exists. Educators feel researchers are far removed from the classroom to suggest practical improvements to classroom practice. I explored the following research question from the classroom teacher’s perspective: "What are the perceptions of teachers toward research articles and how do they read and unpack them?" Julie Alexander (University of Missouri)

13) Critical Review of the Literature on Pedagogical Content Knowledge (PCK)
Since first suggested by Shulman, many researchers have attempted to provide theoretical frameworks and models to articulate the nature and the construct of pedagogical content knowledge (PCK). This study aimed to critically examine the convergences and divergences of PCK conceptualization in empirical studies published between 1986 and 2013. Kyungwoon Seo (University of Iowa) Jee Kyung Suh (University of Iowa) Soonhye Park (University of Iowa)

14) Development and Effects of an Application for the Diagnostic and Formative Assessment in Elementary Science Classes
The aim of this study is to make diagnostic and formative assessment questions based on class design procedure and to develop apps (applications) based on the learning objectives in elementary science
subjects in order to discuss their effect on learning achievement and self-directed learning attitudes. Jun Ho Son (Seoil Elementary School) Jonghee Kim (Chonnam National University) Hyeong Soo Kim (Kyungpook National University) Da Woon Hong (Kyungpook National University)

15) Do Not Underestimate the Power of an Image
We will share results of a study of submicroscopic representations of solids, liquids and gases presented to K-8 students in textbooks. The images were analyzed for scientific accuracy and potential for creating non-scientific conceptions. We found similarities amongst the images as well as concerns about density and depictions of matter. Susan A Everett (University of Michigan-Dearborn) Charlotte A Otto (University of Michigan-Dearborn)

16) Dr. E. Laurence Palmer: STEM Pioneer in Environmental and Teacher Education
This poster will highlight the contributions of E. Laurence Palmer to the field of science education. Dr. Palmer was a pioneer in environmental education and science teacher education. His scholarly contributions and leadership in various organizations helped forge the fields of science teacher and environmental education. Starlin D Weaver (Salisbury University) Beth Klein (SUNY Cortland)

17) Engaging preservice elementary teachers in multidisciplinary lesson planning around socioscientific issues through the collaborative efforts of science and social studies educators
In this presentation we will share an innovative idea for engaging preservice elementary teachers in multidisciplinary lesson planning around socioscientific issues (SSI) that involved co-planning and co-instruction by science and social studies educators in methods courses. Stephen R. Burgin (Old Dominion University) Brandon M. Butler (Old Dominion University) William J. McConnell (Old Dominion University)

18) Engineering and Teacher Partners in STEM Education: What do Engineers Think?
The presenters offer partnership perceptions of early career engineers. An open-response survey was given to a group of early career engineers working on an educational product. The responses were analyzed for themes and the results show that the engineers have misconceptions about the roles and skill sets of the engineer/teacher groups. Mike Borowczak (Erebus Labs) Andrea C. Burrows (University of Wyoming)

19) Exploring Elementary Teacher Candidates' Home Inquiry Experiences and the Impact on their Science Knowledge, Beliefs, and Attitude
This study focuses on the impact of the Home Inquiry Project experiences on elementary pre-service teachers' attitude, beliefs, and knowledge with regard to specific science content and the general process of scientific inquiry. This line of study has immense implications for the preparation of a scientific literate teacher population. Mahsa Kazempour (Penn State University (Berks Campus)) Aidin Amirshokoohi (DeSales University) Stephen Croft (Carlton Elementary School) Christina Lebo (Crestview Elementary School)

20) Exploring the Relationship between Elementary Teachers' Scientific and Practitioner Selves
This proposal reflects research in progress. In this poster, we will present the case of one teacher's science life narrative showing how we characterized the relationship between her retrospective narrative and current narrative of practice as being about what constitutes "good science teaching."

Ashley N. Murphy (West Virginia University) Melissa J. Luna (West Virginia University) Malaya B. Bernstein (West Virginia University)

21) Females' Persistence in the STEM Pipeline: Lessons for Science Educators
The probability for women to leave STEM is higher than for men. In this proposal, we present interview data from women who have persisted in STEM fields. Our theoretical frame allows for new ways of examining how females develop STEM identity. Analysis indicates a strong relationship between critical factors for STEM persistence. Julie Haun-Frank (Michigan Department of Education) Vanessa L Wyss (Ferris State University)

22) First LEGO League's Effect on Student Attitudes towards Science and Engineering
This poster details a study involving twenty-six students from four different schools who participated in the First LEGO League robotics competition and the effect the program had on their attitudes towards science and engineering. Richard L Sanchez (University of Wyoming) Andrea Burrows (University of Wyoming)

Presentation describes an example of a contemporary children's garden used with preservice teachers to study their knowledge of gardening as a vehicle for teaching science ideas. This study explores preservice science teachers' thinking about science learning, systems thinking, and sustainability, at a garden with permaculture inspired features. Susan K. Stratton (SUNY Cortland)

24) How Teachers and Students with known NOS Views Make Sense of the NOS Portrayed in Trade Books during Science Read-Alouds
Eliciting understanding of the NOS may be difficult at the elementary-school level because students are still developing as readers and writers. This study looks at how read-alouds may be used to elicit those NOS views through discourse analysis. Seema Rivera (University at Albany)

25) Integrating Historical Short Stories and the Nature of Science in Secondary Science Instruction: Teachers' Implementation Decisions and Students' Reactions
A mixed methods study exploring the use of historical short stories as nature of science instruction in secondary science classes is presented. The study examines factors influencing teachers' implementation, the impact on students' NOS understanding, students' interest in the stories and factors correlated with student interest. Jennifer A Reid-Smith (Iowa State University) Michael P Clough (Iowa State University) Joanne K Olson (Iowa State University)

26) Investigating Impacts of the NSF Noyce Program on Science And Mathematics Teachers' Self-Efficacy, Epistemological Beliefs, and Constructivist Practice
This paper presents research on impacts of the NSF Robert Noyce Program at UT Arlington. The
program awards scholarships to science and mathematics majors seeking teacher certification through UTeach Arlington, designed to promote self-efficacy, understanding of the content and nature of science/mathematics, and constructivist teaching practices. Ann M.L. Cavallo (The University of Texas at Arlington) Gregory Hale (The University of Texas at Arlington) Ramon Lopez (The University of Texas at Arlington) David Sparks (The University of Texas at Arlington)

27) Moving Beyond Subject Matter Knowledge: Examining Practice-Based Measures of Content Knowledge for Teaching Science
We examine a process for developing and validating assessments of elementary science teachers' content knowledge for teaching (CKT). These CKT assessments can be used for making decisions about what aspects of teachers' knowledge should be the focus of their professional learning opportunities. Jamie N Mikeska (Educational Testing Service) Geoffrey Phelps (Educational Testing Service) Joseph Ciofalo (Educational Testing Service) Andrew Croft (Educational Testing Service)

28) Nature of Science Classroom Observation Protocol (NOS-COP)
We present a NOS Classroom Observation Protocol (NOS-COP) that assists researchers in making transparent and comparing many facets of teachers' NOS implementation practices that have often been unclear in prior research. Michael Clough (Iowa State University) Benjamin Herman (University of South Florida) Joanne Olson (Iowa State University)

29) Pedagogical Value of a Third Grade Prairie Restoration Project
This qualitative case study described the pedagogical value of a tall grass prairie restoration project integrated into third grade curriculum. The pedagogical value of this environmental education project included addressing state science standards, but also extended beyond the standards in significant ways. Teresa J. Shume (Minnesota State University Moorhead)

30) Perceptions of Student Performance and Teacher Preparation in Science Education
Findings revealed teacher perceptions of how the science education of their students compared to high-performing students in other states and nations. This study also provided information about teacher perceptions of preparation to teach an in-depth scientific curriculum comparable to curricula in high-performing states and nations. Rhea L.G. Miles (East Carolina University)

31) Reaching Out beyond Traditional Science Activities by Bringing Non-Traditional Activities into an Elementary Science Methods Course
This proposal describes two non-traditional activities that have been developed and incorporated into an elementary science methods course. The non-traditional assignments include Invitations that encourage students to think about equity issues for science, and Reading adult non-fiction texts and completing non-traditional literature roles for HW. Jane Leeth (Indiana University-Indianapolis) Paula A Magee (Indiana University-Indianapolis)

32) Saudi Secondary School Students' Views About Climate Change and Global Warming: Beliefs about Actions, and Willingness to Act
A 44-item questionnaire was designed to determine students' views about how useful various specific actions might be in helping to reduce climate change and global warming. The instrument was
administered to students in grade 10 at Al Sarwat High School in Al Baha city in Saudi Arabia. Abdulmonem Alghamdi (Akron University)

33) Science, Literacy and Teaching: Strategies to Support Pre-service Teachers in Elementary Education
Science and literacy education may be uniquely suited for integration in order to support the development of science content knowledge and skills in literacy. Elementary teachers find less and less time for teaching science in the classroom day. Most of the focus in the classroom must be on literacy and mathematics. Using science texts that are Kathryn T Watkins (University of New Mexico)

34) STEM-Focused Teacher Preparation: Discovering a Relationship between Beginning Teachers' Beliefs, Teaching Goals, and Enacted Practice
This study examines the beliefs and practices of beginning teachers who completed a STEM focused teacher preparation program. Measures of teachers' reform based and traditional science instruction beliefs are compared to their enacted practice in their first year of teaching. Interview data contribute to data triangulation of data. Sarah J Carrier (North Carolina State University) Daniell Difrancesca (NCSU) Beth Greive (NCSU) Margareta M Thomson (NCSU)

35) Teaching Strategies and Learning Progressions in Environmental Science
What is a productive model of pedagogical content knowledge (PCK) for noticing, documenting, and developing teaching strategies for a learning progression-based approach to environmental science instruction? We offer a model of PCK that emerged from triangulating information from teacher, researcher, and student perceptions. Shandy Hauk (WestEd) Nissa R Yestness (Colorado State University) Kitty Roach (University of Northern Colorado) Alan Berkowitz (Cary Institute)

36) The Best Way to Learn is to Teach: An Early Field Experience in a Science Content Course for Preservice Elementary Teachers
Early field experiences are often used to introduce teaching methods, but what about content? As part of a science content course, future teachers run a lunchtime science/engineering club for 5th graders at a local elementary school. Can future teachers benefit by learning science content in the context of an actual elementary school setting? Matthew A. d'Alessio (California State University Northridge) Holliston Coleman (California State University Northridge) Loraine L. Lundquist (California State University Northridge) Diane Miller (Los Angeles Unified Schools) John Rome (Los Angeles Unified Schools)

37) The Discourse Analysis of Different Level of Classrooms when Teaching with Argument Based Inquiry
The purpose of the study was to explore and explain each level of teachers' discourse analysis when teachers taught with argument based inquiry classroom Nurcan Keles (University of Iowa) Brian Hand (University of Iowa)

38) The Earlier the Better: Teacher Beliefs About Design, Engineering, and Technology Instruction
This exploratory, qualitative, multiple-case study was conducted with high school STEM teachers. This
study addresses STEM teacher beliefs about the instruction of design, engineering, and technology. It further explores the impact teaching experience has on beliefs in regards to design, engineering, and technology. Abeera P. Rehmat (University of Nevada, Las Vegas) Marissa C. Owens (University of Nevada, Las Vegas) Janelle M. Bailey (Temple University)

39) The Effects of Inclusive Science Education on the Attitudes of 8th Grade Students
This presentation will be guided by the research findings that will address the attitudes of 8th grade students without disabilities towards students with disabilities in inclusive science classrooms at a charter middle school. Science education researchers, regular science education teachers, and special education teachers are welcome to attend. Seyithan Demirdag (University of Oklahoma)

40) The Relationship between Individual Differences in Science Teachers' Values and their Perceptions of Inquiry-Based Teaching Practices
This mixed methods study examines whether and how middle school science teachers' values and goals towards student learning is related to their perception of learning situations that occur in inquiry-based classrooms. Daniel M Alston (Clemson University) Jeff C. Marshall (Clemson University)

41) The Use of Coached Rehearsals in a Science Methods Course
This poster describes the strategy of coached rehearsals used in a science methods class as a means of giving teacher candidates the opportunity to engage in the practice of ambitious science teaching with the support of in-the-moment feedback and without the typical constraints found in the secondary science classrooms. Allyson Rogan-Klyve (Oregon State University)

42) Three Strategies for Mentor Teachers to work with Student Science Teachers: Emphasizing Scientific Modeling, Giving Feedback, and Prompting Reflection.
Student teaching experiences in teacher education have a powerful impact on student teachers becoming effective science teacher educators. In a review of literature and my own actions in the area of science educator mentoring, I suggest important criteria to emphasize while hosting student science teachers. Thomas C McElheny (University of Georgia)

43) Using Big Ideas to Structure an Authentic Environmental Inquiry-Wolves and Their Ecosystems
Using an array of methods including video, interviews and surveys, our research examines how a "Big Ideas" approach supports teaching and learning through inquiry in a 9th grade science course. The Biology strand, "Sustainable Ecosystems" will be developed using case studies based on the wolves in Yellowstone and Isle Royale National Parks. Douglas Jones (Lakehead Schools) Sanya Sidhu (Lakehead University) Anthony W Bartley (Lakehead University)

44) Using Scenarios to Assess Pre-service Science Teachers' Pedagogical Strategies for addressing Students' Misconceptions on Electrolysis
This study used instructional scenarios to assess junior high school pre-service science teachers' ability to identify students' misconceptions on electrolysis of acidified water, and their pedagogical strategies for addressing students' misconceptions in junior high school classrooms. Asiana Banda (Southern Illinois University Carbondale) Frackson Mumba (University of Virginia) Vivien M Chabalengula (University of Virginia)
45) **Using Social Media to Enhance the Practice of Scientific Argumentation**
NSF has funded the Center for Research on Learning at the University of Kansas to study how social media can be used in the Biology classroom to foster the practice of scientific argumentation and support the new Next Generation Science Standards. This poster session will report our findings of the first project year. James D Ellis (University of Kansas) Amber L Rowland (University of Kansas) Marilyn M Ault (University of Kansas) Janis A Bulgren (University of Kansas) Barbara A Bradley (University of Kansas) Jana C Hare (University of Kansas)

46) **Vanishing Firefly: A Look at Participant Demographics and Motivations for Volunteering in a Citizen Science Project.**
This study examines the demographics and motivational factors influencing initial participation in a citizen science project. The findings are consistent with similar studies and reveal a relatively homogenous group of participants with similar motivational goals. Renee M Lyons (Clemson University) Michelle Cook (Clemson University) David White (Clemson University) Alex T Chow (Clemson University) Juang Chong (Clemson University) Roy Pargas (Clemson University)

47) **Watching What You Say: Science Discourse Interactions between Teachers and Linguistically Diverse Elementary Students**
This study explored discourse between teachers and students in diverse elementary science classrooms. Our results revealed that teachers directed discourse due to perceived testing pressures and limited pedagogical content knowledge. Developing understanding of these interactions may help teachers address the challenges of diverse classrooms. Jenay Sharp Leach (University of Virginia) Jennifer L. Maeng (University of Virginia) Randy L. Bell (Oregon State University)
FRIDAY JANUARY 9

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| **Web-based Interactive Mapping Applications for Use in Science Methods Courses**  
This session presents a variety of free Web GIS interactive mapping applications that can be used in K-12 science methods courses to promote learning of important science concepts and processes while promoting geospatial thinking and reasoning skills. Alec M. Bodzin (Lehigh University) |  |  |  |

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| **Learning to Really See: How to Bring Out the Scientist, Writer, and Artist in STEM Inquiry**  
Experience an easy, literacy-rich, hands-on method for powering-up close observation, thinking by analogy, writing, art and theorizing in students K-16 """" and instill the NGSS Crosscutting Concepts. Featured in a graduate-level course partnership involving Portland State University, Portland Metro STEM Partnership, and The Private Eye Project. Kerry Ruef (The Private Eye Project) |  |  |  |

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| **The Champlain Research Experience for Secondary Teachers**  
The Champlain Research Experience for Secondary Teachers (CREST) provides STEM professional development and mentorship for GEAR-UP teachers to prepare grade 7-12 students for STEM college and career readiness. Regina E. Toolin (University of Vermont) |  |  |  |
Creating Science Identity with Pre-service Elementary Teachers within an Informal Science Education Course
An Informal Science Education (ISE) course was taught to a group of 22 pre-service elementary teachers (PETs). This course was successful in creating an environment to promote science teacher identity among PETs using a variety of methods, resources and, more importantly, ISE contexts for practicing and refining their science teaching. Bonnie B. Glass (East Carolina University) Tammy D. Lee (East Carolina University) Megan L. Garner (East Carolina University)

Elementary Science Methods: Improving Candidates' Assessment Competence through the Writing Partners Program
This session will examine our elementary science methods syllabus, which integrates a Writing Partners Program, supporting candidates in learning and practicing authentic strategies for effective assessment and instruction. Jenna M. Porter (Sacramento State University) Hui-Ju Huang (Sacramento State University)

Pre-Service Teachers' Science Attitudes and Self-Efficacy in a Life Science Content Course
Improvements in pre-service teachers' science attitudes and self-efficacy result from a content-based life science course incorporating Bloom's Taxonomy, situated learning, active learning, and non-traditional course materials. Syllabi and specific instructional strategies will be shared. Cindi Smith-Walters (Middle Tennessee State University) Heather L Barker (Middle Tennessee State University)

Science Research as a Context for Teacher Professional Development
This syllabus share highlights the first of a 4-part professional development course series. This initial course focuses on science content learning within a scientist's field of research. It is co-taught by a scientist and a science educator. An example is provided of a year the course was taught through the study of a degenerative nerve disease. Jenny D Ingber (Bank Street Graduate School of Education) Mona Freidin (mona.freidin@einstein.yu.edu) JoEllen Schuleman (New York City Department of Education)

Teaching Engineering Design to In-Service Teachers
With the incorporation of engineering practices and design in NGSS, in-service science teachers need course work and professional development on these topics. This syllabus sharing session provides details and design of a graduate course Engineering Design for the K-12 Science Classroom, co-taught by a science educator and engineering educator. Sarah B. Boesdorfer (University of Northern Iowa) Scott Greenhalgh (University of Northern Iowa)

The Use of Photovoice and Nature Autobiography in the Science in the Natural Environment Course
The Science Education Studies in Natural course focuses on establishing a learning community onsite, with group and individual observational and empirical studies in nature. During the course, the students reflect on their relationship with nature, make extensive collections, engage in nature journaling, and plan environmentally-based lessons. Rita Hagevik (The University of North Carolina at
Professional Identity of High School Science Teachers participating in a Reform-based PD
The goal of this presentation is to discuss research involving an emerging model of teacher professional identity applied to a reform-based PD initiative. We will present a multiple case study of five teachers in order to showcase changes and tensions in their professional identity systems that are the impetus for changes in practice. Stephanie J. Hathcock (Oklahoma State University) Joanna Garner (Old Dominion University) Avi Kaplan (Temple University) Daniel Dickerson (Old Dominion University) Petros Katsioloudis (Old Dominion University)

Teacher and Student Learning through a Teacher Design Team (TDT)
Giving students autonomy can be disturbing to teachers. To monitor the "what and how" of student groups working independently, teachers in a team developed learning material plus a student group log that was class enacted. The log stimulated interaction, reflection, influenced learning, and the fast written feedback on student work was appreciated. Fer Coenders (University of Twente)

Tracking Teachers' Engaging their Students in Inquiry/Science Practices Following Authentic Science Professional Development
We will present our newly developed Matrix to track evidence of teaching science inquiry/practices in the classroom, following teacher professional development. This presentation focuses on analyzing what is happening in teachers' classrooms related to NGSS science practices, which is often not addressed in research reports. Barbara A. Crawford (The University of Georgia) Jacyln Murray (The University of Georgia) Alexandria Mazur (Michigan State University) Daniel K. Capps (The University of Maine) Robert Idsardi (University of Georgia) James Ammons (The University of Georgia) Robert Ross (The Paleontological Research Institution) Ryan Nixon (The University of Georgia)

Exploring the Characteristics of PCK displayed by Elementary Teachers for the Topic-Specific Strategies: Preliminary Study of Teaching Progression
This research is preliminary one for students' learning progression research with the focus on astronomical contents as well as practices. To meet this goal of research, the research team investigated the status quo of teachers' PCK at natural setting of teaching astronomy at elementary level as the preliminary one. Seoungho Maeng (Seoul National University) Young-Shin Park (Chosun University) Ki-Young Lee (Kangwon National University) Jeong-A Lee (Seoul National University) Hyunseok Oh (Namdaemoon Middle School)

Perceptions of Science Education among Elementary school Teachers
Elementary teachers' attitude and access to material impacts their willingness to teach science which is often ranked as a least favorite subject (Wilkens, 2010). If teachers do not enjoy science, they will
spend minimal time teaching it. The purpose of this pilot study is to examine attitudes toward teaching science among elementary teachers. Karen L. Cloud (University of Wyoming)

**The Knowledge Needed to Teach Science: Approaches, Implications, and Potential Research**

Science teachers need subject matter knowledge. There are different views about subject matter knowledge that have different instructional and research implications. Julie A Luft (University of Georgia) Kathy A Hill (Bethany College) Ryan S Nixon (University of Georgia) Ben Campbell (University of Georgia) Shannon L. Dubois (University of Virginia)

**Traditional Paper Set**

**Thread: Ethnoscience and Environmental Education**

**Conceptual Changes in Post-Secondary Students Enrolled in an Experiential Environmental Course Embedded with Socioscientific Issue Instruction**

An investigation into the extent that students' experienced conceptual change through SSI instruction embedded in an experiential environmental course. Qualitative evidence shows that SSI instruction effectively addresses aspects of the conceptual ecologies model not addressed by other forms of instruction. Mark H Newton (University of South Florida) Benjamin Herman (University of South Florida) Dana Zeidler (University of South Florida)

**Impact of Experiential Environmental Socioscientific Issues Instruction on Post-Secondary Students' Conceptions of Environmental Issues in the Greater Yellowstone Ecosystem**

An investigation into the extent to which students' ability to take multiple perspectives developed through SSI instruction embedded in an experiential environmental education course. Evidence shows that this course successfully facilitated students to consider more sophisticated perspectives and could act as a model for science courses. Benjamin C Herman (University of South Florida) Mark Newton (University of South Florida) Dana Zeidler (University of South Florida)

**Reason about Climate Issues: Bridging between Cognitive Research and Environmental Education**

This study developed a grounded theory to characterize how college students reason about competing arguments on global climate change. The findings provided important implications for climate change education and initiated further discussion on bridging cognitive research with environmental education and teacher professional development. Shiyu Liu (Pennsylvania State University) Frances Lawrenz (University of Minnesota)

**Traditional Paper Set**

**Thread: Mixed**

**A Biology Curriculum Model for Integrating the Three Dimensions of The Framework and NGSS Using Data from Published Scientific Research**

The Framework for K-12 Science Education and the Next Generation Science Standards call for curricula that integrate disciplinary core ideas, science practices and crosscutting concepts. In response, we have developed and pilot tested a set of lessons on natural selection that engage
students in working with data from published scientific research. Nicola C. Barber (University of Utah) Louisa A. Stark (University of Utah) Jo Ellen Roseman (AAAS Project 2061) Martin Fernandez (AAAS Project 2061)

Engaging Pre-Service Science Teachers in Learning and Teaching of Homeostasis using Computer Simulation
We investigated the effects of a homeostasis computer simulation on pre-service biology teachers' understanding of homeostasis and its related concepts, and participants' perceptions of the simulation. Results revealed improved understanding, and positive perceptions towards the simulation. Vivien Mweene Chabalengula (University of Virginia) Frackson Mumba (University of Virginia) Rasheta Fateen (Southern Illinois University-Carbondale)

Exploring the Design and Theory behind a Field Based Elementary Science Methods Course in an Urban Elementary School
This presentation highlights the design and theory behind an elementary science methods course incorporating a field experience component in a low-income urban school. Teacher candidates identify their students' misconceptions about science concepts that then guide their NGSS instruction. Course syllabus and assignments will be shared. Anne Pfitzner Gatling (Merrimack College)

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Scientific Literacy in the 21st Century Classroom: Examining Elementary Teacher and Student Perspectives of Multiliteracies, Student Voice, and Scientific Practices
The way in which students interact with information and the world around them is changing, and the way in which teaching and learning takes place in the classroom is changing as well. This study explored the impact of multiliteracies on student voice in the teaching and learning of science and scientific practices in elementary classrooms. Elizabeth Allison (University of Alabama) "Dee" J. Goldston (University of Alabama)

The Impact of Emotions on Secondary School Students' Decision Making on Socioscientific Issues
Sympathy and empathy are two major types of emotions that influenced secondary school students' decision making on socioscientific issues. Wardell A Powell (University of South Florida) Dana L Zeidler (University of South Florida)

Understanding Adolescent Student Perceptions of Science Education
Student demographics are shifting across the US with implications for science education. This paper focuses on the results of a study of over 500 second year high school science students in a large southwestern school district regarding their perceptions of science. Results showed that gender, learning context and relevancy impact student perception. Ellen K Ebert (Office of the Superintendent of Public Instruction)
Traditional Paper Set  
**Thread: Educational Technology**  
**Presider: Theresa Cullen**

**Enhancing the Quality of Scientific Arguments by Learners Investigating an Interactive Computer Simulation**  
This study explored how the quality of high school students' arguments changed over time in scientific argumentation when they constructed and defended their arguments using an interactive computer simulation. Tugba Keser (Trakya University / University of Massachusetts Amherst)

**Examination of Individual Differences and Moderators of Science Content and 21st Century Skill Acquisition**  
This study examines the role of Serious Educational Games as a means to moderate changes in student learning across the factors of content scores and 21st Century Skills. Specifically the study examines how the design and use of Serious Educational Games as a support tool for student learning in the 9-12 educational environment. Kaylan B. Petrie (Washington State University) Richard L Lamb (Washington State University) David B. Vallett (University of Nevada Las Vegas) Leonard A. Annetta (George Mason University) Rebecca Cheng (George Mason University)

**Technology Enhanced Performance Tasks (TEPTs): An Approach to Developing and Assessing Science and Digital Literacy the NGSS Way within Middle School Science Classroom**  
TEPTs are an approach to developing and assessing middle school students through authentic NGSS aligned performance expectations that leverage appropriate technologies. Students participating in the TEPT collaborated on an engineering design challenge using cloud-based technologies that supported and enhanced their ability to succeed. Brant G. Miller (University of Idaho) Joel D. Donna (Winona State University) Sarah R. Hick (Hamline University)
How to Develop STEM Inquiry and Problem-Based Learning within K-8 classrooms
Come to this session to discuss the process and thinking behind how to support student construction of scientific explanations, promote active STEM learning and the development of experimental and analytical skills. A handout detailing STEM inquiry and problem-based learning projects will be shared with participants. Linda Plevyak (University of Cincinnati)

Recruiting and Retaining Preservice High School Science Teachers: Early Teaching Experiences
Towson University offers two early teaching experiences to science majors in order to recruit and retain preservice high school science teachers: (1) one-credit early teaching courses and (2) paid learning assistant positions. We provide a list of challenges, suggestions, and lessons learned to help faculty successfully implement their own ETEs. Cody Sandifer (Towson University) Ronald Hermann (Towson University)

Teacher Education for Beginning Teachers: The LAMP Mentoring Program
A university-based mentoring program was developed for new middle and secondary science teachers recently completing a cohort preservice program. A holistic approach was used to design a curriculum to extend the teachers' preservice education and create a professional learning community to promote continued teacher learning. Kelsy M Krise (University of Toledo) Rebecca M Schneider (University of Toledo)

An Exploration of how Students and Teachers Connect Daily Life to Ecology
This interactive discussion session will facilitate a discussion about the significance of connecting teachers' and students' daily life activities to an understanding of their impact on ecological function when teaching about the environment. Yael Wyner (City College of New York/ City University of New York) Erica Blatt (College of Staten Island/City University of New York) Janice Koch (Hofstra University)

Promoting Effective Argumentative Discourse in Pre-Service Teacher Education
Argumentative discourse is an instructional strategy that promotes positive cognitive and affective outcomes in science learning. This session will present research-based strategies and lesson ideas for incorporating effective argumentative discourse into pre-service teachers' science methods or content courses. Heather L Barker (Middle Tennessee State University) Cindi Smith-Walters (Middle Tennessee State University)

Preparing Elementary Preservice Teachers to Teach Nature of Science: Using and Writing Children's Books
A description of an methods course assignment that enabled preservice elementary teachers to design a picture book to use with their own classrooms that taught elementary students about NOS. Preservice teachers were required to create the books to enable them to introduce NOS aspects to elementary students. The books taught and reinforced NOS ideas Valarie L. Akerson (Indiana University)
### Traditional Paper Set

**Thread: Science Teacher Professional Development**

**Presider: Sharon Dotger**

**Data Explorations in Ecology: Students' Understanding of Variability and Use of Data in Environmental Citizenship**

This study investigated the impact of a PD program on participating teachers' and students' understanding of issues related to data exploration and environmental citizenship. Findings indicate that both teachers and students have significant difficulties, but are able to improve and gain confidence with instruction and support. Alan Berkowitz (Cary Institute of Ecosystem Studies) Tobias Irish (Cary Institute of Ecosystem Studies) Cornelia Harris (Cary Institute of Ecosystem Studies)

**In-Service Secondary School Science Teachers' Knowledge Base for Teaching Climate Change**

Photo Elicitation Interviews were used to assess in-service secondary school teachers' conceptual understanding about global climate change. We found that the participants in our study inclined heavily towards causes and implications of climate change. They misunderstood and/or underestimated feedbacks that occur within the climate system. Devarati Bhattacharya (University of Minnesota, Minneapolis) Engin Karahan (STEM Education Center, University of Minnesota,) Gillian Roehrig (STEM Education Center, University of Minnesota)

**Using a Scientist Teacher Partnerships Model to Provide Professional Development in Climate Change**

A 3-year professional development project sandwiched teacher pairs working with climate change researchers at field sites between on-campus PD experiences. This teacher/researcher PD positively impacted teachers, their students, and researchers. We will share our findings, challenges with and suggestions for implementing this PD model. Patricia D Morrell (University of Portland) Kari O'Connell (Oregon State University) Peder Nelson (Oregon State University)

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### Traditional Paper Set

**Thread: Curriculum, Pedagogy and Assessment**

**Presider: Kimberly Haverkos**

**Integrating the Process and Content of Science: Standards vs. Curriculum**

The integration of the process and content of science is a key feature to the NGSS. Such attention to how the details of process and of content fit with each other is new to both reform and research. We explored such integration through a comparison of the NGSS integration and that of a popular middle grades curriculum. Daniel Z Meyer (Illinois College) Bradley Perrin (Illinois College)

**Latent Class Profile Transition Analysis of Student STEM Career Selection using Serious Educational Games**

This study examines the role 21st Century Skills, Mental Rotation Ability, Interest, and Efficacy as predictors of upper-level STEM course selection. Specifically the study examines the design and use of Serious Educational Games as a learning support tool to assist examination of student intention to select upper-level STEM courses. Richard I Lamb (Washington State University) David B Vallett (University of Nevada Las Vegas) Leonard A. Annetta (George Mason University) Kaylan B Petrie (Washington State University) Rebecca Cheng (George Mason University)
**Warming up to Teaching and Learning Science the NGSS Way: Results from a Year 1 Pilot of an On-Line Educative Curriculum Guide on Convection**

An NGSS-aligned on-line educative curricular guide on convection was pilot tested with 160 sixth graders in three diverse urban schools. Results indicate high student interest in experimentation and high teacher interest in student engagement, standards-aligned rigor, curriculum flexibility, and video instructional support. Joel D Donna (Winona State University / 3Ring) Sarah R Hick (Hamline University / 3Ring)

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**Traditional Paper Set**

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<tr>
<th>Thread: Mixed</th>
<th>Friday 9:15-10:15 AM</th>
<th>Portland</th>
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<tr>
<td>Perspective on Exploring the Terrain of Middle Level Education</td>
<td>Presider: Eric Pyle</td>
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Middle level proponents argue that young adolescent learners are unique in the way they develop and learn. This position paper provides a perspective and set of implications on this issue. The intent is to stimulate discussion among science teacher educators who are interested in the preparation of middle school science teachers. Nathan Carnes (University of South Carolina)

**Exploring Beginning Physical Science Teachers' Use of Inquiry-oriented Discourse Practices**

Teachers use discourse and questions to guide and evaluate students' understanding. This study focused on discourse practices used by four beginning physical science teachers, the alignment of their discourse practices with inquiry-oriented practices and explored possible patterns of teacher content knowledge and enacted discourse practices. Aaron A. Musson (University of Nebraska-Lincoln) Elizabeth Lewis (University of Nebraska-Lincoln) Jia Liu (University of Nebraska-Lincoln)

**Scientific Argumentation: NGSS Practice for Improving Climate Change Education**

Findings of this study suggest that scientific argumentation can play an effective role in the preparation of science educators. This research examined changes in future teachers' knowledge and perceptions about climate change in an innovative undergraduate-level elementary science methods course. Julie L. Lambert (Florida Atlantic University) Robert E. Bleicher (California State University Channel Islands)

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**Traditional Paper Set**

<table>
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<tr>
<th>Thread: Preservice Science Teacher Preparation</th>
<th>Friday 9:15-10:15 AM</th>
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<tr>
<td>How Preservice Special Education Teachers Define and Characterize Scientific Inquiry</td>
<td>Presider: Tina Cartwright</td>
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This study explored how 16 K-8 preservice SPED teachers defined and characterized scientific inquiry in the context of a science teaching methods course. Inquiry was defined as an interactive science teaching method, characterized by questioning, learning-by-doing experiences, scaffolding by SPED teachers and sensitivity to learners' special needs. Rajlakshmi Ghosh (Kent State University) Lisa A Borgerding (Kent State University)
Pre-Service Elementary Teachers Creating Science Concept Movies as Context for Understanding the 
5E Teaching Model and Evidence-Based Explanations
This research explored pre-service elementary teachers' creation of science concept movies with a 
goal of enhancing their science conceptual understanding, teaching pedagogical knowledge, and 
supporting explanations with evidence. Findings indicate the activity was valuable for the teachers in 
terms of learning content, technology, and pedagogy. Mark D. Guy (University of North Dakota) 
Richard P. Hechter (University of Manitoba)

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<th>Traditional Paper Set</th>
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<tr>
<td>Thread: Mixed</td>
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<td>Presider: Kathryn Watkins</td>
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Exploring the Relationship between Elementary Pre-Service Teachers' Environmental Literacy and 
Views toward STS Issues and Instruction in an STS-based Science Methods Course
This study will explore the relationship between elementary pre-service teachers' levels of 
environmental literacy and views toward Science, Technology, Society (STS) issues and instruction 
before and after completing an STS-oriented science methods course. Aidin Amirshokoohi (DeSales 
University) Mahsa Kazempour (Penn State Berks)

Outdoor Education: An Integrated Approach to teaching Science at the High School Level
Outdoor education, an integrated science and physical education course has the potential to open the 
doors of science to students who often view it as an isolated subject, unrelated to any part of their 
lives. An integrated class of PE and science has the potential to change students' attitudes and 
opinions about science. Kimberly Murie (University of Arkansas) Laura Ring (Fayetteville Public 
Schools)

Visual Literacy and Creative Expression in the Science Classroom
Visuals are central to science literacy, and serve a wide range of purposes. (Darian, 2001) This study 
introduces Visual Literature Logs to science classrooms, a technique for facilitating scientific literacy. 
The study is premised on the idea that words and pictures do not capture or convey meaning in the 
same way. (Gardner, 1982) Charlene L. Ellingson (University of Minnesota)

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<th>Traditional Paper Set</th>
<th>Friday 9:15-10:15 AM</th>
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<tr>
<td>Thread: Science Teacher Professional Development</td>
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<td>Presider: Regina Toolin</td>
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BioInquiry: How a Course on Inquiry-Based Learning Influences High School Biology Teachers and 
their Students
This study examines the relationship between a two-week professional development course about 
inquriy-based learning and high school biology teachers' use of inquiry and their beliefs about inquiry, 
self-efficacy, and expectancy outcomes. The attitudes of these teachers' students towards science and 
inquiry are also examined. Traci L Carter (Clemson University) Michelle P Cook (Clemson University)
Knowledge Use When In- or Out-of-Field: Exploring Beginning Chemistry Teacher Content Knowledge
This study seeks to understand the content knowledge beginning teachers have for teaching chemistry. Analysis of interviews with teachers who did and did not have degrees indicated differences in the knowledge used to respond to chemistry teaching prompts. Those without degrees were often incorrect and drew upon biology and generic teaching ideas. Ryan S. Nixon (University of Georgia) Benjamin K. Campbell (University of Georgia) Julie A. Luft (University of Georgia)

Two Distinct Measures of In-Service Science Teacher Gains in Chemistry and Physics Content Knowledge: Objective Item Exams and Structural Concept Maps
Twenty in-service science teachers participated in a two-year physics and chemistry academy. Concept maps and selected response exams were used to document participants' changes in content knowledge before and after instruction, with a focus on the assessment information yielded by the two distinct assessment techniques. Sophia J. Sweeney (Northeastern State University) April D. Adams (Northeastern State University) Jim L. Hicks (Northeastern State University) Jessica D. Martin (Northeastern State University)

Traditional Paper Set  Friday 9:15-10:15 AM  Salon D
Thread: Mixed  Presider: Cathy Wissehr

Helping Preservice Elementary Teachers' Teach the Nature of Science
This action research study investigated (1) the struggles of preservice elementary teachers (PSETs) to enact nature of science (NOS) instruction, (2) modifications made to an elementary science methods course based on those struggles, and (3) the impact of those modifications on teacher enactment of NOS instruction. Tiffany Roby (Drake University) Jerrid W. Kruse (Drake University) Colin Seebach (Drake University) Neal Patel (Drake University)

Developing a Program to Enhance Observing and Classifying Process Skills
This study aimed to develop a program to enhance elementary school student's observing and classifying skills and evaluate the effectiveness of it. Ten steps of program were processed and three assessment tools were used to evaluate the program: test, interview and eye movement tracking. This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2013S1A5A8025304) Yeram Kim (Seoul National University of Education) Sanga Choi (Seoul National University of Education) Donghoon Shin (Seoul National University of Education)

Preservice Teachers' Perspectives on 'Appropriate' K-5 Earth and Environmental Science Topics
Preservice elementary teachers were surveyed to determine their perspectives on the environmental science topics they deem appropriate for K-5 science instruction. Results indicate areas where they align and conflict with the Next Generation Science Standards and science education best practices. Implications for methods curricula are discussed. Danielle J Ford (University of Delaware)
**Traditional Paper Set**  
**Friday 9:15-10:15 AM**  
**Salon H**

**Thread: Student Learning P-12**

**Presider: Wardell Powell**

**An Investigation of Images of Solids in Science Education Curricular Materials**

This presentation will summarize a review of images of solids composed of particles found in children's trade books, elementary and middle school science text books. Results will include patterns identified, similarities and differences and sources of alternative nonscientific conceptions. Other misconceptions identified will also be presented.  
Charlotte A Otto (University of Michigan-Dearborn)  
Susan A Everett (University of Michigan-Dearborn)

**Analyzing Eye Movement in Performing Biology Classification Task According to Elementary Students' Cognitive Style**

This study revealed a significant difference in students' scan sequences by students' cognitive style; WG were focused on the whole of the objects but AG were focused on the details. And we discussed about the difference in the steps of the classification process by students' cognitive style.  
Yerum Chun (Seoul National University of Education)  
Donghoon Shin (Seoul National University of Education)

**Examining Elementary Teachers' Use of Multiple Representations to Generate Sense-Making for Students through Different Modalities**

This study demonstrates how K-2 teachers incorporate multiple representations when teaching their students about the Properties of Matter. Additionally, it portrays how students generate meaning of the science content through different modalities. Implications for professional development and teacher education programs will be discussed.  
Heidi L. Wiebke (Indiana University)  
Meredith A. Park Rogers (Indiana University)  
Jared Allen (Indiana University)  
Susan Hawkins (Indiana University)

| Coffee Break | Thursday 10:15 – 10:30 AM | Lower Level 1 |

**KEYNOTE**  
**Friday 10:30 AM-12:00 PM**  
**Salon E-F**

**Dr. Bonnie Nagel**  
**Adolescent Brain Development: A Period of Opportunity and Vulnerability**

Adolescence is a time of dramatic behavioral, cognitive, social, and biological change. Dr. Nagel’s lab focuses on using neuropsychological and neuroimaging techniques to better understand neurodevelopment in both healthy and at-risk adolescent populations. Her presentation will describe cutting-edge research surrounding these changes and help to explain why the adolescent period is a vulnerable and challenging time of development.

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<tr>
<th>LUNCH</th>
<th>Friday 12:00 PM</th>
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<tr>
<td>On Your Own</td>
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<tr>
<td>Forum Meetings</td>
<td>Friday 12:30-1:30 PM</td>
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<td>Informal Science Education Forum</td>
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<td>Policy and Government Relations</td>
<td>Medford</td>
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<td>Technology Forum</td>
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<td>Scientists and Science Education</td>
<td>Salon A</td>
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<td>Environmental Education Forum</td>
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<td>Small Colleges and Programs Forum</td>
<td>Salon C</td>
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<tr>
<th>Experiential Session</th>
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<tr>
<td>Pedagogical Content Knowledge through an Ecological Lens of Energy Flow: Using Next Generation Science Standards to Introduce PCK for Science Teaching</td>
<td>Columbia</td>
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<td>The Next Generation Science Standards clarify curricular goals, but fail to help teachers improve their awareness of student misconceptions. This presentation offers a strategy for identifying those misconceptions prior to engaging students in the NGSS, and guides the design of instruction to integrate pre-existing knowledge with new information. David C. Owens (Middle Tennessee State University)</td>
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<th>Experiential Session</th>
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<tr>
<td>T.A.L.E.S. Teaching and Learning with Engaging Stories</td>
<td>Medford</td>
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<td>Teaching And Learning through Engaging Stories (TALES) consist of the development of six standards-based, after-school modules that include engaging creative stories, weaving in earth and space science concepts, and associated NASA hands-on activities. The modules were distributed through local afterschool programs. Bernard B. Harris (College of Charleston) Cynthia Hall (College of Charleston) Shekina Patterson (College of Charleston) Megan Clark-Davis (College of Charleston) Willie McCray (College of Charleston)</td>
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<th>Experiential Session</th>
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<tr>
<td>Professional Teacher Learning Community as Induction Support for Novice STEM Teachers in High Needs Schools</td>
<td>Salon H</td>
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<td>During this session, presenters will discuss the importance of induction programs. While in attendance, you will have the opportunity to participate in a mock induction meeting. The presenters will facilitate a descriptive consultancy protocol. Induction programs can be utilized with teachers across multiple grade levels and content areas. Jacqueline T McDonnough (Virginia Commonwealth University) Molly A Madden (Virginia Commonwealth University)</td>
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<td>Town Hall Meeting</td>
<td>Salon A</td>
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### Themed Paper Set  
**Friday 1:30-2:30 PM**

**Salon I**

**Science and Mathematics Teacher Preparation: Successes and Lessons Learned from a UTeach Replication Site**

Since 2008, UTeach Arlington has grown into one of the largest UTeach replication sites in the country. UTeach Arlington recently graduated its first class of science and mathematics teachers. This session will share successes and challenges, as well assist universities in developing effective teacher preparation programs. Dr. David M. Sparks (University of Texas at Arlington) Dr. Lee-Ann Snell-Burke (University of Texas at Arlington) Dr. Ann Cavallo (University of Texas at Arlington) Dr. Ramon Lopez (University of Texas at Arlington) Dr. Karen Allmond (University of Texas at Arlington) Erin Gonzales (University of Texas at Arlington) Dr. Greg Hale (University of Texas at Arlington)

### Traditional Paper Set  
**Friday 1:30-2:30 PM**

**Eugene**

**Thread: Science Teacher Professional Development**

**Presider: Tammy Lee**

**Exploring Culturally Relevant Teaching and Learning in Science Classrooms**

Semi-structured interviews were conducted with a cohort of science teachers who implemented climate change curriculum in Native American schools. An interview protocol was designed to probe for culturally relevant teaching and learning practices which included inquiry, place-based, and interdisciplinary approaches. Anne Loyle-Langholz (University of Minnesota) Devarati Bhattacharya (University of Minnesota) Gillian H. Roehrig (University of Minnesota)

**From Awareness to Practice: Conceptualizing High School Science Teachers' Progression as Culturally Responsive Educators**

This study examined the process of becoming a culturally responsive science teacher while participating in the STARTS program. Six themes are discussed: awareness of CRP Science, views of students, community building, student repositioning, utilizing a toolbox, and instructional changes. Implications for teacher education are also shared. Julie C. Brown (University of Minnesota) Kent J. Crippen (University of Florida)

**Science Without Borders: Building Capacity for Culturally Responsive Pedagogies through International Immersion Experiences**

This position paper proposes a professional development model that integrates authentic inquiry with international cross-cultural immersion experiences. It is designed to enhance cultural sensitivity in science teachers with linguistically diverse student populations. A hybrid theoretical framework undergirds the design. Cheryl A McLaughlin (University of Florida) Claudia Grant (University of Florida) Kent J Crippen (University of Florida) Bruce J MacFadden (University of Florida)

### Traditional Paper Set  
**Friday 1:30-2:30 PM**

**Salon B**

**Thread: STEM Education**

**Presider: Meta Van Sickle**

**Building Multi-Institutional STEM Partnerships - Doing Together What We Cannot Do Alone**

This narrative case study examines a NSF-funded multi-institutional partnership focused on STEM teacher development. Six colleges/universities and one non-profit organization adopted a distributed
leadership model to form synergies and share resources in order to strengthen all aspects of the STEM teacher career pipeline in hi-need districts. Greer M. Richardson (La Salle University) Victor J. Donnay (Bryn Mawr) Sheila Rao Vaidya (Drexel University)

**STEM Inquiry Institute for School Leadership Teams: An Analysis of a year-long Professional Development Course for STEM Implementation.**
This study explored the impact of a year-long professional development course on helping schools to implement STEM and inquiry into twelve failing schools. Participants included the administrator, Implementation Specialist, and Master Teacher from each of the school leadership teams. Results indicate significant learning from participation in the David T Crowther (University of Nevada, Reno) Kazi Shahidullah (University of Nevada, Reno) Catherine Pozarski-Conolly (University of Nevada, Reno)

**The Creation and Validation of an Instrument to Measure School STEM Culture**
School STEM Culture is a culture within a school community defined as the beliefs, values, practices, resources and challenges in STEM fields as perceived by the students, parents, teachers, administrators and counselors within the school. This study seeks improve STEM culture by designing a reliable instrument which measures the construct. Chris White (Clemson University) Jeff Marshall (Clemson University)

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<th>Traditional Paper Set</th>
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<tr>
<td><strong>Thread: Science Teacher Professional Development</strong></td>
<td><strong>Presider: Brooke Whitworth</strong></td>
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**Conceptual Storylines: Another Dimension of Teachers' Understanding of the 5E Learning Cycle**
During this session, we share teachers' struggle to implement 5E Learning Cycle in the light of developing coherent conceptual storylines. We also present PD tools to help elicit their ability to recognize a coherent conceptual storyline within a 5E lesson sequence. Eun Ju Lee (University of Missouri, Columbia) Deborah L Hanuscin (University of Missouri, Columbia)

**Modeling in Life Science: Examining Middle School Science Teachers' Conceptions of Plant Processes**
Study examines middle school science teachers' (N=42) conceptions of plant functions and scientific modeling, and changes in related conceptions as a result of participation in a scientific modeling-based professional development initiative. Stephen Thompson (University of South Carolina)

**Nanoscale Science Professional Development: Using it in the Classroom**
Because the world of nanoscience covers so many different content areas, teachers are not comfortable in teaching it, are unsure where it fits in the curriculum standards, and don't often have the resources needed to fully integrate the concepts into the curriculum. Kania Greer (Georgia Southern University) Karen D. Chassereau (Georgia Southern University)
Coherent Science Learning for Future Elementary Teachers: Cross-Disciplinary Collaboration in STEM Education
We will describe our plan for the improvement of the science learning experiences of future elementary teachers through a set of explicitly connected, cross-disciplinary undergraduate courses. We will share our findings regarding improved enthusiasm for and competence in science teacher, and identify the impact of major components of the program. Frederick L Nelson (California State University, Fresno) Mara Brady (California State University, Fresno) Carol Fry Bohlin (California State University, Fresno) Fariborz Tehrani (California State University, Fresno)

Pre-Service Teachers' Understanding of NGSS Science Practices and their Ability to incorporate Science Practices in Science Teaching
Science practices form an integral part of science teaching as explained by Next Generation Science Standards. This study examines eleven pre-service teachers' understanding of science practices and ability to incorporate science practices in teaching science to upper elementary students Miriam Munck (Eastern Oregon University)

Improving At-Risk Students' Attitudes toward and Interests in Science and Science Instruction with Placed-Based Inquiry Instruction
This study examined attitudes of students with disabilities and those who are at-risk of failing school toward, and their interest in, science and science instruction when participating in either traditional or place-based structured inquiry science instruction. Study has implications for science teacher educators and special education faculty. Sarah J Watt (Miami University) Nazan U Bautista (Miami University)

Science Education for All: Using Video, Disciplinary Literacy and Other Research Base Strategies to Support Learning for all Students
This Inclusive Science Education Forum workshop will focus on building awareness of diverse learners, including students with exceptionalities, using film clips. The second part of this workshop will focus on strategies that support all students. Finally, we share how we guide teacher candidates to support all students using focal students. Michele J Koomen (Gustavus Adolphus College) Sharon Dotger (Syracuse University)
ASTE Board Leadership Workshop
The ASTE leadership workshop focuses on ways to become more leaderful in professional activities generally and specifically within ASTE. Requires advance purchase and reading of “The Five Dysfunctions of a Team” available through multiple online vendors.

Integrating the Use of Online Mobile Mapping Technologies to Engage Science Teachers and Students in STEM Learning
In this hands-on workshop, you will use online digital mapping, smartphones and tablets to create story maps. You will be introduced to geographic information systems (GIS) and global positioning systems (GPS) technologies. Each participant will receive information on how to incorporate these technologies into their pre-service or in-service teacher education courses. Rita Hagevik (The University of North Carolina at Pembroke) Patty Stinger-Barnes (The University of Tennessee) Cheryl Hagevik (Environmental Systems Research Institute)

Measuring Mastery of Both Practices and DCIs Using Hands-on Performance Assessment
Engage with a hands-on performance assessment task to assist candidates (and students) to develop concepts, understand scientific processes, relationships and natural patterns from empirical experiences. Implement this powerful set of resources in your science education courses. Encourage your beginning teachers to use this form of assessment. Deborah Tucker (Independent Science Education Consultant) Grant Gardner (Assessment Services, Inc.)

Impact of Project Lead The Way Professional Development on Teachers' Knowledge and Skills about Teaching Science
This presentation will overview a Project Lead The Way professional development program analyzing data from 59 High School science teachers designed to gain an initial understanding of changes in teachers' perceptions of their knowledge and skills for science teaching as a result of their professional development experience. Sarah J Pooler

Preparing Effective STEM Teachers for High-Needs Schools: Assessing the Impact of Noyce Professional Development Experiences on Beginning Teachers' Beliefs and Practices
This session reports on a professional development model created as part of a Noyce project and examines its impact on 25 secondary STEM teachers. A mixed-methods design was used to gather data about how the Noyce experiences shaped beginning science teachers' beliefs and practices, and attitudes about teaching science in a high-needs setting. John W. Tillotson (Syracuse University) Erica A. Layow (Syracuse University)
Preparing the Next Generation STEM Faculty for Indian Universities: The STEM Faculty Project Year One
This proposal reports on the first year of a collaborative international project between a US University and an Indian University to produce world class STEM faculty for Indian institutions and to promote STEM collaboration. The two year program combines both STEM research and pedagogical elements to prepare STEM PhDs for university teaching. Karen E. Irving (Ohio State University) Anil Pradhan (Ohio State University) Sultana Nahar (Ohio State University)

Traditional Paper Set Friday 2:45-3:45 PM Salon A

Thread: Science Teacher Professional Development Presider: Wayne Melville

How Does a Three-Year Technology-Infused Teacher Professional Development Program Impact The Science and Mathematics Achievement Scores of 2300 Students in Two Rural, High Poverty Middle Schools?
This 3-year mixed-methods study investigated the effects of technology-infused teacher professional development on 21 science and math teachers' beliefs and practices in two rural, high poverty middle schools. In addition, the math and science assessment scores for 2300 students were investigated based on contact with Project Teachers. Margaret R. Blanchard (North Carolina State University) Catherine E. LePrevost (North Carolina State University) Dell Tolin (North Carolina State University) Kristie S. Gutierrez (North Carolina State University)

Teachers as Leaders: Exploring the Venture/Vexation Activity in the Teacher Induction Network
This presentation outlines a comparison study that investigates the impact of Teachers as Leaders roles on interactions within a Venture/Vexation activity in TIN, an online program for new STEM teachers. Findings suggest an increase in group cohesion and higher-level depth of commentary as a result of the inclusion of Teachers as Leaders roles. Joshua A Ellis (University of Minnesota) Samuel J Polizzi (Kennesaw State University) Gillian H Roehrig (University of Minnesota) Gregory T Rushton (Kennesaw State University)

This Implies the Need for Further Content-Based Professional Development Opportunities for In-Service Teachers
The authors have characterized novice/expert behaviors of nine teachers attending an astronomy-based science professional development workshop. Data includes pre-/post-tests, activity artifacts, field notes, and interviews. Not all participants exhibited expert levels of content knowledge. Findings, conclusions, and implications will be discussed. Andria C. Schwortz (University of Wyoming, Quinsigamond Community College) Andrea C. Burrows (University of Wyoming)

Traditional Paper Set Friday 2:45-3:45 PM Salon B

Thread: Science Teacher Professional Development Presider: Sungho Kim

A Collaborative Professional Development Program for an Argument-Based Inquiry Teaching Approach
The theoretical framework, development, implementation, and evaluation of an ongoing PD program focused on the SWH teaching approach will be described. The unique way the PD has been built as a
collaboration between higher education faculty, in-service teachers at all levels and in all disciplines, and pre-service teachers will be highlighted. Mark A McDermott (University of Iowa) Mason Kuhn (Waverly-Shell Rock Community Schools) Brian Hand (University of Iowa)

Exploring the Challenges of Teachers' Implementation of Explanation and Argumentation
NGSS implementation can be daunting. We find teachers are struggling with understanding explanation and argumentation (NGSS SEP 6 & 7). Osborne & Patterson (2012) recently highlighted their concern that these two terms have been confounded. We'll share how experienced teachers struggle to implement these as part of a broader PD project. Donna L. Ross (San Diego State University) Meredith H Vaughn (San Diego State University)

Incorporation of Scientific Argumentation into Instruction: Results from a Professional Development for High School Teachers
The purpose of this presentation is to explain the goals, activities, and outcomes for a grant-funded professional development on argumentation for science teachers from rural high schools. Before the PD, the teachers associated argumentation with IV and DV, but came to understand argumentation as building knowledge from evidence and reasoning. Erin E. Peters-Burton (George Mason University)

Meeting the Demands of Science Reforms: Comprehensive Professional Development for Practicing Middle School Teachers
This study describes how inservice middle school science teachers were impacted by a professional development program that included a science education graduate degree, other experiences, and a reform-based curriculum that incorporated effective instructional practices and the three dimensions outlined in reform document. Rose M. Pringle (University of Florida) Jennifer C. Mesa (University of West Florida) Natalie S. King (University of Florida)

Supporting Teachers' Implementation of the Next Generation Science Standards
To support the implementation of the Next Generation Science Standards, K-8 teachers explore science through pedagogies such as the Science Writing Heuristic, concept mapping, and the nature of science activities. This presentation will provide an overview of the three year project and present preliminary findings from year one. Kathryn A Baldwin (Eastern Washington University) Olusola Adesope (Washington State University) Georgia Boatman (Washington Educational Service District 123) Andy Cavagnetto (Washington State University) Chad Gotch (Washington State University) Judith Morrison (Washington State University-Tri Cities) James C Marr (Washington State University)

The Effect of Professional Development on Elementary Science Teachers' Understanding and Classroom Implementation of Reforms-Based Science Instruction: A Randomized Controlled Trial
This study used a cluster randomized controlled trial design to characterize changes in elementary teachers' reforms-based science instruction following participation in a state-wide professional development program. Treatment teachers' understandings and implementation of reforms-based
instruction were significantly greater than control teachers. Jennifer L. Maeng (University of Virginia) Randy L. Bell (Oregon State University) Brooke A. Whitworth (Northern Arizona University)

**Traditional Paper Set**  
**Friday 2:45-3:45 PM**  
**Salon D**

**Thread: Preservice Science Teacher Preparation**  
**Presider: Julianne Wenner**

*At the intersection of Science Inquiry and Teacher Inquiry: A preservice teacher's journey to becoming an inquiry-based Elementary Science Teacher*

This case study examined a preservice teacher's journey to becoming an inquiry-based elementary science teacher after completing a science methods course and seminar encouraging the use of teacher inquiry. The study seeks to understand "In what ways does teacher inquiry support the development of preservice teachers' inquiry-based practices?" Yvonne Franco (University of South Florida)

**Elementary Pre-Service Teachers Field Experience in a Science Museum**

This study investigated how field experiences in a science museum impacted pre service teachers' perceptions about teaching science. Findings have implications for teacher preparation programs designing field experiences that help pre service teachers to modify their perceptions about science teaching and improve science teaching self efficacy. Lori Petty (University of Mary Hardin Baylor) Ratna Narayan (University of North Texas Dallas)

**The Impact of Support Networks within an Elementary Science Teaching Field Placement**

This study investigated how support during field experiences impacts instruction. Comparisons were made between two placement conditions: isolated and support network using the Local Systemic Change Classroom Observation Protocol (LSC-COP). MANOVA results show significantly higher LSC-COP scores for the support network group & large effect sizes. Jerrid W. Kruse (Drake University) Jesse L. Wilcox (Grand View University) Neil Patel (Drake University) Colin Seebach (Drake University)

**Traditional Paper Set**  
**Friday 2:45-3:45 PM**  
**Salon H**

**Thread: Student Learning P-12**  
**Presider: Jeni Davis**

*Communicating Evolution to the Public: A Communicative Approach to Controversial Science Instruction*

We examine how students communicate evolution to the public (students' images and word choices). Our findings illuminate the varied ways that students discursively frame this topic (metaphorically, symbolically, monologically, and dialogically) and highlight the benefits of integrating public communication into controversial science instruction. Alandeom W. Oliveira (State University of New York at Albany) Kristin L. Cook (Bellarmine University)

*The Comparison of a Technology Rich Explanation Phase as compared to a Traditional Text Based Explanation Phase within a Fourth Grade STEM Unit of Instruction*

This study investigates the difference in student learning in a fourth grade STEM unit of instruction with a comparison of the explanation phase of the learning cycle between a traditional textbook
approach to a web-based technology application. Results demonstrate that a technology rich explanation phase not only extends interest in learning, but improves post test content scores. Alicia Klaich (University of Nevada, Reno & Washoe County School District) David T Crowther (University of Nevada, Reno)

**Traditional Paper Set**  
**Friday 2:45-3:45 PM**  
**Salon I**

**Thread: Policy and Reform**
**Presider: Camille Stegman**

**Elementary Science Left Behind**
Since the passage of NCLB time allocated to science instruction at the elementary level has decreased. This study provides data indicating that the drop may be more precipitous than originally thought. Elisebeth S Boyer (The Ohio State University)

**Science to School to Science Again: Second Career Science Teachers’ Reflections on the NGSS Science Practices**
Due to their professional experiences in science careers as well as in science classrooms, much may be learned from the exploration of second career science teachers’ classroom practices and perceptions. This study investigated this group for their perspectives on the NGSS and related classroom practices. Allison Antink Meyer (Illinois State University) Ryan Brown (Illinois State University)

**Sustaining or Diffusing Elementary Science Education Reform after Two Years**
This study returns two years after 48 elementary school teachers participated in an intensive year-long science professional development program. We explore their successes and struggles in implementing reform-based pedagogies since the year of professional development, given the varying contexts in which these teachers teach science. David E Long (George Mason University) Susan Poland (George Mason University) Andrew Keck (George Mason University)

**Regional Meeting**  
**Friday 4:00-5:00 PM**

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<th>Region</th>
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<td>Southeast Region</td>
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<td>Northwest Region</td>
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<td>International Region</td>
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**WISE DINNER**  
**Friday 6:00-8:00 PM**  
**Hotel Lobby**
SATURDAY JANUARY 10

**BREAKFAST**  Saturday 7:00-8:30 AM  Salon E-F

<table>
<thead>
<tr>
<th>Embedded Workshop</th>
<th>Saturday 7:45-9:45 AM</th>
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| It’s Debatable! Using Socioscientific Issues (SSI) in Science Methods Courses to Promote K-12 Scientific Literacy.  
During this interactive workshop, participants will learn how to incorporate controversial socioscientific issues (SSI) into their methods courses so that their students can plan, deliver, and assess SSI curricula in their own classrooms. Participants will receive a copy of the presenters’ book, It’s Debatable!, as well as additional supporting materials. Sami Kahn (University of South Florida) Dana L. Zeidler (University of South Florida) |

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<tr>
<th>Experiential Session</th>
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| NASA’s Space Forensics: Integrating Storytelling into STEM Education  
NASA’s Space Forensics curriculum takes students in formal and informal education settings through astronomy problem-solving narratives and activities that parallel crime scene forensics. Explore hidden black holes, learn about the fusion of STEM and storytelling, and depart with resources that you can immediately use with students in grades 7-12. Sara E. Mitchell (Syneren Technologies & NASA Goddard Space Flight Center) Sarah Eyermann (Syneren Technologies & NASA Goddard Space Flight Center) |

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<th>NTLI Meeting</th>
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<tr>
<th>Embedded Workshop</th>
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| Graduate Student Workshop—Surviving Graduate School  
This session will address topics pertinent to graduate students in their early years of study and those in the midst of finding their dissertation topic. Viewpoints of a graduate school professor, a recent graduate and a student in their third year will give insight and advice on how to successfully conquer the challenges of higher education. Elizabeth M. Klammer (Texas Tech University) Lori Ihrig (The University of Iowa) Deborah L. Hanuscin (University of Missouri) |

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<tr>
<th>Small Group Roundtable</th>
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| A Collaborative Student-Authored Book as a Doorway to Environmental Stewardship  
This study explored how student-authored books were implemented in an environmental education summer camp and what impacts it had relative to other program activities. The book used text and art from the 9th grade, urban participants to form a story about pollution in the Chesapeake Bay and how citizens could address it. Daniel L Dickerson (Old Dominion University) William McConnell (Old Dominion University) Laura Nelson (Portsmouth Public Schools) |
Strategy for Obtaining and Standardizing Ethnoscience Information for use in the Teaching and Learning of Science
Prior cultural knowledge influences science learning negatively where differences exist between learners' everyday life and the world of science. A solution to this requires a collection of science-related cultural beliefs and common verbal expressions. This paper therefore offers a standard format needed for this in Ethnoscience instruction. Rasheed A. FASASI (University of Ibadan, Nigeria)

A Collaborative Self-Study on Co-Teaching an Integrated STEM Methods Course
A science and a math teacher educator conducted a collaborative self-study while co-teaching an integrated STEM methods course to improve their practice and understanding of teaching integrated STEM, as well as how to facilitate K-12 teachers' development in this domain. Xinying Yin (California State University-San Bernardino) Catherine Spencer (California State University-San Bernardino)

Age-related Differences Among Citizen Scientists in Nature of Science Views and Attitudes toward Science and the Environment
The Vanishing Firefly Project is a citizen science project asking participants to engage in an annual census of fireflies. The purpose of this exploratory study is to examine age-related differences among our citizen scientists in terms of their nature of science views and their attitudes toward science and the environment. Michelle Cook (Clemson University) Renee Lyons (Clemson University) Alex T. Chow (Clemson University) Juang-Horng Chong (Clemson University) David White (Clemson University) Roy Pargas (Clemson University)

Where Do I sit? Using Grouping Strategies in an Intermediate Science Class
"How should I group students in my science class?" This presentation focuses on an Action Research project where 5th grade science students are separated into homogeneous or heterogeneous groups based on their 4th grade ISAT science scores. Which students scored better on the post-test? Shannon Phillips (Illinois Institute of Technology)

Themed Paper Set Saturday 8:00-9:00 AM Salon A
Designing and Assessing Science Field Experiences in Teacher Education
We share in this themed paper set session 4 different programs' efforts to design and implement science field experiences that support preservice teachers. Our efforts pull from 4 different institutions, 3 focus on elementary science teacher preparation and 1 on secondary science teacher preparation. Paula A Magee (Indiana University - Indianapolis) Tina Cartwright (Marshall University) Deb Hemler (Fairmont State University) Aimee Govett (East Tennessee State University)

Traditional Paper Set Saturday 8:00-9:00 AM Salon B
Thread: Science Teacher Professional Development Presider: Richard Hechter
Convincing Science Teachers for a Practical Change towards Inquiry-Based Instruction: Revisiting Guskey's Staff Development Model
In this session, we investigate the influence of a one-year professional development program emphasizing implement inquiry-based instruction on science teachers' behavioral and affective
changes, and their students' achievement. We also examine the link between those variables for a teacher change model in science education. Vecihi S Zambak (Clemson University) Daniel M Alston (Clemson University) Jeff C Marshall (Clemson University) Andrew M Tyminski (Clemson University)

**Evaluating the use of Chemistry Representations in Teacher-Developed Activities**
This study assessed the reliability of an observation protocol Representations in Chemistry Instruction (RICI), compared how secondary teachers and researchers used the RICI to evaluate the use of representations in chemistry lessons, and examined how teachers changed their practice over the first year in an intense professional development program Stephanie B Philipp (Miami University) Ellen J Yezierski (Miami University)

**The Intersection of Formal and Informal Science Education: Development, Motivations, and Contributions of Amateur Astronomers and Birder Hobbyists**
In depth interviews were conducted with amateur astronomers and birders. Results showed that the importance of early hobby experiences, and influence of significant others and informal and formal educational experiences on the development of the hobby. Differences by gender and motivations of astronomy and birding hobbyists are described. M. Gail Jones (NC State University) Tom Andre (Iowa State University) Gina Childers (NC State University) Elysa Corin (NC State University) Rebecca Hite (NC State University)

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<th>Traditional Paper Set</th>
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<tr>
<td><strong>Thread:</strong> Preservice Science Teacher Preparation</td>
<td>Presider: Maria Ferreira</td>
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<td><strong>Preservice Teachers' Images of Engineers: Preliminary Investigations</strong></td>
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<td>Perceptions of science and engineering likely influence learning and teaching science. I examined 65 preservice teachers' images of engineers using an adaptation of the Draw-A-Scientist Test. Frequently portrayed: males wearing hard hats, boots, glasses, and iron rings, working alone at mental rather than physical tasks, with bridges and buildings. Christine D Tippett (University of Ottawa)</td>
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<td><strong>Prospective Secondary Teachers' Conceptions of Teaching Biology</strong></td>
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<td>This presentation reports a study that investigated prospective biology teachers' conceptions of teaching biology and how these conceptions revealed their strategies for helping their future students' learning of biology. Karthigeyan Subramaniam (University of North Texas) Dr. David Wojnowski (Jarvis Christian College)</td>
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<td><strong>Understanding Evolution: Exploring Acceptance and Rejection in the Southeastern United States</strong></td>
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<td>Somewhere between university studies and entry into the classroom, pre-service teachers make important choices regarding how, or if, they will teach evolution. Understanding this process is imperative to bridging the gap between the public and scientific sectors regarding the unifying concept of biology. Amanda L Glaze (Jacksonville State University) M. &quot;Dee&quot; J. Goldston (The University of Alabama)</td>
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Metaphors for Student and Teaching in an Elementary Science Methods Course
This study examines metaphors of pre-service elementary teachers in a science methods course providing insight into their beliefs. Qualitative data were gathered focusing on metaphors for students and teaching and showed a preference for traditional instruction and models of student learning inconsistent with the goals of K-6 science education. Michael T Svec (Furman University)

Teaching Pre-Service Teachers Disciplinary Literacy through Popular Fiction
The overall goal for this study is to discern affordances of using popular fiction to connect aims of science-specific content and process standards in the areas of reading, writing, speaking, listening, and critical thinking. Findings indicated a need for writing instruction and practice during preparatory science methods. Kristin L Cook (Bellarmine University) Elizabeth Dinkins (Bellarmine University)

The Role of Journal Clubs in Pre and Inservice Teacher Education
This paper reports on a study of a journal club constructed as a community of practice in which pre and inservice teachers learned to critique and analyze peer-reviewed science education articles in the context of their practice. This helped them learn to examine data outside the context of the study and connect it to their teaching situation. Karen A Tallman (University of Massachusetts Amherst) Allan Feldman (University of South Florida)
## Critical Praxis: Situating Thinking and Practice in a STEM Afterschool Program
This study examined five cohorts of preservice teacher's reflections about their developing practice as they collaboratively engaged in iterative cycles of enactment in an afterschool STEM program as part of their elementary science methods course. SueAnn I. Bottoms (Oregon State University) Kathryn M Ciechanowski (Oregon State University)

## Practice-Based Teaching: Fostering Equity through Discourse in Secondary Science Urban Classrooms
This study provides insights into how a teacher education program has bridged theory and practice tied to science discourse. The study includes various modes of data collection including classroom observations, a discourse assignment and instructional logs. Preliminary data suggest a positive support of discourse enactment in k-12 classroom practice. Imelda L. Nava (UCLA)

## Supporting Pre-Service Science Teachers' Pedagogical Design Capacity for Planning Task-Based Classroom Discussions
This study focuses on a set of core practices in science teacher education that supports pre-service teachers in developing a set of necessary skills to successfully support student science learning. Teacher educators adopted a practice-based focus where students participated in core practice of engaging students in task-based science discussions. Danielle K Ross (Northern Arizona University)

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## Embedded Workshop | Saturday 8:00-10:00 AM | Eugene

### Using Hands-on Performance Assessment in K-12 Classrooms: Assessing Student Mastery of Both the Science Practices and DCIs
“... integration of the dimensions results in greater student understanding of science, therefore the NGSS reflect that and the assessment will need to as well.” (Stephen Pruitt). Science educators use and model multiple assessment strategies. Engage with a hands-on performance assessment task. Encourage your beginning teachers to use this form of assessment. Deborah Tucker (Independent Science Education Consultant) Grant Gardner (Assessment Services, Inc.)

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## Oversight Committee Meeting | Saturday 9:15-10:15 AM | Willamette

## Embedded Workshop | Saturday 9:15-10:15 AM | Portland

### Graduate Student Workshop—Understanding the Professoriate and the Experiences of a New Professor
This session will address topics pertinent to graduate students looking for faculty positions in science education—the professoriate, and the experiences of a new professor during his first years on faculty
at an institution with very high research activity. Also join us for Part 1 of this workshop focusing on the job market, creating CVs, and the interview process. Ryan Walker (Mississippi State University) William F. McComas (University of Arkansas)

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<th>Roundtable</th>
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**Bringing Together the NGSS, EdTPA And Science Teacher Preparation: A Roundtable with Seasoned Implementers**

The presenters will share their experiences implementing edTPA with pre-service science teachers in middle and secondary settings. Topics for further discussion include alignment with the NGSS, support for science credential candidates completing edTPA, and potential challenges and opportunities as implementation continues. Larry Horvath (San Francisco State University) Erica Brownstein (The Ohio State University) Andrea Whittaker (Stanford Center for Assessment, Learning and Equity)

**From STEM to STEAMD: Designing a Program for Science Education and Social Justice in the Neoliberal Era**

This paper describes a teacher education program focused on social justice and science education that challenges the neoliberal reforms emphasizing global competitiveness. The program focuses on democracy as a counter to the human capital emphasis in reforms like STEM. Problems with the program are also discussed as an invitation to feedback. Matthew Weinstein (University of Washington-Tacoma)

**NOS and Elementary Teachers: Do Teaching Changes persist Eight Years after Prolonged Professional Development?**

In 2003 to 2006 sixteen K-6 teachers participated in a Nature of Science (NOS) professional development. Eight years later, nine teachers completed an online survey including the VNOS-D2 and five completed in-depth interviews. Teachers were still teaching NOS, continued to struggle with misconceptions, and fought to keep science in the curriculum. Theresa A Cullen (University of Oklahoma) Valarie L Akerson (Indiana University)

**Storytelling Podcasts to Teach Academic Language and Content in Biology**

We will discuss a project in which faculty and teacher candidates work together to write and produce audio podcasts with a focus on telling stories about biology and its relationship to everyday life. Teacher candidates design "Teacher’s Guides " for podcasts emphasizing the academic language that is used as well as the disciplinary core ideas. Jennifer K Frisch (Kennesaw State University) Brendan Callahan (Kennesaw State University) Neporcha T Cone (Kennesaw State University) Paula C Jackson (Kennesaw State University)

**The edTPA: Successes and Challenges for Pre-service teachers at the University of Wyoming**

The presenters reviewed data from 2 years of Science Methods edTPA completion and scoring, and found patterns of success and areas of challenge for science pre-service teachers. Discussion about ways to address the successes and challenges of the edTPA are encouraged. Overall findings, conclusions, and implications will be discussed. Andrea C. Burrows (University of Wyoming) Jason M. Katzmann (University of Wyoming)
Ways to Include Global Climate Change in Science Courses for Prospective Teachers
After a brief summary of a case study of student learning about global climate change in an undergraduate physics course for prospective teachers, participants will engage in a collaborative conversation about ways in which they are including, or anticipate including, global climate change in their courses and documenting student learning. Emily H van Zee (Oregon State University) Deborah Roberts-Harris (University of New Mexico)

Traditional Paper Set  Saturday 9:15-10:15 AM  Medford
Thread: Curriculum, Pedagogy, and Assessment  Presider: Frederick Nelson

Model of Students' Reasoning about Matter across Disciplines and Its Implications for Methods Course
We developed a model that describes high school students' reasoning about matter across core ideas in life sciences and physical sciences. Using this model, we examined the consistency of students' reasoning. We also show how such models can be used to help pre-service teachers understand learning of crosscutting concepts across disciplines. Cathy E Mehl (The Ohio State University) Hui Jin (The Ohio State University)

Chemistry Teachers' Perceived Benefits and Challenges of Inquiry-based Instruction in Inclusive Chemistry Classrooms
This study explored high school chemistry teachers' perceived benefits and challenges of inquiry instruction in inclusive chemistry classes. While most teachers acknowledged that inquiry instruction in inclusive chemistry classes has several benefits and challenges to students, many believed there were more challenges to them than their students. Frackson Mumba (University of Virginia) Asiana Banda (Southern Illinois University Carbondale) Vivien M. Chabalengula (University of Virginia) Nathan Dolenc (University of Virginia)

Scrutinizing the Position of a Teacher in Argumentation in a High School Physics Classroom
This case study was aimed at understanding how a physics teacher perceived argumentation innovations with the positioning theory. A model of argumentation was constructed to explain the incompatibility between authentic argumentation between scientists and argumentation in schools. Finally, I suggested a school-friendly pattern of argumentation. Jianlan Wang (Indiana University)

Traditional Paper Set  Saturday 9:15-10:15 AM  Salon A
Thread: Mixed  Presider: Jeffrey Carver

Conceptualization of Epistemic Orientations toward Teaching Science
This study aims to identify core elements of Epistemic Orientation of Teaching Science (EOTS) that impact instructional practices and to understand in what ways these core elements of EOTS are related to epistemological, social and physical dimensions of scientific practice. Jee Kyung Suh (University of Iowa) Soonhye Park (University of Iowa)
Drawing Scientists Together: Science Instructors' Conceptions of Art and Perceived Barriers to Constructing and Implementing Visual Data in Science Classrooms
We probed instructors' opinions of graphic construction within science classrooms through a focus group (N=6) led by a science illustrator. After graphic construction sessions, instructors listed advantages of visual storyboarding, identified growth areas, and predicted classroom impact. Results indicate brief sessions impact teachers' perceptions. Renee M Clary (Mississippi State University) Ryan Walker (Mississippi State University) John Paul Remo (scientific illustrator)

Preservice Teachers Learning to attend to Student Thinking: The Use of Video Reflection within a Community of Practice
This study explores how preservice elementary teachers' participation in a content-specific moderated, video-based community of practice developed their attention to students' thinking, thus impacting their "in the moment" instructional decision-making and their views about their future science teaching. Susan R Hawkins (Indiana University) Meredith A. Park Rogers (Indiana University)

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Traditional Paper Set Saturday 9:15-10:15 AM Salon B

| Thread: Science Teacher Professional Development | Presider: Lisa Gross |
| Changing Classroom Practice: Lessons Learned from Professional Development Program Integrating Language Arts for Elementary Teachers |
| This presentation examines the lessons learned from a four-year professional development geared towards changing practices of elementary teachers. Teachers were able to integrate journals and inquiry lessons into their science teaching. Key factors included increase in self-efficacy, inclusion of literacy, and using Community of Practice format. Deborah L Hanson (Hanover College) |

Making School and Science Useful
NGSS requires new instructional skills that teaching science discourse practices. Discourse fluency means connecting some science content to students’ everyday living and how they value education in relation to their future. Interviews two years post-instruction suggest categories of student thought useful to science discourse practices. Micki Halsey Randall (Oregon State University) Larry Flick (Oregon State University)

The Influence of a K-5 Science Endorsement on the Professional Knowledge Bases of Elementary Teachers
Findings from a mixed methods study of the influence of a K-5 science endorsement on the professional knowledge bases that inform the PCK of elementary teachers will be presented. The session will focus on how a self-efficacy survey was integrated with a cross-case analysis of six participants to make assertions about the influence of the program. Donna J. Barrett (Georgia State University) Anton S. Puvirajah (Georgia State University) Lisa M. Martin-Hansen (California State University Long Beach)
### Traditional Paper Set | Saturday 9:15-10:15 AM | Salon C
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**Thread: Preservice Science Teacher Preparation** | **Presider: Judith Morrison**

#### Teaching in the Field: What Teacher Professional Life Histories Tell about how They Learn To Teach in the Outdoor Learning Environment
The purpose of this study was to investigate the narratives of the professional life histories of upper elementary teachers who facilitate effective science teaching both within the classroom and in the OLE that through thematic analysis to reveal how pre- and in-service development helped teachers construct understandings of OLE instruction. Kelly Feille (University of North Texas)

#### The Effect of Pre-Service Elementary Teacher Participation in Citizen Science Project on Efficacy, Beliefs, and Perceptions of Teaching Science
Elementary teacher lack self-efficacy for teaching science resulting in apprehension related to engaging their student to science instruction. The purpose of this design study is to evaluate the effectiveness of participation in a Citizen Science Project to improve self-efficacy, beliefs, and perceptions about science teaching. Cindy L Kern (University of New Haven)

#### Transforming Science Teaching Identities: Lessons Learned from Preservice Elementary Teachers in a Science Concentration
We interviewed 20 preservice elementary teachers (PETs) enrolled in an elementary science concentration (ESC). As students reflect on their past science experiences and their experience in the science concentration, they provide insight to how discipline-specific methods courses can transform the way that they think about science teaching. Megan L. Garner (East Carolina University/ Graduate Student) Tammy D Lee (East Carolina University) Meredith G Weaver (Howard University)

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### Traditional Paper Set | Saturday 9:15-10:15 AM | Salon D
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**Thread: Preservice Science Teacher Preparation** | **Presider: Kimberly Lott**

#### A Learning Progression Depicting How Preservice Elementary Teachers Construct Their Ideas about Energy
This study reports on our work of an initial learning progression on how preservice elementary teachers form their ideas about the concept energy. University students participated in the study where data was extracted through scenarios about energy. The results have implications to potentially foster change in teacher preparation programs. Channa N Barrett (Texas Christian University) Jingjing Ma (Texas Christian University)

#### Bridging the Gap between Theory and Practice in an Alternative Certification Program
Teaching as a clinical profession is leading to alternative teacher certification programs such as urban teacher residency models (UTRs). Central to the clinical model is the blending of coursework with clinical experiences or what some refer to as developing a hybrid or third space. Maria M. Ferreira (Wayne State University)

#### Pre-service Elementary Teachers' SMK through Literature-Rich Instruction
The purpose of the study was to assess pre-service elementary teachers' subject matter knowledge including the nature of science (NOS) when a multiple genre text set was explored, unconventionally
beginning with folklore and sequentially ending with fact-based information books. Krista L Adams (University of Nebraska-Lincoln) Kathy Phillips (University of Nebraska-Lincoln)

### Challenges and Advantages of Collaborative Small Group Work during Inquiry-Based Science Laboratory Activities

Study examines small group work in three 9th grade science classes suggesting successful group work and science learning when students collectively construct a triple problem solving space: attending/developing "content space" (problem to be solved), "relational space" (social interactions in group), and "affective space" (emotional life of group). Martina Nieswandt (University of Massachusetts Amherst) Elizabeth H. McEneaney (University of Massachusetts Amherst) Renee Affolter (University of Massachusetts Amherst)

### Effective, Sustained Inquiry-Based Instruction Promotes Higher Science Proficiency among All Groups: A Five-Year Analysis

This study analyzes a five-year inquiry-based instruction intervention designed to: (a) transform teacher practice, (b) improve student achievement, and (c) narrow the achievement gap. Significant gains for all student groups were noted and a narrowing of the achievement gap of minority students relative to Caucasian students was seen. Jeff C Marshall (Clemson University) Daniel M Alston (Clemson University)

### The Effects of Inquiry-Based Teaching Approaches Compared to Traditional Textbook Science Instruction

This presentation will discuss research comparing the effects of inquiry science education and textbook-only science instruction on fourth-graders' long-term content knowledge retention. The importance of inquiry education will be discussed in light of the Common Core State Standards and the Next Generation Science Standards. Deanna LeBlanc (University of Nevada, Reno & Lyon County School District) David T Crowther (University of Nevada, Reno)

### Academic Language Supports in Elementary Science Instruction

Schools require students to use language in ways that for many students are different than how they use language at home. This study investigates how an elementary education teacher candidate supported student academic language use during science instruction, related to the requirements of the edTPA. Karl G Jung (University of Minnesota)

### Learning to Notice Students' Understanding through the Examination of Student Work

In this session, we will examine studies of elementary preservice teachers' ability to notice evidence of learning while teaching in a first grade classroom as well as their ability to notice after professional development on the collaborative examination of student work. Wendy P. Ruchti (Idaho State University)
Preservice Science Teachers' Argumentation and Scientific Reasoning
In this study, investigate how a physical modeling activity promotes the teachers' argumentative practice around the given socio-scientific issue. The results show that the experience of manipulating variables in a physical model helped the pre-service science teachers improve the content and quality of argumentative practice. Younkyeong Nam (The College at Brockport - State University of New York) Ying-Chih Chen (Arizona State University) Gillian Roehrig (University of Minnesota)

Embedded Workshop Saturday 9:45-11:45 AM Columbia
Coaching College Instructors in Teaching and Learning
The aim of the workshop is to brainstorm how to support and coach college instructors in a non-intimidating fashion. The Brown model which is based in over 250 instructor observations will be presented and discussed. In the last hour participants will design their own professional development model for college instructors. Esther L. Zirbel (Brown University) Milijana Suskavcevic (Houston University)

Equity Committee Meeting Saturday 10:30-11:30 AM Willamette

Small Group Roundtable Saturday 10:30-11:30 AM Salon G
Defining and Measuring Pedagogical Content Knowledge: Piloting Environmental Science Scenarios with Elementary Teachers
Participants at this Roundtable will be engaged in a discussion about Pedagogical Content Knowledge (PCK) and challenges associated with articulating and measuring topic-specific PCK. The context for this discussion will focus on environmental science-related prompts that were embedded into a summer professional development course. Sybil S. Kelley (Portland State University/Educational Leadership & Policy) Emily Saxton (Portland State University) Dilafruz R. Williams (Portland State University)

The Next Generation STEM Classroom Professional Development: A Teacher Lead Model for Best Practice in Inquiry Based Elementary Science Teaching
The Next Generation STEM Classroom Project offers a new model of professional development for science teachers as they shift their instruction to meet the needs of the Next Generation Science Standards. In a study of this project, participants rate it very highly and indicate a need for additional training. Patricia Bills (Northern Kentucky University) Madhura Kulkarni (Center for Integrative Natural Science and Mathematics) Reeda Hart (Center for Integrative Natural Science and Mathematics) Carrie Holloway (Center for Integrative Natural Science and Mathematics)

Developing Pedagogical Content Knowledge through the Evaluation and Discussion of Science Teaching Resources within an Online Social Bookmarking Forum
This presentation will discuss an assignment developed for a course focused on pedagogical content knowledge (PCK) in the life sciences, in which students' applied their developing PCK to the evaluation and discussion of science teaching resources through an online social bookmarking forum. Data on
the assignments' effectiveness will be shared. Jerine M Pegg (University of Alberta) Garrick Burron (University of Alberta)

**Science Teacher Professional Growth from Collaborative Curriculum Design**
How can we maximize teacher change and growth in a weeklong professional development experience? This presentation describes the impacts of a highly selective and popular science curriculum development summer institute on secondary biology teachers' professional learning. Dina Drits-Esser (University of Utah) Louisa A. Stark (University of Utah)

**Teaching to reach Rural Science Educators: A Study on Continuous Professional Development**
This study on how teachers acquire PCK through science professional development suggests emergent themes and a theory on the development of physics and physical science teachers' PCK. A spiral model of acquisition is suggested from the study. Implications may be of interest to those implement science professional development in rural areas. April A Nelms (University of North Georgia) Dennis W Sunal (University of Alabama) Cynthia V Sunal (University of Alabama)

**We-Teach: Revising Undergraduate Science Teacher Education at the Convergence of CAEP, UTeach, and edTPA**
This roundtable focuses on a program revision that occurred at the program level due to changing accreditation factors and a merger with a polytechnic university. Topics such as the process of program revision, the reasoning behind adopting an UTeach model, and resolution of the perceived shortcomings in the UTeach model will be discussed. Brendan E Callahan (Kennesaw State University) Michelle L Dean (Kennesaw State University) Michael Dias (Kennesaw State University) Jennifer K Frisch (Kennesaw State University) David Rosengrant (Kennesaw State University)

**Themed Paper Set**
**Saturday 10:30-11:30 AM**

**Using Visual Data to Investigate K-6 Pre-service Teachers' Science Content Knowledge, and Instructional Practices**
This presentation reports on the use of visual data, specifically drawings, to assess pre-service teachers' science content knowledge, and instructional practices. The purpose of this paper set is to bring together researchers of four studies who have used visual data, specifically drawings, to investigate and assess two phenomena: (1) pre-service Pamela Harrell (University of North Texas) Karthigeyan Subramaniam (University of North Texas) David Wojnowski (Jarvis Christian College) Sumreen Asim (University of North Texas) Benjamin Kirby (University of North Texas) EunYoung Lee (University of North Texas)

**The Smithsonian's 'Teaching Evolution through Human Examples' project**
The Smithsonian's "Teaching Evolution through Human Examples" project developed and tested curriculum supplements and a Cultural and Religious Sensitivity (CRS) teacher strategies resource focusing on positive classroom dialogue that increased teacher and student comfort in teaching and learning evolution and students' understanding of evolution. Briana Pobiner (Smithsonian Institution (National Museum of Natural History) Constance Bertka (Science and Society Resources) Paul Beardsley (Cal Poly Pomona) Bill Watson (Diocese of Camden Office of Catholic Schools)
**Thread: Science Teacher Professional Development**

**Presider: Margaret Blanchard**

**Learning to Teach Inquiry through Reflection on Practice**
We explored middle school teachers' learning of inquiry strategies through reflection on practice-teaching sessions during a student enrichment program. We collected and analyzed teachers' oral and written reflection sources, focusing on teachers' reflection levels and themes to learn how they used practice-teaching to guide their instruction. Christine Lotter (University of South Carolina) Cory Miller (University of South Carolina)

**Reflection Writing: A Tool for Understanding Teacher's Perspectives on Long Term Professional Development**
Reflective prompts were created to capture teacher change during a two-year PD program. Through the analysis of responses, we describe changes in teacher perceptions of how they develop as professionals and their perceptions of their roles as professional educators. The results are explored at the individual and project level, as well as over time. Jenesta R Nettles (Texas Christian University) Kelly K Feille (University of North Texas) Molly H Weinburgh (Texas Christian University)

**Using Teachers' Voices to Inform Professional Development on Science Teacher Leadership**
We explored the responsibilities, supports, and needs of science teacher leaders (STLs) in schools that have been successful in closing science achievement gaps, so as to inform the design of an STL professional development (PD) program. Our findings indicate that STL PD should go beyond instructional leadership in order to fully support STLs. Julianne A Wenner (University of Connecticut) Tonjua B Freeman (University of Central Florida)

<table>
<thead>
<tr>
<th>Traditional Paper Set</th>
<th>Saturday 10:30-11:30 AM</th>
<th>Salon A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread: Science Teacher Professional Development</td>
<td>Presider: Karen Chassereau</td>
<td></td>
</tr>
</tbody>
</table>

**Critical Factors Impacting the Role of a District Science Coordinator**
This sequential explanatory mixed-methods study explored the professional responsibilities of district science coordinators, their professional development, and the relationship between their role, responsibilities, district context, and background. Brooke A Whitworth (Northern Arizona University) Jennifer L Maeng (University of Virginia) Lindsay B Wheeler (University of Virginia) Jennifer L Chiu (University of Virginia)

**Science Teacher Attitudes toward Inquiry-Based Teaching and Learning**
The purpose of this study was to determine teachers' attitudes, values and beliefs about inquiry. The participants of this study were 275 middle grades and secondary science teachers from four districts in North Carolina. Issues such as class size, accountability, time, curricular demands and classroom management are perceived as constraints. Warren J DiBiase (UNC Charlotte) Judy McDonald (Belmont Abbey College)

**The Role of Alternative Certification Programs in Teacher Induction: Understanding the Needs of Newly Hired Alternatively Licensed Science Teachers in Louisiana**
Nationwide, alternative certification programs address teacher shortages in key areas, including
science. In Louisiana, this is no different. The purpose of this study is to describe the induction supports provided to newly hired alternatively licensed science teachers, focusing on the role of alternative certification programs in induction. Angela W Webb (Louisiana State University)

<table>
<thead>
<tr>
<th>Traditional Paper Set</th>
<th>Saturday 10:30-11:30 AM</th>
<th>Salon B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread: Science Teacher Professional Development</td>
<td>Presider: Andrea Burrows</td>
<td></td>
</tr>
</tbody>
</table>

**Changes in Teachers' Beliefs about Reformed Science Teaching and Learning and Practices Concerning Inquiry-Based Instruction**

This study investigates the extent to which teachers' beliefs about reformed science teaching and learning and classroom practices concerning inquiry-based instruction changes following participation in a year-long RET-PLC professional development program. The findings of this study can help to inform teacher education and professional development. Rommel Miranda (Towson University) Julie Damico (Towson University)


Grounding professional development (PD) in an educative curriculum, focused on cyber-enabled cognitive tools and reformed science teaching principles integration can produce powerful student learning outcomes. This presentation will provide an understanding of such a project that investigated the contributions of PD on student learning. Max L. Longhurst (Utah State University) Todd Campbell (University of Connecticut) Daniel C. Coster (Utah State University)

**Science Teacher Professional Learning: Expanding the Model**

This study expands current models of science teacher learning by investigating an important dynamic in professional growth: the role of teachers' own perspectives and engagement in the learning process. The findings highlight the importance of a professional growth mindset and collaborative engagement in professional development experiences. Tobias Irish (Cary Institute of Ecosystem Studies) Carol Rinke (Marist College) Alan Berkowitz (Cary Institute of Ecosystem Studies)

<table>
<thead>
<tr>
<th>Traditional Paper Set</th>
<th>Saturday 10:30-11:30 AM</th>
<th>Salon C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread: Preservice Science Teacher Preparation</td>
<td>Presider: SueAnn Bottoms</td>
<td></td>
</tr>
</tbody>
</table>

**A Pilot Study Examining Preservice Science Teachers' Perceptions with 'Google-A-Science-Teacher'**

This session features a pilot study investigating a variation of the Draw-A-Science-Teacher-Teaching Checklist (DASTT-C), in which preservice teachers used the Google Images search engine to select a "science teacher" image they perceived best represented themselves teaching. Discussion includes pre/posttest results and implications for future use. Daniel J. Bergman (Wichita State University)

**How the Pedagogy of Poverty and Administrative Power Drove Highly Qualified and Effective Beginning Science Teachers from a NCLB Turnaround School**

In the study reported here, beginning science teachers' efforts to implement effective science
teaching were sabotaged by colleagues and administrators who made threats and imposed sanctions for practices that deviated from the school norms. Implications for teacher education programs and professional development efforts will be addressed. Lori M Ihrig (University of Iowa) Joanne K Olson (Iowa State University) Michael P Clough (Iowa State University)

**Why Teach Physics? Factors that lead Undergraduate Students to consider Physics Teaching as a Career**
This study explores the factors that lead undergraduate students to consider teaching as their future career. Through a self efficacy survey and semi-structured interviews, we found a variety of factors including, but not limited to, their prior teaching experiences, the way their prior teachers taught, and the self-rewards of teaching. Nilay Muslu (University of Missouri) Suleyman Cite (University of Missouri) Karen E.L. King (University of Missouri)

---

**Effects of a Multi-Phase Conceptual Change Instructional Approach on Elementary Preservice Teachers**
The study investigated the impact of a multi-phase conceptual change instructional approach on elementary preservice teachers' understanding of science content and pedagogy. The findings suggest that the experience enhanced the preservice teachers' understanding of content and heightened their abilities to promote students' understanding. Suzanne M Nesmith (Baylor University)

**Infusing High Leverage Practices in Elementary Science Methods-An Iterative 4-semester Design**
Teacher education is emphasizing high-leverage practices for novice teachers. This paper explains how high-leverage practices have been infused in an elementary science methods course. It explains two important alterations in the design of the course and how these alterations came to exist over the course of four semesters. Sharon Dotger (Syracuse University) Jessica Whisher-Hehl (Syracuse University)

**The Inclusion of Sustainability Education in K-6 Science Teacher Education: Exploring the Importance of Targeted and Teacher Mentored School-based Experiences**
We explored the influence of sustainability education experiences in University and elementary school spaces on pre-service teacher self-efficacy, dispositions, and content knowledge. Content and pedagogy were framed and guided by the nine themes of sustainability literacy (Nolet 2009). Kathleen G Sparrow, PhD (Florida International University) George E O'Brien, PhD (Florida International University) Jennifer Morales, MS (Florida International University) Jaeson Clayborn, MS (Florida International University)

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**Assessing Argumentation of Socioscientific Issues in Critical Friend Pair Case Studies**
Promoting argumentation and scientific literacy through the use of SSIs in science is a core practice in science education. Utilizing critical friend pairings and a claim-evidence-reasoning framework, we
implemented a unit in a science methods class designed to explore students' beliefs and how they impact their argument construction and reasoning. Sara Raven (Kent State University) Vanessa Klein (Kent State University) Bahadir Namdar (University of Georgia)

**Future Science Teachers as NOS-focused Curriculum Designers**
This presentation will share suggestions for improving future teachers' NOS understandings from lessons learned over four summers of a NOS-focused internship. The final internship model engaged future teachers as curriculum designers who developed their NOS understanding while creating curriculum for courses in their own science departments. Jennifer S Coble (University of North Carolina at Chapel Hill)

**The Effectiveness of Field Experiences for Elementary Methods Course: After-School Instruction vs. Classroom Observations**
Are there benefits of an afterschool field experience beyond what a normal observation field experience can give for elementary science? We followed preservice teachers from both types of field experiences (N=16) into student teaching and found overlapping themes with a few differences related to classroom management and more time teaching. Tina J Cartwright (Marshall University) Suzanne Smith (Marshall University) Brittan Hallar (Research For Action)

**Roundtable**

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>An Epidemiological Response to the Anti-Evolution Movement</td>
<td>Saturday 10:30-11:30 AM</td>
<td>Salon G</td>
</tr>
</tbody>
</table>

In response to the anti-evolution movement, a multi-faceted epidemiological response is required. Drawing from the tobacco epidemic response, we provide a multifaceted approach to address the anti-evolution movement. This roundtable engages science educators in identifying and responding to areas of need to address the anti-evolution movement. Ronald S Hermann (Towson University) Ian C Binns (UNC Charlotte) Joseph W Shane (Shippensburg University)

**Business/Awards Luncheon**

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual business meeting, ASTE Award presentations, passing of the gavel, and 2016 ASTE Reno Conference preview.</td>
<td>Saturday 11:45 AM-1:30 PM</td>
<td>Salon E-F</td>
</tr>
</tbody>
</table>
### ATE Awards

#### Outstanding Science Educator of the Year (Award I)

<table>
<thead>
<tr>
<th>Year</th>
<th>Recipient</th>
<th>University or Location</th>
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<tbody>
<tr>
<td>1973</td>
<td>Gerald Krockover</td>
<td>Purdue Univ.</td>
</tr>
<tr>
<td>1974</td>
<td>No Award Given</td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>Vincent Lunetta</td>
<td>Univ. of Iowa</td>
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<tr>
<td>1976</td>
<td>No Award Given</td>
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<tr>
<td>1977</td>
<td>No Award Given</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>Harold Jaus, Univ. of Illinois-Chicago</td>
<td></td>
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<tr>
<td>1979</td>
<td>Roger W. Bybee, BSCS</td>
<td></td>
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<tr>
<td>1980</td>
<td>Anton Lawson, Arizona State Univ.</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>No Award Given</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>James A. Shymansky, Univ. of Iowa</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>William R. Capie, Univ. of Georgia</td>
<td></td>
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<tr>
<td>1984</td>
<td>No Award Given</td>
<td></td>
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<tr>
<td>1985</td>
<td>James Dudley Herron, Purdue Univ.</td>
<td></td>
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<tr>
<td>1986</td>
<td>Charles R. Coble, East Carolina Univ.</td>
<td></td>
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<tr>
<td>1987</td>
<td>John Penick, Univ. of Iowa</td>
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<tr>
<td>1988</td>
<td>James Barufaldi, Univ. of Texas</td>
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<tr>
<td>1989</td>
<td>Lawrence F. Lowery, Univ. of California</td>
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<tr>
<td>1990</td>
<td>William C. Kyle, Jr., Purdue Univ.</td>
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<tr>
<td>1991</td>
<td>Barry Fraser, Curtain Univ. of Technology, Australia</td>
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<tr>
<td>1992</td>
<td>No Award Given</td>
<td></td>
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<tr>
<td>1993</td>
<td>Cheryl Mason, San Diego State Univ.</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>Patricia Simmons</td>
<td>Univ. of Georgia</td>
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<tr>
<td>1995</td>
<td>J. Preston Prather</td>
<td>Univ. of Virginia</td>
</tr>
<tr>
<td>1996</td>
<td>Sandra Abell</td>
<td>Purdue Univ.</td>
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<tr>
<td>1997</td>
<td>Bonnie Shapiro</td>
<td>Univ. of Calgary</td>
</tr>
<tr>
<td>1998</td>
<td>William F. McComas</td>
<td>Univ. of Southern California</td>
</tr>
<tr>
<td>1999</td>
<td>Patricia Simpson</td>
<td>St. Cloud State Univ.</td>
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<tr>
<td>2000</td>
<td>Wolf-Michael Roth</td>
<td>Univ. of Victoria</td>
</tr>
<tr>
<td>2001</td>
<td>John Settlage</td>
<td>Cleveland State Univ.</td>
</tr>
<tr>
<td>2002</td>
<td>No Award Given</td>
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<tr>
<td>2003</td>
<td>Ronald Bonnstetter</td>
<td>Univ. of Nebraska (10+ yrs.)</td>
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<tr>
<td>2004</td>
<td>No Award Given</td>
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<tr>
<td>2005</td>
<td>Larry Yore</td>
<td>Univ. of Victoria (10+ yrs.)</td>
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<tr>
<td>2006</td>
<td>Penny J. Gilmer</td>
<td>Florida State Univ. (10+ yrs.)</td>
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<tr>
<td>2007</td>
<td>James A. Shymansky</td>
<td>Univ. of Missouri-St. Louis (10+ yrs.)</td>
</tr>
<tr>
<td>2008</td>
<td>Kathryn Scantlebury</td>
<td>Univ. of Delaware (10+ yrs.)</td>
</tr>
<tr>
<td>2009</td>
<td>Deborah Tippins</td>
<td>Univ. of Georgia (10+ yrs.)</td>
</tr>
<tr>
<td>2010</td>
<td>Julie A. Luft</td>
<td>Arizona State Univ. (10+ yrs.)</td>
</tr>
<tr>
<td>2011</td>
<td>Julie Gess-Newsome</td>
<td>Northern Arizona State Univ. (10+ yrs.)</td>
</tr>
<tr>
<td>2012</td>
<td>Rebecca Schneider</td>
<td>University of Toledo (10+ yrs)</td>
</tr>
<tr>
<td>2013</td>
<td>Lynn Bryan</td>
<td>Purdue University (10+ yrs); Carla Johnson, University of Cincinnati (&lt;10 yrs)</td>
</tr>
<tr>
<td>2014</td>
<td>Alec Bodzin</td>
<td>Lehigh University (10+ yrs); Deborah Hanuscin, University of Missouri (&lt;10 yrs)</td>
</tr>
</tbody>
</table>
2015  Gail Jones, *North Carolina State* (<10yrs)

**Outstanding Mentor (Award II)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>John Penick</td>
<td>Univ. of Iowa</td>
</tr>
<tr>
<td>1999</td>
<td>Norman Lederman</td>
<td><em>Oregon State Univ.</em></td>
</tr>
<tr>
<td>2001</td>
<td>Robert E. Yager</td>
<td>Univ. of Iowa</td>
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<tr>
<td>2002</td>
<td>Walter S. Smith</td>
<td>Ball State Univ.</td>
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<tr>
<td>2003</td>
<td>Larry Enoch</td>
<td><em>Oregon State Univ.</em></td>
</tr>
<tr>
<td>2004</td>
<td>Catherine Yeotis</td>
<td><em>Wichita State Univ.</em></td>
</tr>
<tr>
<td>2005</td>
<td>Sandra Abell</td>
<td>Univ. of Missouri-</td>
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<tr>
<td></td>
<td></td>
<td>Columbia</td>
</tr>
<tr>
<td>2006</td>
<td>Tom Koballa</td>
<td>Univ. of Georgia</td>
</tr>
<tr>
<td>2007</td>
<td>Kenneth Tobin</td>
<td><em>Graduate Center of the City Univ. of New York</em></td>
</tr>
<tr>
<td>2008</td>
<td>Dana Zeidler</td>
<td>Univ. of South Florida</td>
</tr>
<tr>
<td>2009</td>
<td>Lloyd Barrow</td>
<td>University of Missouri</td>
</tr>
<tr>
<td>2010</td>
<td>Kathryn Scantlebury</td>
<td>Univ. of Delaware</td>
</tr>
<tr>
<td>2011</td>
<td>Gerry Saunders</td>
<td>Unity College</td>
</tr>
<tr>
<td>2012</td>
<td>Alec Bodzin</td>
<td>Lehigh University</td>
</tr>
<tr>
<td>2013</td>
<td>Julie Luft</td>
<td>University of Georgia</td>
</tr>
<tr>
<td>2014</td>
<td>Gillian Roehrig</td>
<td>University of Minnesota</td>
</tr>
<tr>
<td>2015</td>
<td>Pat Obenaut</td>
<td>West Virginia University</td>
</tr>
</tbody>
</table>

**Emeritus Awards/ Outstanding Longtime Service to ASTE (Award III)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
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</thead>
<tbody>
<tr>
<td>N. Eldred Bingham</td>
<td>Univ. of Florida</td>
</tr>
<tr>
<td>Milton O. Pella</td>
<td>Univ. of Wisconsin</td>
</tr>
<tr>
<td>Pinchas Tamir</td>
<td>Hebrew Univ.</td>
</tr>
<tr>
<td>Clarence Boeck</td>
<td>Univ. of Minnesota</td>
</tr>
<tr>
<td>Fletcher Watson</td>
<td>Harvard Univ.</td>
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<tr>
<td>Marvin Druger</td>
<td>Syracuse Univ.</td>
</tr>
<tr>
<td>R. Will Burnett</td>
<td>Univ. of Illinois</td>
</tr>
<tr>
<td>Fred Fox</td>
<td>Oregon State Univ.</td>
</tr>
<tr>
<td>Nasrine Adibe</td>
<td>Dowling College</td>
</tr>
<tr>
<td>Gerald Craig</td>
<td>Teachers College, Columbia Univ.</td>
</tr>
<tr>
<td>Herbert Smith</td>
<td>Colorado State Univ.</td>
</tr>
<tr>
<td>Roger Olstad</td>
<td>Univ. of Washington</td>
</tr>
<tr>
<td>Alfred DeVito</td>
<td>Purdue Univ.</td>
</tr>
<tr>
<td>Hans Anderson</td>
<td><em>Indiana Univ.</em></td>
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<tr>
<td>Paul Dehart Hurd</td>
<td>Stanford Univ.</td>
</tr>
<tr>
<td>Robert W. Howe</td>
<td>Ohio State Univ.</td>
</tr>
<tr>
<td>Ronald K. Atwood</td>
<td>Univ. of Kentucky</td>
</tr>
<tr>
<td>Willard Jacobson</td>
<td>Teachers College, Columbia Univ.</td>
</tr>
<tr>
<td>Donald W. McCurdy</td>
<td>Univ. of Nebraska-Lincoln</td>
</tr>
<tr>
<td>Ralph Lefler</td>
<td>Purdue Univ.</td>
</tr>
<tr>
<td>Harold Tannenbaum</td>
<td>Hunter College</td>
</tr>
<tr>
<td>Steven Winter</td>
<td>Tufts Univ.</td>
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<tr>
<td>William C. Ritz</td>
<td>California State Univ.- Long Beach</td>
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<td>Edward Victor</td>
<td>Northwestern Univ.</td>
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<tr>
<td>Stanley Helgeson</td>
<td>Ohio State Univ.</td>
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<td>Floyd E. Mattheis</td>
<td>East Carolina Univ.</td>
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<td>Kenneth J. Appleton</td>
<td>Central Queensland Univ.</td>
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<tr>
<td>William E. Baird</td>
<td>Auburn Univ.</td>
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<tr>
<td>Michael Cohen</td>
<td>Indiana Univ.-Purdue Univ.</td>
</tr>
<tr>
<td>Vincent Lunetta</td>
<td>Pennsylvania State Univ.</td>
</tr>
<tr>
<td>Dorothy Gabel</td>
<td>Indiana Univ.</td>
</tr>
<tr>
<td>Addison Lee</td>
<td>Univ. of Texas</td>
</tr>
<tr>
<td>Dana Zeidler</td>
<td>Univ. of South Florida</td>
</tr>
<tr>
<td>Jon Pedersen</td>
<td>Univ. of Lincoln-Nebraska</td>
</tr>
</tbody>
</table>
Innovations in Teaching Science Teachers (Award IV)

1990  A Reflective Approach to Science Methods Courses for Preservice Elementary Teachers- Dorothy Rosenthal (California State Univ.- Long Beach)
1991  Enhancing Science and Mathematics Teaching- Kenneth Tobin, Nancy Davis, Kenneth Shaw, and Elizabeth Jakubowski (Florida State Univ.)
1992  The Learning Cycle as a Model for the Design of Science Teacher Preservice and Inservice Education- Peter Rubba (Pennsylvania State Univ.)
1993  Reconstructing Science Teacher Education Within Communities of Learners- Deborah Tippins (Univ. of Georgia), Sharon Nichols and Kenneth Tobin (Florida State Univ.)
1994  No Award Given
1995  Science for Early Adolescence Teachers (Science FEAT): A Program for Research and Learning- Samuel Spiegel, Angelo Collins, and Penny J. Gilmer (Florida State Univ.)
1996  An Innovative Model for Collaboration Reform in Elementary School Science Teaching- M. Gail Shroyer, Emmett Wright, and Linda Ramey-Gassert (Kansas State Univ.)
1997  Reconceptualizing the Elementary Science Methods Course Using Reflective Orientation- Sandra Abell and Lynn Bryan (Purdue Univ.)
1998  What Science Education Standards Say: Implications for Teacher Education- Penny Hammrich (Temple Univ.)
1999  No Award Given
2000  Professional Development Programs for Elementary Science Teachers: An Analysis of Teacher Self-Efficacy Beliefs and the Professional Development Model- Tracy J. Posnanski (Univ. of Wisconsin- Milwaukee)
2001  Empowering Teachers as Researchers and Inquirers- Anne M. (Amy) Cox-Petersen (California State Univ.- Fullerton)
2002  Being There and Not Being “There:” The Experience of Teaching an Elementary Science Education Course on the Internet- Janice Koch and Michael Barriere (Hofstra Univ.)
2003  Using a Card-Sorting Task to Elicit and Clarify Science Teaching Orientations- Patricia Friedrichsen (Univ. of Missouri- Columbia) and Thomas Dana (Pennsylvania Univ.)
2004  An Inquiry-Based Laboratory Lesson to Construct an Understanding of Earth’s Seasons- Paul Ashcraft and Susan Courson (Clarion Univ.)
2005  No Award Given
2006  No Award Given
2007  Using Historical Non-Fiction and Literature Circles to Develop Elementary Teachers’ Nature of Science Understanding- Sharon E. Nichols (Univ. of Alabama) and William Straits (California State Univ.- Long Beach)
  Expanding the Ways in Which Urban Students Participate in Science Education: Rituals, Transactions, and Fundamental Interactions. Christopher Emdin (Columbia Univ.)
2009  Flexibly adaptive professional development in support of teaching science with geospatial technology. Nancy M. Trautman (Cornell Laboratory of Ornithology) & James G. Makinster (Hobart and William Smith Colleges)
2010  *Learning to Teach Science Through Collaboration: Coteaching and Cogenerative Dialogue in Elementary Science Methods Courses*- Christina Siry (Univ. of Luxembourg), Nicole Lowell, and Elizabeth Zawatski (Manhattanville College)

2011  *What about those left behind? A template for developing quality science lessons for English language learners.* Susan Gomez-Zwiep & Bill Straits. (California State University of Long Beach)

2012  *Descriptive Inquiry in The Throes of Learning to Teach: Can Prospective Teachers Learn to Teach and Study their Teaching Closely?* - Michele Koomen and Jamie Mitchell (Gustavus Aldophus College)

2013  No Award Given

2014  *Connecting to our community: Utilizing photovoice as a pedagogical tool to connect college students to science.* Kristin Cook, Bellarmine University and Cassie Quigley, Clemson University

2015  *If You Can’t Say Something Nice: A Design-Based Research Approach Investigating the Social Interactions of New Science/Math Teachers Using a Video Annotation Tool.* Joshua Ellis, Tasneem Anwar, Justin McFadden, and Gillian Roehrig (University of Minnesota)

**Implications of Research for Educational Practice (Award V)**

1981  *Wait-time and Learning in Science* - Kevin Tobin (Western Australia Institute of Technology) and William Capie (Univ. of Georgia)

1982  No Award Given

1983  *The Disadvantaged Majority: Science Education for Women* - Jane Butler Kahle (Purdue Univ.)

1984  *Training Science Teachers to Use Better Teaching Strategies* - Russell H. Yeany and Michael J. Padilla (Univ. of Georgia)

1985  *Using Research to Improve Science Teaching Practice* - Kenneth Tobin (Western Australian Institute of Technology)

1986  *Active Technology for Higher Cognitive Level Learning in Science* - Kenneth Tobin, William Capie, and Antonio Bettencourt (Univ. of Georgia)

1987  *Training Teachers to Teach Effectively in the Laboratory* - Pinchas Tamir (Hebrew Univ.)

1988  *What Can Be Learned From Investigations of Exemplary Teaching Practice* - Kenneth Tobin (Florida State Univ.)

1989  *Visual/Spatial Thinking: An Essential Element of Elementary Science* - Alan J. McCormack (San Diego State Univ.)

1990  *Helping Students Learn How to Learn: A View from a Teacher-Researcher* - Joe Novak (Cornell Univ.)


1992  *Teacher Development in Microcomputer Usage in K-12 Science* - James D. Ellis (BSCS)

1993  *Understanding and Assessing Hands-On Science* - Lawrence Flick (Washington State Univ.)

1994  *Teaching Evolution: Designing Successful Instruction* - Lawrence Scharmann (Kansas State Univ.)

1995  *Using Visits to Interactive Science and Technology Centers, Museums, Aquaria and Zoos to Promote Learning in Science* - Leonie Rennie and Terrence McClafferty (Curtain Univ. of Technology)

1996  *General Biology: Creating a Positive Learning Environment for Elementary Education Majors* - Larry Scharmann and Ann Stanheim-Smith (Kansas State Univ.)
1997  Empowering Science Teachers: A Model for Professional Development- Ann Howe (Univ. of North Carolina- Raleigh) and Harriet Stubbs (North Carolina State Univ.)

1998  No Award Given

1999  A Dynamical Systems Based Model of Conceptual Change- Andrew Hurford (Haskell Indian Nations Univ.)

2000  Teachers and Technology: A Case Study From an Implementation Project- Myra Halpin (North Carolina School of Science and Mathematics) and Ann Howe (North Carolina State Univ.)

2001  Visual/Spatial Thinking: A Forgotten Fundamental for School Science Programs- Alan J. McCormack and Cheryl L. Mason (San Diego State Univ.)

2002  What Knowledge is of Most Worth for Lateral Entry Secondary Science Teachers?- William R. Veal (Univ. of North Carolina- Chapel Hill)

2003  Teacher Student Co-Construction in Middle School Life Science- Maria Nunez-Oviedo (Univ. of Massachusetts- Amherst), Mary Ann Rea-Ramirez (Hampshire College), John Clement and Mary Jane Else (Univ. of Massachusetts- Amherst)


2005  Culturalized Science Instruction: Exploring Its Influence upon Black and White Students’ Achievement- Eileen Parsons (North Carolina State Univ.)

2006  No Award Given

2007  Narrative of Community: Visualizing Culturally Relevant Science Pedagogy Through the Identities of Black Middle School Teachers- M. Jenice Goldston and Sharon E. Nichols (Univ. of Alabama)

2008  A Case Study of Fifth Grade Teachers’ Changes in Methodology During a Two-Year Timeframe- Anita Martin and Brian Hand (Univ. of Iowa)

2009  Pathways to success in science: A phenomenological study examining the life experiences of African-American women in higher education, Claudette L. Giscombe

2010  Exploring Multiple Outcomes: Using cogenerative dialogues and coteaching in a middle school science classroom, Nicole K. Grimes, The Graduate Center, The City University of New York

2011  Synergistic Teaching of Science to English Language Learners: Comparative Analysis of the Strategies  Daniel J. Bergman, Wichita State University

2012  A mixed methods study of mid-career science teachers: The growth of professional empowerment. Amy Moreland and Mary Hobbs, University of Texas at Austin.

2013  Teachers’ NOS Practices Two to Five Years after Having Completed an Intensive Science Education Program, Benjamin Herman, University of South Florida, Michael Clough, and Joanne Olson, Iowa State University

2014  Educational turbulence: The influence of macro and micro policy on science education reform. Carla Johnson, Purdue University

2015  Using our heads and HARTSS*: Developing perspective-taking skills for socioscientific reasoning (*Humanities, ARTs, and Social Sciences). Sami Kahn and Dana Zeidler, University of South Florida.
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<td>Anna M. Gemmill</td>
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<td>Herbert Smith</td>
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<td>Sylvan Mickelson</td>
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<td>1974-1975</td>
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Forging New Trails
towards 21st Century Science Education
Reno, Nevada January 7-9, 2016

We are excited to announce the location and theme of the 2016 International Conference for the Association of Science Teacher Educators (ASTE). Come and join us in Reno, Nevada on the eastern side of the Sierra Nevada Mountains near Lake Tahoe and experience the “Biggest Little City in the World.” Reno was founded as a western town with ties to mining and the western expansion. Reno is a full service city with an international airport and the amenities of a large city in a small city atmosphere. Reno experiences over 300 days of sunshine and relatively mild weather. Being located on the eastern side of the Sierra Nevada Mountains puts Reno in a rain shadow, but within one hour drive, you can experience Lake Tahoe and over 20 different world class ski resorts. The conference will be held in the Peppermill Resort Spa and Casino. We will be located in the new Tuscany Tower with luxury rooms for everyone! The hotel has eight fine and casual dining restaurants, numerous bars, cafes, a full day spa, multiple pools, full service gym, casino, and an onsite geothermal plant that provides all heating and cooling for the resort [http://www.peppermillreno.com/](http://www.peppermillreno.com/).

The theme of the conference is based upon forging new trails in science education which include Science, STEM, and Engineering and associated disciplines as a collaboration for teaching and learning science in the 21st Century. Although the traditional strands of the ASTE conference will apply, we are also looking for new and innovative proposals that push the boundaries of traditional science education.

The conference leadership personally invite you to attend this conference and experience what Reno and surrounding areas have to offer.

Conference Committee:
Dave Crowther
Melissa Jurkiewicz
Adam Kirn
John Cannon
Camille Stegman