Forging New Trails towards
21st Century Science Education

Reno, NV
January 7-9, 2016
All meeting rooms (1-12 & A-F) are in the Tuscany Ballrooms. Lake View, Valley View, Sierra, and the Board Room are all located on the 17th floor of the Peppermill Tower. All rooms are two levels with an internal staircase.
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Welcome to the 23rd International Conference of the ASTE!

The Far West Region of ASTE is excited to host this year’s conference! Our conference theme is “Forging New Trails towards 21st Century Science Education”.

Our keynote speakers were carefully selected to expand content knowledge and to captivate the passion for practicing science in the real world. We hope that as you engage with these speakers that you think about the bigger picture of sustaining our planet and help to integrate that into working with your students. The Professional Development Workshops offerings should both solidify and broaden our understandings and skills. The conference presentations, in all the various formats, will do the same!

Our Thursday evening poster session and ASTE reception will be held at the Nevada Discovery Museum. This provides all ASTE participants to visit the museum with the National Geographic Monster Fish Exhibit while engaging in research and conversation with peers in this great science setting.

When you need a break from the ASTE environment, be sure to visit several of our local attractions including the museums, downtown, and midtown districts. Reno also has great shopping within a short distance of the hotel. Reno has great dining in the Midtown and Downton districts as well as walkable dining options from the hotel (See map insert and last pages of program for Peppermill options).

We encourage you to attend as many sessions as possible, dialog with colleagues, visit the exhibitors, enjoy the city and make the wonderful connections that the ASTE conference provides.

David Crowther, Melissa Jurkeiwicz, & Camille Stegman
ASTE 2016 Conference Co-Chairs
Dear Colleagues,

Welcome to the 2016 conference of the Association for Science Teacher Education in Reno, Nevada! This is our 23rd annual meeting for ASTE members to share research and practices in science teacher education, foster collaborations, and support one another in our work to advance science teacher education. Whether you are a new or returning conference attendee, I hope you will find our organization to be as friendly, welcoming, and supportive as I have over the years. In that spirit, please be mindful to introduce yourself to attendees that you do not know.

ASTE has a mission to “promote leadership and support for professionals involved in the education and development of teachers of science at all levels,” and our international conference epitomizes this mission. I encourage you to take full advantage of all the conference has to offer. In this program, you will find a wide range of opportunities, including workshops, keynote addresses, sessions that share research and/or exemplary practices, forum meetings, committee meetings, social events, and even athletic events.

This year’s theme is “Forging New Trails towards 21st Century Science Education” and the Far West region’s many volunteers have taken this theme to heart when preparing the program. Our keynote speakers will engage us in the consideration of issues at the frontier that have important implications for our work. Joe McConnell, a Research Professor of Hydrology, will speak with us about the documentation of long-term environmental impacts of industrialization and land use change with ice cores and chemistry. Zeb Hogan, a National Geographic Fellow/Emerging Explorer, will provide background about the work he’s done to find, study, and protect the world's largest freshwater fish; and introduce the show (Monster Fish on Nat Geo WILD) as an educational tool that's made it possible to reach millions of people, especially children.

These speakers will challenge us to better understand the new frontiers we face as we work to improve the preparation and professional development of science teachers. Conference themes have their greatest impact when our participants take them to heart. To that end, I encourage you to forge new trails at this meeting—reach out to ASTE members you do not yet know, attend sessions outside of your specific research area, share a meal or a session break with unfamiliar faces, attend a forum or committee meeting (which are open to all members), consider volunteering for an ASTE committee, and make the most of this wonderful opportunity.

A conference of this magnitude requires many hours of work by dedicated volunteers. I want to thank Dave Crowther, Melissa Jurkiewicz, and Camille Stegman, and the many other members of the Far West Region and the ASTE Program Committee for their outstanding efforts to make this conference an informative and meaningful experience for you. I hope you also enjoy some of the many opportunities available here in Reno as you participate in this year’s conference!

Best wishes,

Lisa Martin-Hansen, ASTE President
Types of Concurrent Sessions at ASTE 2016

**Traditional Paper Set** – Each one hour set will consist of two to three presenters whose papers usually relate to the same thread. Each presenter will discuss a research study, philosophical viewpoint, position, or innovative idea. The session presider will manage the time and facilitate the transition from one presenter to the next. Approximately 20 minutes per presenter, including time for questions.

**Themed Paper Set** – Each set should consist of 2-4 papers decided upon by the authors to share a common theme. Each presenter will discuss research, a philosophical viewpoint, position, or innovative idea. Themed Paper Set will last 60 minutes. Authors will determine how to use the allotted time.

**Poster Presentation** – Each presenter will prepare and display a visual representation of research (completed or in-progress), issue, or practice related to science teacher preparation. Appropriate displays include posters or other creative formats. Presenters will participate in one-on-one conversations about their displays.

**Roundtable** – Each one-hour roundtable offers the opportunity for participants to share and discuss syllabi, creative pedagogy, issues and trends, culture, history, and research in an intimate and informal manner. Each participant will provide a brief (2-3 minutes) synopsis prior to allowing the audience to circulate among tables.

**Syllabus Sharing** – This format has been designed for the purpose of sharing science education syllabi. Presenters should include evidence of outcomes or student learning to support the course activities and assessments shared.

**Experiential Session** – Each presenter will facilitate a one hour hands-on session in which participants interact with specific materials/equipment, methods, activities, or technology applications.

**Professional Development Workshop** – Each 1-3 hour workshop provides information and interaction with a new approach to some aspect of science teacher preparation. Workshops will be offered during both the pre-conference and conference sessions.
Special ASTE Sponsored Sessions

**Presider Training** – A one-hour special training and information session for Presiders on Wednesday at 5:30-6:30 PM in Room 5, repeated Thursday, 8-9 AM in the Valley View Room.

**Meet the ASTE Board** – Meet the members of the ASTE Board and see how you can help serve your organization. Ask any questions. Friday 9:15-10:15 AM in Room 10.

**Town Hall Meeting** – This is an opportunity to share ideas about ASTE with board members and is open to all conference attendees. Friday at 1:30-2:30 PM in Room 11.

**ASTE Publications: Reviewing for JSTE journal** – Meet and talk with the editors of JSTE, Norm and Judy Lederman. Editors will provide information about acceptance rates, submission guidelines, and upcoming monographs and journal issues. Friday 3:00 – 5:00 pm in Room 10.

**ASTE Publications: Meet the Editors/submitting to the journal** – Meet and talk with the editors of ASTE journals. Editors will provide information about acceptance rates, submission guidelines, and upcoming monographs and journal issues. Thursday, 1:00 PM in Room 9

**ASTE Publications: Introducing the Innovations in Science Teacher Education** – A new online ASTE Journal - Meredith Park Rogers and Gillian Roehrig will introduce the editors and share the vision of this new practitioner journal for ASTE that will be offered online to members. Thursday 3:30 – 4:30 pm in Room 10

**Forum Meetings** – All forum meetings will be Friday during lunch hours (12:30-1:30). Please see the program for locations.

**Committee Meetings** - Committee meetings will be held Friday during breakfast hours with a few exceptions – see the program for locations.

- **Oversight Committee Meeting** - Saturday at 8:00 AM in Room 12.
- **Equity Committee Meeting** - Saturday 9:15 – 10:15 in Room 12
- **Regional Directors Meeting** – Friday 1:30 – 2:30 in Room 10

**Regional ASTE Meetings** – The ASTE regions will meet as individual groups on Friday at 4:00 PM. See the program for locations.

**Women in Science Education Forum and Dinner** – Join your friends at the annual dinner. This is a ticketed event.

**Interview Room**: In the East Wing of the Tuscany Conference center there is the Tuscany Green Room. This is available to ASTE members from 8-4 pm (Thursday – Saturday) Sign-up sheet is located on the door.
2016 Thread Coordinators

Leslie Bradbury & Rachel Wilson  College and University Science
Eun Ju Lee & Jaimie Foulk  Curriculum, Pedagogy, and Assessment
Kristin Cook & Ingrid Weiland  Equity and Diversity
Paula Magee  Preservice Science Teacher Preparation
Devarati Bhattacharya & Sue Ann Bottoms  Science Teacher Professional Development
Andrea Milner  Student Learning P-12
Catherine Koehler  Policy and Reform
Mark Bloom  History, Philosophy, and Nature of Science
Meredith Kier & Shelly Rodriguez  Educational Technology
Stephen Burgin & Cathy Wissehr  Informal Science Education
Sharon Schleigh  STEM Education
Vanessa Dodo Seriki  Ethnoscience/Environmental Education

2016 Proposal Reviewers

Pamela Abder  Krista Adams  Jared Allen  Elizabeth Allison
Aidan Amirshokoohi  Raoul Amstelveen  Allison Antink-Meyer  Tasneem Anwar
Scott Ashmann  Comfort Ateh  Nazan Bautista  Michael Beeth
Matthew J. Benus  Ian Binns  Margaret Blanchard  Phillip Boda
Alec Bodzin  Sarah Boesdorfer  Julie Bokor  Mike Borowczak
Julie Brown  Erica Brownstein  Muhammad Hadi Bunyamin
Stephen Burgin  Andrea Burrows  Brendan Callahan  Nate Carnes
Daniel Carpenter  Tina Cartwright  Robert Ceglie  Devasmita Chakraverty
Angela Chapman  Julie Contino  Kent Ceglie  Emily Dare
Jeni Davis  Glenn Dolphin  Shannon Dubois  Charlene Ellingson
Allan Feldman  Frederick Freking  Julie Frey  Yohanis de la Fuente
Michael Giamellaro  Kelsey Gillstrom  Rory Glass  Amanda Glaze
Aimee Govett  Lisa Gross  Mark Guy  Rita Hagevik
Deborah Hanuscin  Pamela Harrell  Brian Hartman  Susan Hawkins
Cheryl Heitzman  Deb Hemler  Ben Herman  Gary Holliday
Elaine Howes  Robert Humphrey  Robert Idsardi  Lori Ihrig
Karen Irving  Karl Jung  Melissa Jurkiewicz  Sybil Kelley
Meredith Kier  Catherine Koehler  Jerrod Kruse  Anna Lewis
Yi Li  Lindsay Lightner  Shiyu Liu  Paula Magee
Michael Mahan  Katherine Mangione  Catherine Martin-Dunlop
Maria Maulucci  Matthew Maurer  Stacy McCormack  Tanya McKinney
Jennifer Mesa  Christina Melki  Wayne Melville  Helen Meyer
James Minogue  Rommel Miranda  Patricia Morrell  Judith Morrison
Miriam Munck  Bridget Mulvey  Jaclyn Murray  Aaron Musson
Gil Naizer Vanashri Nargund-Joshi  Frederick Nelson  Ryan Nixon
Celestin Ntemngwa  James Nyachwaya  David Owens  John Pecore
Jerine Pegg  Deniz Peker  Erin Peters-Burton  Linda Plevyak
Kate Popejoy  Eric Pyle  Babara Rascoe  Sara Raven
John Rhea  Jessica Riccio  Greer Richardson  Mike Rivas
Seema Rivera  Diego Rojas  Danielle Ross  Heather Rudolph
Jeffrey Sack  Line Saint-Hilaire  Susannah Sandrin  Dannah Schaffer
Vanessa Dodo Seriki  Therese Shanahan  Teresa Shume  David Slykhuis
David Sparks  Lara Smetana  Kathy Snow  Morgan Stewart
Karthigeyan Subramaniam Sophia Sweeney Kristina Tank  Stephen Thompson
Christine Tippett  Angelique Troelstrup  Bruce Waldrip  Kathryn Watkins
Angela Webb  Jillian Wendt  Sandra Westmoreland Lindsay Wheeler
Brooke Whitworth  Heidi Wiebke  Francine Wizner  David Wojnowski
Yael Wyner  Yichun Xie  Sandra Yarema  Xinying Yin

Professional Development Workshop Reviewers

Renee Schwartz  Andrea Burrows  Cathi Koehler
Selcen Guzey  Charles Eick  Wayne Melville
Susan Gran  Stephen Thompson  Sharon Schleigh
Patricia Hewitt  Patricia Morrell
Michelle Klosterman  Anne Kern
## 2016 Presidents

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<th>Yohanis de la Fuente</th>
<th>James Nyachwaya</th>
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<tr>
<td>Krista Adams</td>
<td>Michael Giamellaro</td>
<td>John Pecore</td>
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<td>Jared Allen</td>
<td>Kelsey Gillstrom</td>
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<td>Raoul Amstelveen</td>
<td>Rory Gillstrom</td>
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<td>Tasneem Anwar</td>
<td>Lisa Glass</td>
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<td>Nazan Bautista</td>
<td>Aimee Govett</td>
<td>Jessica Riccio</td>
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<td>Mark Guy</td>
<td>Diego Rojas</td>
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<td>Maria Rivera Maulucci</td>
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University of Nevada, Reno College of Education / Raggio Research Center for STEM Education

Exhibitors

Vernier Software & Technology
National Science Teachers Association
V-Note Video Analysis Software

And a special thanks to all those who have helped to make this conference a success!
## ASTE 2016 PROGRAM AT A GLANCE

### WEDNESDAY, JANUARY 6

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<th>Event</th>
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<tr>
<td>1:00 – 5:00</td>
<td>Pre-conference Workshops</td>
<td>Rooms 1-4</td>
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<tr>
<td>12:00 – 2:00</td>
<td>Executive Board Meeting</td>
<td>Peppermill Board Room</td>
</tr>
<tr>
<td>4:00 – 9:00</td>
<td>Registration</td>
<td>Tuscany Lobby</td>
</tr>
<tr>
<td>5:00 – 9:00</td>
<td>Board Meeting</td>
<td>Peppermill Board Room</td>
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<tr>
<td>5:30 – 6:30</td>
<td>Presider Training</td>
<td>Room 5</td>
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### THURSDAY, JANUARY 7

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<tbody>
<tr>
<td>6:45</td>
<td>STS Fun Run/Walk</td>
<td>Hotel Lobby</td>
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<tr>
<td>7:00 – 5:00</td>
<td>Registration</td>
<td>Tuscany Lobby</td>
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<tr>
<td>7:00 – 8:00</td>
<td>Mentor Meeting</td>
<td>Room 1</td>
</tr>
<tr>
<td>7:00 – 8:00</td>
<td>Breakfast</td>
<td>Ballroom</td>
</tr>
<tr>
<td>8:00 – 9:00</td>
<td>Presider Training</td>
<td>Valley View</td>
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<tr>
<td>8:00 – 10:15</td>
<td>Concurrent Sessions</td>
<td>Rooms 1-9</td>
</tr>
<tr>
<td>9:15 – 10:15</td>
<td>Graduate Student Forum</td>
<td>Valley View</td>
</tr>
<tr>
<td>10:00 – 11:00</td>
<td>Coffee Break</td>
<td>Tuscany Foyer</td>
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<tr>
<td>10:30 – 12:00</td>
<td>Keynote: Dr. Zeb Hogan</td>
<td>Ballroom D-F</td>
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<tr>
<td>12:00 – 1:30</td>
<td>Lunch on your own</td>
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<tr>
<td>12:30 – 5:00</td>
<td>Concurrent Sessions</td>
<td>Rooms 1-9</td>
</tr>
<tr>
<td>3:00 – 4:00</td>
<td>Coffee Break</td>
<td>Tuscany Foyer</td>
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<tr>
<td>5:30 – 7:30</td>
<td>Poster Session/Social</td>
<td>Discovery Museum</td>
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### FRIDAY, JANUARY 8

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<th>Event</th>
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<tr>
<td>7:00 – 4:00</td>
<td>Registration</td>
<td>Tuscany Foyer</td>
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<tr>
<td>7:00 – 8:30</td>
<td>Breakfast</td>
<td>Ballroom A</td>
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<tr>
<td>7:00 – 8:00</td>
<td>Committee Meetings</td>
<td>Rooms 1-9</td>
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<tr>
<td>8:00 – 10:15</td>
<td>Concurrent Sessions</td>
<td>Rooms 1-12</td>
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<tr>
<td>9:15 – 10:15</td>
<td>Meet the Board</td>
<td>Room 10</td>
</tr>
<tr>
<td>10:00 – 11:00</td>
<td>Coffee Break</td>
<td>Tuscany Foyer</td>
</tr>
<tr>
<td>10:30 – 12:00</td>
<td>Keynote: Dr. Joe McConnell</td>
<td>Ballroom D-E</td>
</tr>
<tr>
<td>12:00 – 1:30</td>
<td>Lunch on your own</td>
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<tr>
<td>12:30 – 1:30</td>
<td>Forum Meetings</td>
<td>Rooms 1-9</td>
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<tr>
<td>1:30 – 5:00</td>
<td>Concurrent Sessions</td>
<td>Rooms 1-12</td>
</tr>
<tr>
<td>1:30 – 2:30</td>
<td>Town Hall Meeting</td>
<td>Room 11</td>
</tr>
<tr>
<td>5:15 – 6:00</td>
<td>Regional Meetings</td>
<td>Rooms 1-8</td>
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<tr>
<td>6:00 – 8:00</td>
<td>WISE Dinner (Ticketed Event)</td>
<td>Ruby River Steak House</td>
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### SATURDAY, JANUARY 9

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<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>7:00 – 8:00</td>
<td>Breakfast</td>
<td>Ballroom A</td>
</tr>
<tr>
<td>8:00 – 11:30</td>
<td>Concurrent Sessions</td>
<td>Rooms 1-12</td>
</tr>
<tr>
<td>10:30 – 11:30</td>
<td>NTU Meeting</td>
<td>Room 10</td>
</tr>
<tr>
<td>8:00 – 9:00</td>
<td>Oversight Committee Meeting</td>
<td>Room 12</td>
</tr>
<tr>
<td>9:15 – 10:15</td>
<td>Equity Committee Meeting</td>
<td>Room 12</td>
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<tr>
<td>11:45 – 1:30</td>
<td>Awards Luncheon</td>
<td>Ballroom D</td>
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- Note that Rooms Lake View, Valley View, Sierra & Board Room are located on the 17th floor of the Peppermill Tower.
**WEDNESDAY, JANUARY 6**

<table>
<thead>
<tr>
<th>Local Tours</th>
<th>Wednesday Tours</th>
<th>Hotel Lobby</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrive early! Reno and the surrounding area have a lot to offer! Visit Lake Tahoe or historic Virginia City, both of which are less than an hour drive from the Peppermill. The hotel has a tour desk that can arrange tours or you can rent a car from the lobby of the hotel and head out on your own.</td>
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<td></td>
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<table>
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<tr>
<th>ASTE Executive Board Meeting</th>
<th>Wednesday 12:00-2:00 PM</th>
<th>Peppermill Board Room</th>
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<table>
<thead>
<tr>
<th>Workshop</th>
<th>Wednesday 1:00-4:00 PM</th>
<th>Room 1</th>
</tr>
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</table>
| **Science Writing Tasks that Support Scientific Practices, Sense-making, and Communication**  
Leah A. Bricker (University of Michigan) Amy Deller-Antieau (Ann Arbor Public Schools)  
We will engage workshop participants with sample science writing tasks. Workshop participants will experience sample tasks, accompanying rubrics, and associated student work. We will also hear from secondary science teachers about how they used and adapted the tasks, as well as their reflections on their students’ engagement with the tasks. |

Evaluation Link: [https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2kraH5v7](uportland.qualtrics.com)  

<table>
<thead>
<tr>
<th>Workshop</th>
<th>Wednesday 1:00-4:00 PM</th>
<th>Room 2</th>
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</thead>
</table>
| **Video case-based, Analysis-of-Practice for Teacher and Student Learning: Structure, Substance, and Findings from 10 Years of Use in Pre-service and In-service Contexts**  
Connie Hvidsten (BSCS) Betty Stennett (BSCS) Deborah Roberts-Harris (University of New Mexico)  
Participants will learn about the design, implementation, and study of videocase, analysis-of-practice programs to prepare pre-service and in-service science teachers to reach the vision of the NGSS. Using program tools, we will engage in video analysis of classroom science teaching and learning, and explore findings from a 10-year line of research. |

Evaluation Link: [https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2kraH5v7](uportland.qualtrics.com)  

<table>
<thead>
<tr>
<th>Workshop</th>
<th>Wednesday 2:00-4:00 PM</th>
<th>Room 3</th>
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</table>
| **Incorporating Engineering Education into Science Classrooms**  
Melissa A. Jurkiewicz (University of Nevada, Reno) Adam Kirn (University of Nevada, Reno) and David T. Crowther (University of Nevada, Reno)  
Demands placed on science teacher educators and science teachers have shifted and now include the need to incorporate engineering education. The workshop is for ASTE members who are interested in learning more about implementing engineering into science classrooms. |

Evaluation Link: [https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2kraH5v7](uportland.qualtrics.com)
Real World Computing in K20 Classrooms though NGSS
Andrea C. Burrows (University of Wyoming) Mike Borowczak (Erebus Labs)
This workshop uses the NGSS as a frame to understand the Scientific Method, Engineering Design, Computer Science, and Computer Engineering so that pre-service, in-service, and professors/instructors have concrete examples to develop, use, and extend in their classrooms. While sample materials will be provided during the workshop for participant use, bringing an Arduino and/or Raspberry Pi to the workshop will allow participant to leave with a working unit instead of only using the materials during the workshop.

Evaluation Link: https://uportland.qualtrics.com/SE/?SID=SV_aaaTf2F2krzaH5v7[uportland.qualtrics.com]

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<tr>
<th>Workshop</th>
<th>Wednesday 2:00-5:00 PM</th>
<th>Room 4</th>
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<tbody>
<tr>
<td>Real World Computing in K20 Classrooms though NGSS</td>
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<tr>
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<tr>
<th>ASTE Board Meeting</th>
<th>Wednesday 5:00-9:00 PM</th>
<th>Peppermill Board Room</th>
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<tr>
<th>Presider Training</th>
<th>Wednesday 5:30-6:30 PM</th>
<th>Room 5</th>
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THURSDAY JANUARY 7

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<tr>
<th>Event</th>
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<th>Location</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>Meet in the Lobby (by Concierge Desk) and we will jog around Virginia Lake (Pond) if weather permits</td>
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<tr>
<td>Mentor Meeting</td>
<td>Thursday 7:00-7:50 AM</td>
<td>Room 1</td>
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<tr>
<td>BREAKFAST</td>
<td>Thursday 7:00-8:00 AM</td>
<td>Ballroom A-C</td>
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<tr>
<td>Presider Training</td>
<td>Thursday 8:00-9:00 AM</td>
<td>Room 12</td>
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<tr>
<td>Traditional Paper Set</td>
<td>Thursday 8:00-9:00 AM</td>
<td>Room 1</td>
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<tr>
<td>Thread: Mixed Thread</td>
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<td>Presider: Lara Smetana</td>
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The effect of gamification on students' perception of learning environment and motivation in an introductory undergraduate biology laboratory course
David C. Owens (Middle Tennessee State University)
The use of elements of video games in non-gaming settings, or gamification, can enhance students’ perceived motivation to study science and aid in their ability to learn in an introductory undergraduate biology laboratory course.

GO (Girls Only) STEM! Camp – a Measure of Girls' Attitudes, Self-efficacy and Aspirations toward STEM Careers
Kelly Sparks (University of Southern Indiana) Allison Grabert (Southwest Indiana STEM)
GO (Girls Only) STEM! Camp focuses on helping girls overcome barriers and stereotypes faced while preparing for, and pursuing, STEM-related careers through a five-day summer camp experience. This study evaluated the effectiveness of the camp on high school girls’ attitudes, self-efficacy and aspirations toward STEM Careers.

A Qualitative Research Tool for Tracing Idea Development in On-line Science Discussion Forums
Matthew J. Benus (Indiana University Northwest) L. E. Whitman (Purdue University Calumet)
A research tool is presented seeking to incorporate the tracking of idea development with the literature’s existing schemes concerning individual actions and the construction of knowledge within online discussion groups. The tool includes 4 categories within 5 levels concerning ideas; development, building, relationship, and consolidation.
Developing Wonder as a Pedagogical Tool with Pre-service Elementary Teachers.
Andrew Gilbert (George Mason University)
This presentation represents a direct effort to meet the conference call to "forge a new trail" by developing the concept of wonder as a pedagogical tool designed to positively impact pre-service elementary teachers perceptions of science. Findings and implications for science teacher education will be discussed.

Using Scientific Humor to Help Students Analyze, Evaluate, and Create Knowledge
Francine Wizner (University of Albany)
This is a study of the way a teacher uses scientific humor and how that humor is perceived by his students. Content humor is a strategy for getting student attention and improving their receptivity toward science. Humor events occur to establish rapport and have students make connections between science concepts and prior knowledge.

Using Web GIS to Promote Geospatial Thinking and Reasoning About Malaria in the Environment.
Rajika E. Reed (Lehigh University) Alec M. Bodzin (Lehigh University)
The implementation of an interdisciplinary science curriculum that used Web GIS mapping to investigate World Health Organization global data to examine malaria patterns and the role of environmental factors is presented. Implications for teacher professional development are discussed.

Teachers' Pedagogical Perceptions of Novel 3-D, Haptic-Enabled Virtual Reality Technology
Rebecca L. Hite (North Carolina State University) M. Gail Jones (North Carolina State University) Gina M. Childers (North Carolina New Schools) Katherine Chesnutt (North Carolina State University) Elysa N. Corin (North Carolina State University) Mariana Pereyra (North Carolina State University)
This study explored pre-service and in-service teacher perceptions of the ease of use and usefulness of a 3-D, haptic-enabled virtual reality system (zSpace®) in teaching science concepts compared to traditional pedagogical strategies. Teachers’ perceptions of utility and usability of this technology varied upon the level of teaching experience.

Exploring Pre-service Teachers’ Science PCK through a TeachLivE Virtual Experience
Meredith W. Kier (College of William and Mary) Seema Rivera (Union Graduate College) Alisandra P. Thompson (Howard University)
Ten elementary pre-service teachers at a Historically Black University in the southeast US developed a fifth grade lesson on matter and taught a segment of the lesson to avatar students in TeachLivETM. Their pedagogical content knowledge was assessed through the Reformed Teacher Observation Protocol (RTOP) and through written reflections.
Understanding Newcomer ELLs: Rubrics for Assessing Academic Language Proficiency and Chemistry Content Knowledge
Jingjing Ma (Texas Christian University) Beau Hartweg (Texas Christian University)
This presentation reports the first stage of a study in which 51 newcomer ELLs were interviewed to examine relationships between their academic language proficiency (ALP) and chemistry content knowledge (CCK). The authors will introduce the development of, ways to apply, and empirical examples of the two rubrics that were used for coding.

"Discussion, that is kind of hard..."
Yi Li (Teachers College, Columbia University) Felicia Moore Mensah (Teachers College, Columbia University)
This study reports the findings from a grade 11 Asian American girl’s experience and performance in a reform-based chemistry class. Science educators need to think carefully about how students interpret the conflicts between new and past school experiences and think carefully about who will benefit and who will not from science reforms.

Pre-service Teachers and the Noticing of Elementary Diverse Learners Science Ideas as Represented in Their Written Work.
Anne Pfitzner Gatling (Merrimack College) Meredith Houle-Vaughn (San Diego State)
In this presentation we will examine how a scaffolded activity in which elementary pre-service teachers work to interpret the science and engineering ideas of English Language Learners' (ELL) writing influences their professional noticing of science ideas. As a part of this activity we utilize a rubric to assess ELL students’ written observations.

Uncovering High School Students' Knowledge and Beliefs about Climate Change to Inform the Development of Embedded Curriculum Materials
Molly Nation (University of South Florida) Allan Feldman (University of South Florida) Glenn Smith (University of South Florida) Ping Wang (University of South Florida) Yiping Lou (University of South Florida)
The study examines the effects of a climate change curriculum incorporated into secondary marine science classrooms. The study measures secondary students' understanding and misconceptions of global warming, and their attitudes towards appropriate actions to be taken both personally and politically to mitigate its effects.
The Longitudinal Association of an Experiential Environmental SSI Course with Students Conceptualizations and Behaviors
Mark H. Newton (University of South Florida)
An investigation into the extent students conceptualized and acted to resolve contentious environmental issues (CEI) one year after completing an experiential environmental education course embedded with SSI instruction. Data indicates a residual association with how students negotiate CEI and their willingness to act to resolve these issues.

Influence of Terminology and Science Learning Experiences on Secondary Students' Perceptions of and Willingness to Mitigate Global Warming and Climate Change
Benjamin C. Herman (University of Missouri)
This investigation determined the extent surveyed secondary marine science students’ perceptions about and willingness to mitigate climate change/global warming (CC/GW) were influenced by: 1) using the term “CC” or “GW”; 2) the number of science courses completed; and 3) the extent CC/GW and related topics were a focus in their science coursework.

Traditional Paper Set Thursday 8:00-9:00 AM Room 6

Observations of Pre-service Secondary Science Methods Courses Addressing English Learners
Jorge L. Solis (University of Texas at San Antonio (UTSA) Edward Lyon (Sonoma State University) Joyce Hill (University of California, Santa Cruz)
This presentation will report on the use of an observation protocol to explore how a group of secondary science methods instructors across four university sites in California, Arizona, and Texas prepared their pre-service teachers to teach science effectively to all students with a focus on English learners (ELs).

"In Their Shoes": Developing Pre-service Elementary Teachers' Awareness of the Science Learning Experiences of English Language Learners
Angela W. Webb (Louisiana State University)
This presentation considers the learning opportunities that might result from having pre-service elementary teachers assume the role of language learners in science to develop a deeper understanding of the role of appropriate scaffolds and an awareness of the linguistic needs of students in science.

Supporting Pre-Service Science Teachers' Planning For and Scaffolding of Academic Language Use in the Elementary Classroom
Karl G. Jung (University of Minnesota – STEM Education Center) Julie C. Brown (University of Minnesota – STEM Education Center)
The language used in science for teaching and learning presents significant challenges to many students in reading, writing and talking science. This study investigates how an academic language planning organizer supported pre-service science teachers in identifying language demands and planning language supports for elementary science lessons.
Experiential Session Thursday 8:00-9:00 AM Room 7

Introducing Project Draw for Science: How Aesthetic Inquiry Can Make Science Matter to More Students

Merrie Koester (University of SC Center for Science Education) Meta Van Sickle (College of Charleston)
Science teacher educators will learn about research which employed drawing practice to deepen teacher content knowledge, enable struggling students to acquire epistemic agency, achieve academic success, and communicate their understanding of the language and nature of science in classrooms characterized by an ethic of care and aesthetic inquiry.

Experiential Session Thursday 8:00-9:00 AM Room 8

Biotechnology 101: Model the Most Crucial Biotech Skills and Techniques with Confidence
Lisa M. O'Connell (Diman Regional Vocational Technical High School/NSF TEACH)
Learn how to train teachers and students on critical biotechnology skills. Facilitate learning of concepts like micro volumes, dilution factors, electrophoresis, and PCR. Virtual and hands-on resources provided.

Roundtable Thursday 8:00-9:00 AM Room 9

Thinking Outside the Box: A Final Exam using Visual Metaphors
Cindi Smith-Walters (Middle Tennessee State University) Heather L. Barker (La Sierra University)
Biology 3000: Life Science for Elementary Teachers uses the powerful tools of visual data and written metaphors in the final exam to assess student understanding of concepts covered throughout the semester. This session will share a copy of the exam (directions, rubric, etc.), examples of student answers to items, and overall student feedback.

Embedded Workshop Thursday 8:15-10:15 AM Room 10

Using Hands-on Performance Assessment in K-12 Classrooms: Assessing Student Mastery of Both the Science Practices and DCIs
Deborah Tucker (Independent Education Consultant) Grant M. Gardner (Assessment Services, Inc.)

Evaluation Link: https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2krzaH5v7[uportland.qualtrics.com]

Embedded Workshop Thursday 8:15-10:15 AM Room 11

Language and Literacy, Multimodality, and STEM
Christine D. Tippett (University of Ottawa) Todd M. Milford (University of Victoria) Mark A. McDermott (University of Iowa)
Language in science is of interest to science educators and researchers; a growing emphasis on STEM and engineering shifts our focus to language in STEM. Language, literacy, and STEM will be explored.
though multimodal reading, writing, and representing activities for Grades 3-12. Science teacher education and research will be discussed.

Evaluation Link: https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2krsaH5v7[uportland.qualtrics.com]

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<th>Experiential Session</th>
<th>Thursday 9:15-10:15 AM</th>
<th>Room 8</th>
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**What's So Critical About Common Core? Exploring Close Reading and Technical Writing in Science**
Leslie Suters (Tennessee Technological University) Kristen Pennycuff-Trent (Tennessee Technological University)
Explore, experiment, and analyze your way through CCSS’s literary demands and the content of NGSS with research-based strategies for teaching close reading and technical writing!

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<th>Graduate Student Forum</th>
<th>Thursday 9:15-10:15 AM</th>
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<th>Traditional Paper Set</th>
<th>Thursday 9:15-10:15 AM</th>
<th>Room 1</th>
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**Filling in the Gaps: An Explicit Protocol for Scaffolding Inquiry Lessons**
Austin M. Hitt (Coastal Carolina University) Doug W. Smith (Coastal Carolina University)
In order to help our pre-service science teachers improve the scaffolding of their science lessons the presenters developed an explicit scaffolding protocol. Our pre-service teachers used the protocol to critique the scaffolding of their inquiry lessons. As a result, they created more targeted and useful guiding questions in their lessons.

**Cultivating 21st Century Elementary Science Educators using Teacher Inquiry: A Teacher Educator's Insight**
Yvonne Franco (University of South Florida)
Acknowledging the call for teacher educators to use reflective practices to prepare capable teachers, this study seeks to understand, in what ways does my use of teacher inquiry support the development of inquiry-based instructional practices in the elementary science classroom? Findings suggest strategies for cultivating skilled practitioners.

**The Influence of Argumentative and Collaborative Discourse on Pre-service Teachers’ Alternative Conceptions in Life Science**
Heather L. Barker, (La Sierra University) Cindi Smith-Walters (Middle Tennessee State University)
Argumentative and collaborative discourse may promote conceptual change in elementary pre-service teachers. This session will present study results examining the influence of such instructional activities on photosynthesis and cellular respiration alternative conceptions of PSTs during a science content course.
Epistemic Orientation toward Teaching Science: Toward Better Conceptualization and Measurement
Jee Kyung Suh (University of Iowa) Soonhye Park (University of Iowa)
This study fundamentally aims to improve the understanding of how teachers' thoughts and beliefs shape their orientations to teaching science and how those orientations are reflected in teaching practices that foster students' learning about science.

Finding Common Ground: Using Theoretical Inquiry to Identify Promising Frameworks for the Promotion of Socioscientific Perspective Taking
Sami Kahn (University of South Florida) Dana Zeidler (University of South Florida)
Utilizing theoretical inquiry, we develop an array of promising socioscientific perspective taking (SSPT) interventions for use by science teacher educators and their students while assessing the feasibility of three non-science frameworks as sources for novel and expansive work in socioscientific issues (SSI).

Adding computational thinking to your science lesson: what should it look like?
Jennifer Albert (The Citadel)
This paper describes efforts to develop computational thinking activities that can be easily implemented in any science classroom. Overall, most students created a presentation of their project without much complexity. Eight of 29 students created interactive projects that required user participation and used more advanced computational concepts.

Chemistry Teachers' Technology Decisions for Inclusive Chemistry Classrooms
Frackson Mumba (University of Virginia) Laura Ochs (University of Virginia) Vivien M. Chabalengula (University of Virginia)
We explored high school chemistry teachers’ technology decisions for inclusive chemistry classes. Although chemistry teachers’ technology decisions were within the framework that integrates instructional technology for regular classes, such decisions are unlikely to promote effective science teaching and learning in inclusive classes.
Edward Lyon (Sonoma State University)
This study reports on findings from observing secondary science teachers’ assessment practices before participating in Professional Development around equitable science assessment for English Learners. Practices such as student thinking through scientific/engineering practices and disciplinary literacy were examined to make connections with NGSS and CCSS.

Bilingual Students Science Discourse: A Mixed Methods Study of Outcomes in an Elementary School
Soleil H. Roper (Texas Tech University)
Mixed methods research was used to understand the scientific oral language of students and teachers in a bilingual classroom. After mixing qualitative and quantitative data findings indicate that students’ performance in oral language proficiency assessments is not associated with their scientific oral discourse.

Developing Pre-service Teachers’ Pedagogical Content Knowledge for teaching Science to English Language Learners
Vanashri Nargund-Joshi (New Jersey City University) Nazan Bautista (Miami University)
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 pre-service teachers’ pedagogical content knowledge (PCK) contributes critically to the field. PCK is the knowledge developed by teachers to help others learn specific content.

Rural librarians as STEM educators
Ryan A. Brown (Illinois State University) Allison Antink-Meyer (Illinois State University)
This study examined the status of STEM education within Midwestern rural libraries through the lens of librarians themselves as they attempt to manage limited resources yet remain a vital information resource in their community.

Piloting STEM Career Clubs at Four Rural, High Poverty Middle Schools: What Students Tell Us about Their Club Experiences and Their Future Plans
Margaret R. Blanchard (NC State University) Kristie S. Gutierrez (NC State University) Lauren A. Harper (NC State University) Jason L. Painter N. Scott Ragan (NC State University)
This pilot study focuses on students in after school STEM Career Clubs in 4 rural, high poverty middle schools, and was designed to give students’ out of school experiences to generate interest in STEM subjects and preparation for related careers. Pathways toward careers are analyzed using interview and survey data.
The Influence of Parent STEM Experience on Children’s Interests in and Understanding of STEM Majors and Careers
This study examined the role that parents’ experience with science, technology, engineering or math (STEM) fields plays in their children’s interest in STEM fields, their understanding of STEM professions, and performance on a science knowledge assessment. More than 150 parent-child dyads from 4th grade classes participated.

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<th>Traditional Paper Set</th>
<th>Thursday 9:15-10:15 AM</th>
<th>Room 6</th>
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<tbody>
<tr>
<td>Thread: Pre-service Science Teacher Preparation</td>
<td>Presider: Karthigeyan Subramaniam</td>
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Illuminating a critical role of science course instructors through digital video ethnographies of elementary pre-service co-teachers
Adam Devitt (New York University) Kara Naidoo (Iona College)
Using digital video ethnography, we investigate two pairs of co-teachers to understand how their interpersonal relationships may affect their identities on their way to becoming science teachers. We discuss the role of instructors as they are in charge of designing learning spaces that effect the interactions pre-service teachers will have.

Helping a Pre-service Science Teacher Develop a Social Justice Identity
Maria S. Rivera Maulucci (Barnard College) Kassidy T. Fann (Bedford Public Schools, MA)
This qualitative case study explores a pre-service high school Physics teacher’s social justice identity development across three field/pedagogical experiences, a science methods course, a general methods course and urban school practicum, and student teaching in an urban school.

Professional Identity Changes in Pre-service Elementary Science Teachers: Studying a Differentiated Preparation Program Approach
Stephanie Hathcock (Oklahoma State University) Toni Ivey (Oklahoma State University)
This presentation showcases research on pre-service elementary science teachers’ professional identity systems. We will discuss the application of a new theoretical framework for professional identity research, and highlight similarities and differences in the PI’s of our students based on a differentiated science teacher preparation program.

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<td>Thread: Mixed</td>
<td>Presider: James Nyachwaya</td>
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A Phenomenographic Study of Rural High School Students Perceptions of Sustainability
Rita Hagevik (The University of North Carolina- Pembroke) Jennifer Spivey (East Columbus High School)
This study examined high school students’ understandings of sustainability as the result of an on-campus apiary project conducted by their science teacher. Students completed an environmental behavior and attitude survey and drew their definition of sustainability both pre/post. The results showed a positive influence on students’ understandings.

**Comparing Classroom Inquiry and Sociological Accounts of Science as a Means of Explicit-Reflective Learning**  
Daniel Z. Meyer (Illinois College) Allison Antink-Meyer (Illinois State University)  
This study investigated the potential of comparing an class inquiry activity to a sociological account of scientific work as a means to explicit-reflective teaching of nature of science and scientific inquiry. The approach enabled spontaneous generation of some NOS/SI aspects by participants, discussion of others and the exposing of misconceptions.

**An Analysis and Critique of the Nature of Science (NOS) in the Next Generation Science Standards (NGSS)**  
William F. McComas (University of Arkansas) Noushin Nouri (University of Arkansas) Cathy Wissehr (University of Arkansas)  
We examined the eight Nature of Science categories and NOS illustrations in the Next Generation Science Standards and determined the completeness of the NOS recommendations, the accuracy of the illustrations, and the frequency that each NOS category is linked to science content, cross cutting concepts and science/engineering practices.

<table>
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<tr>
<th>Roundtable</th>
<th>Thursday 9:15-10:15 AM</th>
<th>Room 9</th>
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<tr>
<td><strong>New Teachers’ Construction of Context-specific Science Classroom Communities: Context-Specific Teacher Preparation and Induction for High-Need Urban Schools</strong></td>
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<td>Elaine V. Howes (American Museum of Natural History)</td>
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<td>Our MAT and induction programs prepare and support science teachers for high-need schools. This round table presentation describes our new teachers’ construction of classroom communities that value students’ ideas, cultures, and local settings. We base our discussion in the implementation of core science teaching practices in high-need classrooms.</td>
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| Coffee Break | Thursday 10:00 – 10:30 AM | Tuscany Foyer |
Chasing Giants: Use of Questions, Evidence, and Communication to Find, Study, and Protect the World's Largest Freshwater “Monster” Fish

National Geographic Fellow/Emerging Explorer Zeb Hogan is an aquatic ecologist and photographer as well as a research assistant professor of Biology at the University of Nevada, Reno. In 1996–1997, Zeb was a Fulbright Scholar at Chiang Mai University in Thailand, and in 2004 he earned his PhD in Ecology from the University of California, Davis.

Around the world, freshwater ecosystems support tens of thousands of unique species and hundreds of millions of people. Through the Megafishes Project, Zeb has traveled to six continents to study critically endangered fresh water very large “monster Fish” and the livelihood of people who share their habitats. In this lecture Zeb will speak about his research on several continents and how his research has led to new discoveries and more sustainable strategies for preserving these giant fish. Zeb believes new approaches, investment, and research offer real hope to both fish and fishing communities. In Cambodia, for example, when fishermen catch vulnerable species, Zeb buys live fish, which he studies, tags, and then releases downstream from the fishermen's nets. This practice keeps more endangered fish alive and allows scientists to gain insight on fish migration patterns, habitat use, and mortality rates. Zeb hopes, that will lead to the creation of no-fishing zones and more sustainable management of Cambodia's fisheries. National Geographic now has a traveling museum exhibit honoring Dr. Hogan’s research. This exhibit is currently on exhibition at the NV Discovery Museum where the Reception and Poster Session will be held this evening. The Educators Guide for this exhibit is available at: http://issuu.com/cosdiscovermagazine/docs/monster_fish_2015_guide

LUNCH Thursday 12:00 – 1:00 PM

On your own

Publication Committee Session Thursday 1:00-2:00 PM Room 7

Meet the Journal of Science Teacher Education (JSTE) Editors: Publishing in JSTE Information Session
Norman G. Lederman (Illinois Institute of Technology) Judith Lederman (Illinois Institute of Technology)
This session offers new and experienced conference attendees an opportunity to meet and talk with the editors of the Journal of Science Teacher Education (JSTE). Editors will provide information about acceptance rates, submission guidelines, and upcoming monographs and journal issues.

NSTA Affiliate Session Thursday 1:00 – 2:00 PM Room 10

Preparation Program Accreditation, Recognition, and Standards: A Town Hall Meeting
Facilitators: Eric J Pyle, (NSTA Pre-service Teacher Preparation Division) John Tillotson (NSTA Research Division)
Do we understand the impact of NSTA standards on science teacher preparation? This session will a
conversation on the efforts of ASTE and NSTA to examine and restructure science teacher program recognition standards and practices.

**Embedded Workshop**  
**Thursday 1:00-3:00 PM**  
**Room 11**

**Engineering an Online Course in Science Education**  
Jeffery S. Townsend (Eastern Kentucky University) and Jennifer C. Perkins (Eastern Kentucky University)  
We will share a fully online MA-level course for engineering in grades K-8. Focus will be on technology and methods used that resulted in its receiving Blackboard Catalyst Exemplary and Director’s Choice Course of Distinction awards. Access to all documents and modules will be provided as presenters give full access to the course.

Evaluation Link: [https://uportland.qualtrics.com/SE/?SID=SV_aatF2F2krzaH5v7](https://uportland.qualtrics.com/SE/?SID=SV_aatF2F2krzaH5v7)

**Experiential Session**  
**Thursday 1:00-2:00 PM**  
**Room 8**

**Dinosaur Dig: An Integrated Science Experience for Pre-service Teachers**  
Luke C. Lyons (Texas A&M University)  
Pre-service science teachers need to teach many different areas of science. Dinosaurs offer a path for teachers to involve students in hands-on activities that incorporate inquiry practices, Earth and life science concepts. Dinosaur Dig is a student-centered model to train pre-service teachers on how to integrate curriculum areas in one activity.

**Traditional Paper Set**  
**Thursday 1:00-2:00 PM**  
**Room 1**

**Thread: College and University Science Education**  
Presider: Sandra Westmoreland

**Introducing an analog for teaching the concept of electric field based on the analogy model of TWA for planning a lesson**  
Maryam Saberi (Shiraz University) Noushin Nouri (University of Arkansas) Mansour Vesali (Shahid Rajaee Teacher Training University).  
In this survey, after mentioning some of the students’ problems with the concept of field, a lesson plan with the method of analogy was introduced. In evaluating this method we interviewed experiment and control groups. Comparing the results shows that using this analogy-based lesson plan helped students to overcome some of their problems.

**The English version of The Nature of Solutions and Solubility – Diagnostic Instrument (NSS-DI Eng): a psychometric evaluation**  
Mandy McCormick Smith (Capital University) Lin Ding (The Ohio State University) Kathy Cabe Trundle (North Carolina State University)  
The Nature of Solutions and Solubility—Diagnostic Instrument (NSS–DI) developed by Adadan and Savasci (2012) was designed to assess students’ understanding of solution chemistry concepts. This report presents statistical findings from five psychometric tests used to evaluate the reliability and the discriminatory power of the modified Eng.
Teaching Systems Thinking in the Context of the Water Cycle
Tammy Dutton Lee (East Carolina University) Gail Jones (NC State University) Bonnie Glass (East Carolina University) Katherine Chesnutt (NC State University)
Although national elementary science standards have included the teaching of systems for decades, little is known about teachers’ understanding of complex systems. This study focuses on how elementary pre- and in-service teachers understand and apply “systems thinking” to one particular system, the water cycle.

Traditional Paper Set Thursday 1:00-2:00 PM Room 2
Thread: Curriculum, Pedagogy and Assessment
Presider: Melissa Jurkiewicz

Going Beyond Subject Matter Knowledge: Developing Measures to Assess Content Knowledge for Teaching Elementary Science
Jamie N. Mikeska (ETS) Geoffrey Phelps (ETS) Andrew Croft (ETS)
We report on findings from the online administration of a set of content knowledge for teaching science assessments developed for upper elementary teachers across three topics: matter; ecosystems; and Earth’s place in the universe. Findings contribute to validating a design theory for measures of content knowledge for teaching science.

STEAM Classroom Assessment of Learning Environment: Transdisciplinary Teaching Practices for Science Teachers
Cassie F. Quigley (Clemson University) Dani Herro (Clemson University) Faiza M. Jamil (Clemson University)
STEAM, a transdisciplinary learning process, has the potential to increase participation in STEM fields. In this presentation, we provide a much-needed conceptual model that clearly articulates essential components of the STEAM approach providing science educators with the opportunity to employ transdisciplinary inquiry approaches.

Development and Validation of Teacher Intentionality of Practice Scale (TIPS): A Measure to Evaluate and Scaffold Professional Development
Julie B. Smart (Clemson University) Jeff C. Marshall (Clemson University)
The Teacher Intentionality of Practice Scale (TIPS) provides a highly reliable and valid measure for assessing teacher effectiveness with today’s more complex standards and expectations. The theoretical foundation, the validity and reliability, and applications of TIPS for teacher evaluation and professional development will be discussed.

Traditional Paper Set Thursday 1:00-2:00 PM Room 3
Thread: STEM Education
Presider:

Teaching Science and Engineering through Historical Reconstruction
Nigel Standish (University of Virginia) Glen Bull (University of Virginia) David Slykhuis (James Madison University)
The Smithsonian is collaborating with the Laboratory School for Advanced Manufacturing sponsored by the University of Virginia to digitize key inventions in its collections such as the telephone, telegraph, and early electric motors. The science principles underlying the inventions can be leveraged in science class to teach foundational knowledge.

**STEM-S IMPACT: A model for transitioning to NGSS and STEM practices**
Issam H. Abi-El-Mona (Rowan University)
This pilot study examined the impact of the use of an innovative curricular model that seeks to facilitate transitions from existing state based science content standards to the Next Generation Science Standards with a STEM community inquiry based focus. The study is part of a broader study submitted to the National Science Foundation.

**The First Year of an Innovative STEM Elementary School**
Judith A. Morrison (Washington State University) Jonah Firestone (Washington State University) Laura Grant (Washington State University)
The development of one STEM elementary school, the planning, implementation, and organization of the school, will be laid out in this presentation as a model for other STEM elementary school projects. Challenges and successes achieved will be discussed and an overview of the integrated curriculum designed for the school will be presented.

<table>
<thead>
<tr>
<th>Thursday 1:00-2:00 PM</th>
<th>Room 4</th>
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</thead>
<tbody>
<tr>
<td><strong>Thread: Equity &amp; Diversity</strong></td>
<td>Presider: Sophia Sweeney</td>
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</table>
**Differential Parental Encouragement and Guidance during Science Problem Solving?**
Examining Implicit Biases Based on Gender and Ethnicity
Kayla Messinger (Arizona State University) Susannah Sandrin (Arizona State University) Alyssa Trudel (Arizona State University) Katherine Short-Meyerson (University of Wisconsin-Oshkosh)
The goal of this study is to examine the types of praise (process/person) and guidance behaviors (constructive/intrusive) that parents exhibit during a hands-on science session with their 4th grade child. A mixed method approach is employed to determine if these behaviors differ based on parent and/or child gender, and family ethnicity.

**Considering Girl-Friendly Science Instructional Strategies within an Integrated STEM Curriculum**
Emily A. Dare (Michigan Technological University) Gillian H. Roehrig (University of Minnesota)
This presentation focuses on an integrated STEM curriculum that aligns to various girl-friendly science instructional strategies. An examination of curriculum implementation in a 6th grade middle school science class provides insight on how to engage students in lessons that incorporate physics content into an engineering design challenge.

"The Pill" and Organic Chemistry: Feminist-framed, Critical Chemistry Education in a High School Classroom
Patrick D. Ashby (Teachers College, Columbia University) Felicia Moore Mensah (Teachers College, Columbia University)
This study reports findings of a successful method for implementing feminist-framed, critical science education in a suburban high school chemistry class. Moreover, the study specifically documents and frames student learning through the lens of sociocultural learning theory.

### Traditional Paper Set

**Thursday 1:00-2:00 PM**

**Room 5**

**Thread: Informal Science Education**

**Presider:** Aimee Govett

**Learning about Nature in Nature: Learning Experiences of Thru-hikers on the Appalachian Trail**

Vanessa A. Klein (Montclair State University)

This study explored informal learning on the Appalachian Trail (AT). Analysis of qualitative data revealed that thru-hikers on the AT learn about a variety of scientific subjects through social learning.

**Science Museums as Intentional Partners in Teacher Preparation: Exploring Influences on Candidates' Thinking about Teaching and Learning**

Lara K. Smetana (Loyola University Chicago) Jenna Carlson (Loyola University Chicago) Daniel Birmingham (Colorado State University) Heidi Rouleau (The Field Museum) Kyla Cook (The Field Museum)

This qualitative study explores how a preparation program that intentionally integrates experiences in science museums has influenced teacher candidates’ thinking about museums as partners in education, and about science, science learning and science teaching.

**Science Olympiad Experiences in Saudi Arabia**

Aziz S. Alamri (Kent State University) Bridget K. Mulvey (Kent State University) Mila R. Librea (Kent State University) Lucy Kulbago (Kent State University)

This qualitative study examines Saudi students’ Science Olympiad experiences to present a conceptual model of the interplay between inspiration, competition, and cooperation. This study revealed significant outcomes related to enhancing social skills such as cooperation and making friends among Saudi students. It also showed how engaging in such activities inspired them to pursue science related majors.

### Traditional Paper Set

**Thursday 1:00-2:00 PM**

**Room 6**

**Thread: Policy and Reform**

**Presider:** Erica M. Brownstein

**Dispersed to the Wind: Issues and Implications of Tracking (or not) STEM Education Graduates**

Helen Meyer (University of Cincinnati)

Many States claim to use data from graduates to evaluate and report on the quality of teacher preparation programs. Putting validity aside, to discuss the difficulty our program found tracking our graduates in order to gather meaningful information about their preparation, experiences and satisfaction with their decision to be a science teacher.

**Goals and strategies for political advocacy in science teacher education**

Joseph Shane (Shippensburg University of Pennsylvania) Jodi Peterson (National Science Teachers Association) Ian Binns (University of North Carolina Charlotte)
This session sponsored by the ASTE Forum on Policy and Government Relations as well as the NSTA Office of Communication, Legislative and Public Affairs will address general goals and strategies for advocating for policies affecting science teacher education. It will also serve as an annual “state of science teacher education” update.

**Intellectual and physical shared workspace: professional learning communities and the collaborative culture**
Daniel Carpenter (Texas Tech University)
Professional learning communities are a leading school reform movement. Shifts in collaborative culture provide physical and intellectual interaction. An emergent framework provides attributes of effective collaboration and characteristics of effective professional learning that merge into intellectual and physical shared workspace.

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<tr>
<th>Roundtable</th>
<th>Thursday 1:00-2:00 PM</th>
<th>Room 9</th>
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<tbody>
<tr>
<td><strong>Course Embedded Undergraduate Research on the Nature of Science: A strategy for deepening NOS understanding among pre-service elementary teachers</strong></td>
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<td>Presider: Tasneem Anwar</td>
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<tr>
<td>Liz Bergeron (University of Wisconsin-La Crosse) Dr. Erin Peters-Burton (George Mason University)</td>
<td>This session will explore the use of course embedded undergraduate research to deepen pre-service teacher understanding of Nature of Science.</td>
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**Experiential Session**

Thursday 2:15-3:15 PM

**Teaching Science Teachers for Sustainability**
Allan Feldman (University of South Florida) Rita Hagevik (University of North Carolina at Pembroke) Susan K. Stratton (State University of New York at Cortland) Mark Bloom (Dallas Baptist University)
Participants will engage with “Educating Science Teachers for Sustainability” - a book in the ASTE Series in Science Education - to help them to prepare science teachers how to educate their students for sustainability (EFS). The session will use a small group format to explore pedagogical approaches for teaching EFS theory and practices.

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<tr>
<th>Traditional Paper Set</th>
<th>Thursday 2:15-3:15 PM</th>
<th>Room 1</th>
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<tr>
<td><strong>Thread: Student Learning P-12</strong></td>
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<td>Presider: Heather Rudolph</td>
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**Combining Research and Practice to Investigate What Young Children Know and Can Do in Life Science**
Mary E. Hobbs (University of Texas at Austin) Robert A. Williams (Consultant)
Researchers will describe the methodology and preliminary results from a four-year NSF funded study that looked inside prekindergarten classrooms to assess young learners’ knowledge and skills and test strategies for teaching core life science concepts. The mixed methods research involved 24 prekindergarten teachers-as-researchers.

**Technological Tools to Teach NGSS Practices in Early Elementary Classrooms**
Kimberly H. Lott (Utah State University) Alan C. Lott (Technical Consultant)
Early exposure to STEM activities has shown to increase student interest in science in later grades; however, to what extent can young students use technology tools to engage in NGSS practices? This presentation examines the effects of using technology tools within STEM units on Kindergarten students' knowledge of NGSS content and practices.

Factors affecting the use and exploration of everyday experiences in the science classroom
Diego F. Rojas-Perilla (Teachers College Columbia University) Felicia Moore Mensah (Teachers College Columbia University)
This study investigates the difficulties of using every day experiences in two science classrooms. Using a grounded theory approach and a social constructivist framework, there were identified seven interacting factors, suggesting that any approach to tackle this issue requires consideration of simultaneously multiple curricular and pedagogical aspects.

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<th>Traditional Paper Set</th>
<th>Thursday 2:15-3:15PM</th>
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<tr>
<td><strong>Thread: Curriculum, Pedagogy, and Assessment</strong></td>
<td>Presider: Jeni Davis</td>
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<tr>
<td><strong>Analysis of Inquiry Practices in The American Biology Teacher</strong></td>
<td>Laura K. Ochs (University of Virginia) Frackson Mumba (University of Virginia) Vivien M. Chabalengula (University of Virginia)</td>
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<td>This study examined the nature of inquiry practices presented in The American Biology Teacher by analyzing articles that were published from 1998-2014. Four features of inquiry received more coverage. Less coverage for learner engages in scientifically oriented questions. There was partial inquiry practice that was mostly teacher-centered.</td>
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<td><strong>Connecting Secondary Education to the Job Market in Mississippi: Establishing true measures of college and career readiness.</strong></td>
<td>Christina S. Hillesheim (Mississippi State University) Ryan M. Walker (Mississippi State University) Aressa B. Coley (Mississippi State University)</td>
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<td>This presentation tells the story of secondary education and the connections to the middle skill workforce. It addresses high-stakes testing, college or career readiness and school accountability. The Mississippi SLDS and the research methodology used offers a natural solution to the greater national problem of school accountability.</td>
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<td><strong>The Application of Research to Practice: A Collaborative Approach to STEM Curriculum Refinement in an Urban District</strong></td>
<td>Carolyn Parker (The Johns Hopkins University) Amanda Lauier (The Johns Hopkins University) Erica Smith (The Johns Hopkins University) David McKinney (The Johns Hopkins University)</td>
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<td>Our presentation and paper describes how student assessment data, generated through an NSF-funded Math Science Partnership, helped support ongoing grades 3-5 STEM curriculum revisions in a large urban school district. Findings will help inform collaborative curriculum initiatives between institutions of higher education and public school districts.</td>
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Exploring Students' Readiness for STEM Learning in College
Shiyu Liu (The Pennsylvania State University)
The present study explored the nature of underrepresented students’ readiness for STEM learning when they are matriculated in college. The findings provided important implications for STEM teaching in higher education and called for further efforts in enlarging the pipeline of STEM majors among students from underrepresented backgrounds.

Prospective Teachers' Images of Scientific Practices: Precursors in Identifying Effective STEM Instructional Strategies
Karthigeyan Subramaniam (University of North Texas) Pamela Harrell (University of North Texas) Eun Young Lee (University of North Texas) Sumreen Asim (University of North Texas) Elisabeth Pope (University of North Texas)
This presentation details a study of prospective K-12 teachers’ depictions of scientific practices as evident within their drawn images of (teacher as, male as and female as) scientists. Analysis of drawings indicated that prospective K-12 teachers, despite taking many science courses, lacked experiences and familiarity with scientific practices thereby holding constrained perceptions of authentic scientific research and perceptions of inquiry.

Connecting Instruction and Teachers' Self-efficacy and Beliefs in STEM Education
Philip I. Myszkal (University of Toronto) Isha DeCoito (University of Western Ontario)
Effective inquiry based STEM education is paramount to engaging and inspiring students to pursue STEM studies and careers. Although science and math teachers express confidence and beliefs in an inquiry approach and in their practice, findings indicate levels of disconnect when implementing interactive STEM instruction in their own classrooms.

Impact of Professional Development on Perceived Importance Of, Frequency Of Use Of, Familiarity With, And Confidence of Teaching Literacy and Science Concepts for 5th through 12th Grade Teachers
Kristen Pennycuff-Trent (Tennessee Technological University) Leslie Suters, (Tennessee Technological University)
Science teachers investigated research-based strategies for critical reading and technical writing embedded within science content. Participants increased their familiarity with, importance of, and frequency of use of CCSS, NGSS, and pedagogically sound strategies for critical reading and technical writing in science with significant results.
The relationship between science coordinator professional development and teacher change
Brooke Whitworth (Northern Arizona University) Lindsay Wheeler (University of Virginia) Jennifer Maeng (University of Virginia) Randy Bell (Oregon State University)
This study examined how science coordinators who attended PD may have impacted teachers in their districts. We sought to understand if there was a relationship between science coordinator and teacher understanding of inquiry, nature of science, and problem-based learning, and how these understandings impacted instruction.

In-service science teacher needs: Integration of mathematics and language
Molly H. Weinburg (Texas Christian University) Cecilia Silva (Texas Christian University) Kathy H. Smith (Tarleton State University)
We examined long-term PD that integrates science, math, and language for 34 biology teachers to determine what parts were most beneficial to the teachers and how they used their new knowledge/skills in their teaching. Multiple types of data were gathered: reflective responses, focus groups discussion, teacher artifacts, and research notes.

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<th>Traditional Paper Set</th>
<th>Thursday 2:15-3:15</th>
<th>Room 5</th>
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<tbody>
<tr>
<td>Thread: Pre-service Science Teacher</td>
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<td>Presider: Sherri Brown</td>
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<tr>
<td>Examining Secondary Science Pre-Service Teachers' Planning for Questioning in Lesson Planning</td>
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<td>Danielle K. Ross (Northern Arizona University)</td>
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<td>This study examines pre-service teachers' planning for questions. The Boaler and Brodie (2004) question types framework is used in data analysis.</td>
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<td>Experimental and Experiential Teaching and Learning: What teacher educators can learn from listening to student teachers and experienced teachers?</td>
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<td>Kathryn T. Watkins (UNM)</td>
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<td>Student teachers and experienced teachers engage in collaboration with teacher educators to develop an experimental model of student teaching based on extensive and early experiences in a diverse school district. Teacher educators actively participate in a professional learning communities with school based teachers and student teachers.</td>
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<td>Does video-based reflection within a pre-service community of practice help scaffold attention to student thinking?</td>
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<td>Susan R. Hawkins (Indiana University) Meredith A. Park Rogers (Indiana University)</td>
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<td>This study explores differences in the development of two groups of pre-service elementary science teachers learning to attend to student thinking. Selected from the same methods course, the intervention group participated in a content-specific moderated, video-based community of practice. Results point to the positive influence of this context.</td>
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22
Elementary Teachers’ Perceptions about the Effective Features of Explicit Reflective Nature of Science Instruction
Elif Adibelli (University of Nevada, Las Vegas) Hasan Deniz (University of Nevada, Las Vegas)
The purpose of this study is to explore which features of the explicit-reflective NOS instruction are perceived to be effective by elementary teachers after participating one year long professional development about nature of science.

Comparing the Implementation of NOS Activities by Preservice Elementary Teachers
Neal Patel (Drake University) Jerrid Kruse (Drake University) Caleb Gruulke (Drake University) Colin Seebach (Drake University) Mitchell Klocke (Drake University)
This study sought to shed light on pre-service elementary teachers (PSET) implementation of two approaches to teach nature of science (NOS). Using videos, we compared historical stories to black-box activities. Analysis focused on the extent to which PSETs were able to successfully implement the activities and how each activity supported PSETs.

Comparing Successful and Unsuccessful First Year NOST Teaching Experiences
Caleb Brulke (Drake University) Jerrid Kruse (Drake University) Neal Patel (Drake University) Mitchell Klocke (Drake University) Renald Daemicke (Drake University)
This study followed two teachers during their first year of teaching and investigated the extent to which they included nature of science and nature of technology (NOST) in their instruction. Analysis shows one success story and one failure to include NOST. Comparison of these cases sheds light on implementation hurdles for NOST instruction.

Action Research on STEM Education Development into Japanese Contexts: Possible Revises on Japanese Course of Study from the Consequences of Shizuoka STEM Education Trails
Yoshisuke Kumano (Shizuoka University) Tomoki Saito (Shizuoka University) Ilman Anwari (Shizuoka University) Irma Rahma Suwarma (Shizuoka University) Jin-Ichi Okumura (Shizuoka University)
In order to develop better models for the Japanese contexts, we have been trying second year trials at the attached school, Shizuoka University and informal STEM education at four locations in Shizuoka with funding from JST. In this presentation we explain the results from the attached school, STEM camp and STEM education in informal setting.

Ecology of integrated learning environment for Japanese STEM Education: An Example in Future Scientist Program
Tomoki Saito (Shizuoka University) Jin-Ichi Okumura (Shizuoka University) Yoshisuke Kumano (Shizuoka University)
In this session, the authors provide entire picture of the STEM Junior Project in Japan which invited
5th-9th grade elementary and junior high school students. The project includes STEM Classes, Camp, Tour, and support for students’ Free Study. Through those activities, they exploratory collected evidence of what were learned in the environment.

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<tr>
<th>Event</th>
<th>Time</th>
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<tbody>
<tr>
<td>Roundtable</td>
<td>Thursday 2:15-3:15 PM</td>
<td>Room 9</td>
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<tr>
<td><strong>Informal Science Education and Community Outreach in an Elementary Teacher Preparation Program</strong></td>
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<td>Kaylan B. Petrie (Washington State University)</td>
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<td>This roundtable will discuss the history and pedagogy of incorporating informal science education (ISE) into teacher preparation programs. Specifically, the session will outline successful strategies in a science education and community outreach program.</td>
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<tr>
<td>Coffee Break</td>
<td>Thursday 3:00-4:00PM</td>
<td>Tuscany Foyer</td>
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<tr>
<td>ASTE Board Leadership Workshop</td>
<td>Thursday 3:00-5:00 PM</td>
<td>Room 12</td>
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<tr>
<td>Robert Hollon (ASTE Executive Director) and members of ASTE Board</td>
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<td>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.</td>
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<tr>
<td>Publications Committee</td>
<td>Thursday 3:30-4:30 pm</td>
<td>Room 10</td>
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<tr>
<td><strong>Introducing the Innovations in Science Teacher Education – A new online ASTE Journal</strong></td>
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<td>Meredith A. Park Rogers (Indiana University) Gillian H. Roehrig (University of Minnesota)</td>
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<td>This session will introduce the editors and share the vision of this new practitioner journal for ASTE that will be offered online to members.</td>
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<tr>
<td>Experiential Session</td>
<td>Thursday 3:30-4:30 PM</td>
<td>Room 7</td>
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<tr>
<td><strong>Forging New Trails: Negotiating Science and Engineering Content in Teacher Education</strong></td>
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<td>Mary M. Atwater (The University of Georgia) Barbara Rascoe (Mercer University)</td>
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<td>This experiential workshop will embrace strategies designed to launch, promote, and enhance science educators’ effectiveness relative to future elementary science teachers’ negotiating science core ideas while using science and engineering practices and crosscutting concepts.</td>
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<td>Traditional Paper Set</td>
<td>Thursday 3:30-4:30 PM</td>
<td>Room 1</td>
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<tr>
<td><strong>Thread: Student Learning P-12</strong></td>
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<tr>
<td><strong>Data Explorations in Ecology: Secondary Students’ Knowledge, Skills and Attitudes towards Data</strong></td>
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<td>Tobias E. Irish (Cary Institute of Ecosystem Studies) Alan R. Berkowitz (Cary Institute of Ecosystem Studies) Cornelia Harris (Cary Institute of Ecosystem Studies)</td>
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<td>The Data Explorations in Ecology Project supported students in gaining proficiency with data</td>
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exploration practices. The research findings highlight students’ knowledge, skills and attitudes toward a variety of data exploration activities, including interpreting data representations, understanding variability and evaluating claims based on evidence.

"Why You Think You Get to Do Everything?!” An Ethnographic Case Study of Eighth Graders Engaged in Garden-based Learning
Heather A. Rudolph (University of Georgia) Deborah Tippins (University of Georgia) Elizabeth Pate (University of Texas, San Antonio)
Exploration of enactment of the theory of action gardening was conducted by observing an agricultural science teacher and her eighth grade students for one semester in this ethnographic case study. Place conscious education was used as a theoretical framework to present students’ perceptions of garden-based learning in this paper and presentation.

Using the Instructional Congruence Model to Increase English Language Learners’ Attitudes and Achievement in Science
Hania M. Salame (Wayne State University) Maria M. Ferreira (Wayne State University)
This presentation discusses the impact of the Instructional Congruence Model on English Language Learners’ attitudes and achievement in science. Results indicate a significant increase in student achievement and in all the domains of their attitudes toward science. Implications of these results are discussed.

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<tr>
<th>Themed Paper Set</th>
<th>Thursday 3:30-4:30 PM</th>
<th>Room 2</th>
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<tbody>
<tr>
<td>Science Education Field Experience 2.0: Intentional Field Experience to Develop Culturally Relevant, Confident and Content Expert Teachers</td>
<td>Paula A. Magee (Indiana University – Indianapolis) Tina J. Cartwright (Marshall University) Deb Hemler (Fairmont State University)</td>
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<td>In this presentation we share the goals of three approaches (culturally relevant teaching; confidence; and content area knowledge) to field experience in science teacher education.</td>
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<th>Thematic Paper Set</th>
<th>Thursday 3:30-4:30 PM</th>
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<tr>
<td>Traditional Paper Set</td>
<td>Thursday 3:30-4:30 PM</td>
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<tr>
<td>Thread: STEM Education</td>
<td>Mark A. McDermott (University of Iowa) Mason Kuhn (University of Northern Iowa) Katie Graf (University of Iowa)</td>
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<tr>
<td>The Argument-based Strategies for STEM Infused Science Teaching (ASSIST) Approach</td>
<td>The Argument-based Strategies for STEM Infused Science Teaching (ASSIST) approach combines the argument-based Science Writing Heuristic (SWH) with infusion of mathematics, technology, and engineering. The ASSIST approach also includes tools and templates to help teachers plan units, classroom activities, and communication opportunities.</td>
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<tr>
<td>An Action-Research on the Expansion of Biological Knowledge and Achievement of the Scientific and Engineering Processes in High School Students through an Embryonic Outbreak Experiment Based on Bio-STEM Perspective</td>
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In a Japanese high school’s biology classes, the embryonic outbreak experiment was performed with quail eggs. At first it didn’t work out. The students thought about the causes of the failure and solved a problem to design and make two types of artificial incubators. Students generated many ideas connected to the STEM fields.

The Tower Builders: Making the Case for Ethics in STEM Education
Astrid Steele (Nipissing University) Christine Brew (Nipissing University) Brenda R. Beatty
Based on a science lesson in a pre-service teacher class, we consider the roles of STEM and STSE (science, technology, society and environment) education initiatives. We take a lesson from history, and in conjunction with Habermas’ knowledge theories, and several contrasting ethical perspectives, we seek to strengthen science pedagogy.

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<th>Traditional Paper Set</th>
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<tbody>
<tr>
<td>Thread: Science Teacher Professional Development</td>
<td>Presider: Angela Webb</td>
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<tr>
<td>A Model for Implementation: How One District is Preparing Elementary Teachers to Engage Students in 3-Dimensional Science</td>
<td>Max L. Longhurst (Utah State University) Kimberly H. Lott (Utah State University)</td>
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<tr>
<td>Local school districts are uniquely positioned to provide the needed support to elementary teachers allowing them to provide high quality 3-dimensional science instruction that is aligned to NGSS. Learn how one district’s model for elementary science learning engaged teachers in science professional learning.</td>
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<tr>
<td>Beginning Teachers, Mentor Teachers, and their Administrator: A Comparison of Methodological Readiness for Implementing the Next Generation Science Standards</td>
<td>Cindy L. Kern (Quinnipiac University) Amanda Bozack (University of New Haven) Rosemary Whelan (University of New Haven) Beth Markello (University of New Haven)</td>
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<tr>
<td>This presentation describes pre-existing, written descriptions of science teaching methodology for three distinct categories of educator’s (beginning teachers, mentor teachers, and administrators) with the intention of determining if and how teachers’ pre-existing descriptions align with NGSS-based teaching and learning.</td>
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<td>An exploration of Teacher’s Perceptions Toward Their Learning Opportunities</td>
<td>Fahad Alshaya (King Saud University) Abdulrahman Alorain (Ministry of Education)</td>
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<tr>
<td>This longitudinal study looked at (3236) science and mathematics teachers perceptions of professional development during a new curriculum implementation. A questionnaire was developed to measure teacher’s perceptions Surveys conducted suggest that PD is far from ideal in providing effective learning opportunities for teachers.</td>
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Challenges of Implementing Effective Mentoring in Summer Research Experiences: Implications for Science Teacher Education
David Seis (University of South Florida) Allan Feldman (University of South Florida) Sarina Ergas (University of South Florida)
This study looked at changes in the mentoring styles of graduate student mentors and undergraduates’ mentoring preferences during a 10-week summer research experience structured as an apprenticeship. The paper ends with implications for the mentoring of novice teachers, who, like the REUs, are learning in an apprenticeship situation.

An Examination of Pre-service-Mentor Science Teacher Interactions of Their Beliefs, Professional Identity, and Teaching Practices
Jan Nourollahi (Georgia State University)
This case study examines pre-service and mentor science teachers’ interactions on their beliefs, professional identity, and teaching practices and the implications on pre-service science teacher preparation programs.

Outcomes of Nature of Science Instruction Along a Context Continuum: Preservice secondary science teachers’ conceptions and instructional intentions
Bridget K. Mulvey (Kent State University) Jennifer Maeng (University of Virginia) Randy Bell (Oregon State University)
This case study examined outcomes associated with NOS along a context continuum on the development of 70 secondary preservice science teachers’ conceptions, plans and rationales to teach NOS. Details on activities along the continuum are presented, as we seek to contribute by exploring NOS beyond the dichotomy of contextualized or not.

A First Time Method's Instructor's Experience Teaching Nature of Science in a Pre-service Elementary Science Methods Class
Noushin Nouri (University of Arkansas)
This is a report of my first experience teaching a pre-service elementary science method course, with a specific focus on the nature of science. Using reflections recorded before and after instruction, I discuss the general experience and the challenges of adding NOS to methods instruction and ways such challenges were handled.

Tacit Knowledge in High School Classrooms
Rory J. Glass (State University of New York at Albany)
Tacit knowledge has been theorized for the past 50 years with little practical insight. This presentation
reports data on the emergence of tacit understandings from urban high school students and discusses their teachers’ views of those understandings. These understandings will be an important component if we are to meet the goals of the NGSS.

**Rural STEM Professional Development**
Miriam Munck (Eastern Oregon University)
This research focuses on a three year long professional development attempting to prepare rural K-12 teachers to design STEM units that capitalize on interconnectedness of STEM disciplines as mandated by NGSS, and to use authentic applications of STEM in active learning situations.

**Experiential Session**
**Thursday 3:30-4:30 PM**
**Room 8**

**Exploring Two Cases: edTPA as Measure of Teacher Effectiveness: Looking Closely at Analyzing Data and the Nature of Science**
Jessica F. Riccio (Teachers College, Columbia University) Lisa Neesemann (Teachers College, Columbia University) Peter Hillman (Teachers College, Columbia University)
This interactive experiential session highlights two cases of a secondary science candidate’s edTPA™ portfolios. We wish to engage the ASTE community in a conversation about the components of the portfolio and specifically the artifacts and commentaries specific to Analyzing Scientific Data.

**Roundtable**
**Thursday 3:30-4:30 PM**
**Room 9**

**A Science Teacher Preparation Program Designed by Master Teachers**
Georgianna L. Saunders (Missouri State University)
This roundtable will discuss a teacher preparation program designed by master science teachers and university science educators. The program will result in an increased, and more applicable, knowledge base by educating teachers in state-of-the-art pedagogy and the everyday, practical knowledge necessary to be an effective teacher. NSF Noyce funded.

**Poster Session**
**Thursday 5:30-7:30 PM**
**Discovery Museum**

**ASTE Welcome Reception and Poster Session.** Located at the Discovery Museum and Featuring the National Geographic Monster Fish Exhibit. Enjoy an array of snacks while interacting with colleagues at this Social / Poster Session. Shuttle Busses at the Valet of the Peppermill and in front of the Discovery run every 15 minutes from 5:00 till 8:00 pm. 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. The Discovery is located near downtown in the midtown district that has many restaurants for dinner after the reception.

1) **Spatial Skills for STEM Success**
Jaclyn K. Murray (University of Georgia) Barbara Crawford (University of Georgia)
Countless students enter STEM programs every year with underdeveloped spatial skills. Universities
now offer additional coursework to enhance spatial visualization skills. Learn about spatial training and its importance to K-12 science education. Preliminary spatial data from spatially untrained pre-engineering students will be presented.

2) Exploring NITARP's Impacts on Teacher's Knowledge, Attitudes, and Teaching
Debbie A. French (University of Wyoming) Andrea C. Burrows (University of Wyoming) Timothy F. Slater (University of Wyoming)
This qualitative study describes how the NASA/IPAC Teacher Archive Research Program (NITARP) changed teachers’ thoughts about astronomy and what happened in their classrooms. Teachers reported increasing astronomy content knowledge, incorporating the use of real data, and implementing new skills, programs, and research into their curriculum.

3) Intensive Professional Development for NGSS Implementation and Science Teacher Leadership: An Overview of an Effective and Sustainable Model
Peter Hillman (Mercy College) Meghan Marrero (Mercy College) Amanda Gunning (Mercy College) Arthur Eisenkraft (University of Massachusetts Boston/COSMIC) Amanda Jaksha (NY Hall of Science)
The current need for effective professional development models for science teachers is especially critical given the rapid shift to national standards occurring within public education in the United States. We present a model of professional development that we are using across five districts in our state and that is in use across 15 districts in the Northeastern United States.

4) The Systemic Nature of Professional Development via Partnerships
Andrew C. Burrows (University of Wyoming)
Exploring the systemic nature of STEM professional developments (PD), and paying special attention to partnership development and lesson plan creation, is this poster’s focus. Two PDs, totaling 19 days of participant contact time (n=31), are explored for the systems that enabled K-12 teacher growth and for the themes uncovered in their perceptions.

5) Situating Teacher Content Learning within Scientific Research
Jenny D. Ingber (Bank Street College of Education)
This poster highlights the 1st of a 4-part PD course series, noting how it has been developed and experienced over 3 years with 3 different content foci: neuroscience, paleontology, and ecology. This course focuses on science content learning within a scientist’s field of research. It is co-taught by a scientist and a science educator.

6) The Professional Development and Implementation of an NGSS aligned Elementary STEM Curriculum
Frederick W. Freking (University of Southern California)
This poster shares the Speedometry curriculum developed through a collaboration between Mattel, university science educators, and elementary teachers and a study of the professional development to implement this curriculum. Elementary teachers overwhelming reported a positive impact of the PD on their STEM teaching understanding and practice.
7) Effects of Professional Development on Teacher Beliefs and Knowledge: Preliminary Results from a 3-year Research Project
Yejun Bae (The University of Iowa) Jee Kyung Suh (The University of Iowa) Soonhye Park (The University of Iowa) Brian Hand (The University of Iowa)
This research is a 3-year professional development (PD) project that addresses the need for science teachers to shift their instructional practices to more argument-based approaches. 18 middle school teachers participated in PD for learning to implement the Science Writing Heuristic (SWH) and showed positive changes in their practices and beliefs.

8) Differentiated Professional Development for Science Teachers: Incorporating Reform Efforts into a Personalized PD Plan
Brandy Bourdeaux (University of Colorado, Denver) Geeta Verma (University of Colorado, Denver) Kirstyn Dutton (Regis Jesuit High School, Boys Division) Kathleen Willson (Regis Jesuit High School, Girls Division) Helen Douglass (University of Colorado, Denver)
This poster presentation describes a series of hybrid-model professional development (PD) modules that were presented to a group of science teachers at a large private high school. Various reform documents were incorporated into a personalized model of PD that was dynamic and relevant for the teachers.

9) Developing Content, Pedagogy, and Mentorship Capacity for Improving Elementary Math and Science
Jerrid W. Kruse (Drake University) Jesse Wilcox (Grand View University)
A partnership between two universities and an urban school district has been established to provide math and science professional development to elementary teachers. Design of this 12-month PD experience and formative assessment data will be shared.

10) The Nature of Elementary Pre-service Teachers' Explanations of Buoyancy
James Minogue (NC State University)
This poster session chronicles a study of pre-service elementary teachers (N = 48) that categorized and described the relationship between the teachers’ descriptions and explanations of the sinking/floating phenomena. Results pointed to the impoverished conceptual status of the teachers and implications for science teacher education are discussed.

11) Maximizing Data Collection and Analysis of a Teaching Episode
Craig Berg (The University of Wisconsin-Milwaukee)
We will share an iPad App for observing teachers and designed for data collection regarding student engagement, teacher questioning and responding, use of wait-time, and classroom management issues. It provides a running record and summative counts, and patterns of teaching, displaying many indicators related to effective instruction.

12) Exploring Science Teacher Identity Development of Elementary Teachers
Sarah J. Carrier (North Carolina State University) Margaret Thomson (North Carolina State University)
This qualitative study investigated pre-service teachers’ memories of science and science education and into their first year of teaching. Grounded within a theoretical framework of identity we examine experiences that contribute to case studies’ developing identities as teachers of science.

13) UNC Charlotte 49ers Teach Program
Warren J. DiBiase (UNC Charlotte) David K. Pugalee (UNC Charlotte)
The UNC Charlotte 49ers Teach Program supports outstanding science students in becoming K-12 math and science teachers through the Robert Noyce Teacher Scholarship. The 49er Teach Program at the University of North Carolina Charlotte offers competitive, generous scholarships and collaborative education research and teaching opportunities to junior and senior undergraduates majoring in science.

14) Science Teaching Efficacy: A Study of Credential Students' Beliefs Pre and Post Science Methods Course
Jenna Porter (California State University, Sacramento)
This study highlights the increased science teaching efficacy levels of multiple subject credential students pre and post a science methods course. Challenges to science education were also identified by credential students including lack of time and resources, as well as the need for teachers’ strong content knowledge.

15) Building the Pipeline to Teacher Preparation in Chemistry and Physics
Michelle L. Head (Kennesaw State University) David Rosengrant (Kennesaw State University) Charlease Kelly-Jackson (Kennesaw State University) Katarina Dass (Kennesaw State University) Gregory T. Rushton (Kennesaw State University)
This poster seeks to understand what external and cultural factors influence one in making the choice to pursue a career in science education. The population studied was college and high school minorities recruited into a mini teacher development program to be camp counselors in a low-stakes science camp for area high needs middle school students.

16) The 5E Learning Cycle with Explicit Attention to Conceptual Storylines
Kelsey Gillstrom (University of Missouri-Columbia) Eun Ju Lee (Wisdom Center-Seoul, Korea) Deborah Hanuscin (University of Missouri-Columbia)
While the learning cycle is thought to help teachers package important instructional goals into a developing conceptual storyline, we have found that how and when pre-service teachers are introduced to the idea of a conceptual storyline influences the extent to which they understand the learning cycle.

17) The T-RES Teacher Residency Program: an Effective Alternative in Science Teacher Preparation
Gil Naizer (Texas A&M University-Commerce) Amanda Glaze (Texas A&M University – Commerce)
Surveys of post-bac resident teachers and their mentors regarding preparedness to perform tasks indicative of effective teaching and, in the case of mentors, preparedness to mentor and coach residents indicate positive perceptions of the residency program in terms of resident preparedness and mentor willingness to work with the residents.
18) Elementary Pre-service Teachers' Orientations toward Teaching Science
Lisa S. Fanning (University of Nebraska-Lincoln) Krista L. Adams (University of Nebraska-Lincoln)
Elementary pre-service teachers enter science methods courses with a diverse set of ideas on how science should be taught. They need a clear understanding of their orientations of teaching science. This presentation is an analysis of pre-service teachers' orientations in an undergraduate methods class.

19) A Review on Prospective Teachers' Understandings of Modeling Practice and its Assessment in Science Education
Young Ae Kim (University of Georgia) Deborah Tippins (University of Georgia)
In this study, we examined: a) prominent features about prospective teachers’ understanding of modeling practice and its assessment in science education research, b) design principles for teacher preparation program to better promote modeling practice. This presentation highlights what we learned in the literature and future directions in research.

20) Pre-service secondary science teachers' view of models and modeling
Eunmi Lee (DePaul University) Bryan Meeker (DePaul University)
The purpose of this study is to examine the understanding and uses of models and modeling presented by three pre-service secondary science teachers. Results of this study demonstrate a limited understanding of the use of models and modeling as shown by an overwhelming preference for only physical representations.

21) The Creation and Validation of an Instrument to Measure School STEM Culture
Chris D. White (Clemson University) Jeff Marshall (Clemson University)
School STEM Culture is a cultural aspect 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.

22) Recruiting STEM Majors into Science and Mathematics Teaching Through a Teaching Internship Program
Michelle Cook (Clemson University) Renee Lyons (Clemson University)
This presentation will focus on an internship program developed to recruit undergraduates, specifically STEM majors, into secondary science and math teaching. The purpose of this research is to investigate what the interns are learning from the teaching experience and how the internship influences their decision to pursue teaching careers.

23) Initiating Instructional Change of STEM Faculty at a Large Research Institution
Julie Luft (University of Georgia) Robert Isardi (University of Georgia) Mustafa Erol (Bozok University) Paula Lemons (University of Georgia) David Meyers (University of Georgia) Marguerite Brickman (University of Georgia)
STEM faculty are being encouraged to change their instruction from traditional to active learning approaches. This is how one university is supporting this change.
24) Designing an Informal Elementary STEM Summer School Experience: Teachers, students and parents speak out
Helen Douglass (University of Colorado Denver) Geeta Verma (University of Colorado Denver) Sarah Bloms (St. Vrain Valley School District)
Schedules, curricular choices and professional development are limited and difficult to control in formal settings. Informal elementary summer programming provides experiences that afford participation by all learners, more choice in curriculum, professional development and opportunities for teachers to focus on science and STEM content.

25) An Apprenticeship Model on a Robotics Team
Nathan R. Dolenc (University of Louisiana at Lafayette) Claire Mitchell (University of Virginia) Robert H. Tai (University of Virginia)
This case study examined adult mentors taking a high degree of involvement on their high school robotics team. Through an apprenticeship learning framework, researchers found mentors following all the stages of apprenticeship as the team built their robot, but truncated the apprenticeship student learning experience during times of competition.

26) Preparing Future Teachers and Future Scientists for Successful Outreach Partnerships with a Life Science Standards-Based K-5 Outreach Program Accessible to All Students
Kerry O. Cresawn (James Madison University)
We present the pilot year of a K-5 science outreach program that prepares future outreach partners by incorporating future teacher/future scientist collaboration, is designed to make science enrichment accessible to all students, and models practical approaches to best practices for teachers by using standards-aligned life science foundations.

27) Assessing Science Teachers' Appraisals, Negative Emotions, and Emotion Regulation Habits when Facilitating Inquiry-based Lessons
Daniel M. Alston (Clemson University) Jeff C. Marshall (Clemson University) Deborah Switzer
This study examines how middle and high school science teachers appraise and emotionally respond to challenging situations that can occur when facilitating inquiry-based lessons.

28) Adventure Learning @ The Confluence
Brant G. Miller (University of Idaho)
This presentation will report on a novel approach to connecting teachers and students in Idaho and Alaska via web-based technologies and place-based watershed issues. Emphasis will be placed on the Adventure Learning model of teacher professional development utilized for the project and on preliminary research results.

29) A review of discourse's outcomes for English language learners in K-12 mathematics and science classrooms
Lindsay K. Lightner (Washington State University) Laura E. Grant (Washington State University) Angela J. Witters (Washington State University)
This study comprises a systematic review of mathematics and science education research regarding how K-12 classroom discourse influences student outcomes for English language learners (ELLs). Few researchers have addressed this population’s outcomes; many of those who have argue that multilingualism is vital to promoting equity in education.

Gina M. Childers (STEM Consultant Raleigh, North Carolina) M. Gail Jones (North Carolina State University)
This study explored students’ perceptions of science motivation, science identity, and virtual presence during a remote microscopy investigation. An exploratory factor analysis identified 3 constructs of a successful remote investigation: Science Learning Drive, Environmental Presence, and Inner Realism Presence.

31) Technological Pedagogical Content Knowledge of Science Teachers Engaging in Blended Learning Techniques
Brandi L. Kamp (Clemson University)
This study examines science teachers engaged in blended learning to create e-Lessons when school was canceled. Researchers compare the teachers’ perceived successful e-Lessons with their technological pedagogical content knowledge (TPCK) scores and determine what aided or hindered the e-Lesson development.

32) Non-Intrusive Assessment of Communication and Collaboration in STEM
Mike Borowczak (Erebus Labs LLC) Andrea C. Burrows (The University of Wyoming)
Communication & collaboration are critical soft-skills often overlooked by the STEM community. Since these skills are formed early - but measured in practice this work used a popular collaboration tool to examine and predict communication success and failures of several STEM senior capstone teams to drive K20 feedback.

33) Developing a Project Based Learning Progression in a Technology Rich Environment
Len Annetta (George Mason University) Richard Lamb (Washington State University) David Vallett (University of Nevada-Las Vegas) Marina Shapiro (George Mason University) Benjamin Matthews (George Mason University)
This poster will illustrate a new learning progression theorized then developed through a Serious Educational Game design and development project funded by the National Science Foundation. The new progression will show how project based activities can be formatively assessed at different nodes throughout the project rather than at the conclusion.

34) Student's Role during Instruction: A Comparison Study of United States and Australia
Yohanis de la Fuente (Texas Christian University)
Since students’ role in the classroom is vital to their learning, this study ponders on observation, and analysis of the opportunities given to students to advance their learning of science in a classroom from United States and Australia. This study argues that students’ own knowledge constructing effort is key
to the learning process.

35) Inquiry Immersion for Content Understanding Prior to a High School Freshman Biology Class
LeeAnn Snell-Burke (University of Texas Arlington) Melissa Hulings (University of Texas Arlington) Raylynn Jansing (University of Texas Arlington) Tracy Campbell (University of Texas Arlington) Yolanda Parker (Tarrant County College)
Summer camps and learning facilities seek to apply inquiry-based approaches to learning with the ultimate goal of improving student achievement. Strictly using science inquiry during a one week summer camp contributed to the effectiveness of these approaches. This project explores the success of specific explorations relevant to the content.

36) Using Bioenergy Science and Engineering to Integrate STEM Concepts: A Delphi Consensus Study
Brian D. Hartman (Oregon State University) Kimi Grzyb (Oregon State University) Katherine G. Field (Oregon State University)
This study developed a framework for bioenergy curriculum in K12 settings. Bioenergy represents a unique opportunity to integrate largely independent STEM disciplines. The resulting framework will provide direction for future curriculum development efforts and will be a framework for research in alternative energy education.

37) Faculty & Student Views Regarding Student Preparation for College Chemistry
Ayanna Pantallion (Santa Monica High School) Alan Colburn (California State University, Long Beach)
This interview-based study compared student and faculty perceptions of student preparation for college chemistry. Neither group believed high school adequately prepared students. Rather than content, though, results implicate emphasizing critical thinking, problem solving (esp. in the lab), connecting related topics, and extracting meaning from text.

38) Connecting Science Literacy and Inquiry-Based Instruction
Pamela G. Christol (Northeastern State University) April D. Adams (Northeastern State University) Karen Harris (Northeastern State University)
This poster presentation highlights an action research project focused on whether inquiry-based instruction increases science literacy in high school biology students. Alternating the teaching strategies of inquiry-based instruction with more traditional forms of instruction, responses were analyzed that reflect the goals of scientific literacy.

39) Effects of NSF GK-12 Resident Scientists on Student Attitudes: A Five-Year Study
Julie Westerlund (Texas State University) Lisa Hanson (Texas State University) Kristina Dame (Texas State University)
Our research describes secondary student attitudes towards science and science graduate students, called resident scientists, in the five-year NSF GK-12 program Project Flowing Waters. We demonstrated significant differences in changing students’ attitudes towards science and scientists before and after their experiences with resident scientists.
Friday January 8

**BREAKFAST**  
Friday 6:30-8:00 AM  
Ballroom A-C

| Committee Meetings          |  
|-----------------------------|---
| Publications Committee     | Room 1  
| Long Range Planning Committee | Room 2  
| Elections Committee         | Room 3  
| Conference Planning Committee | Room 4  
| Membership Committee        | Room 5  
| Oversight Committee         | Room 6  
| Professional Development    | Room 7  
| Awards Committee            | Room 8  

| Traditional Paper Set      |  
|-----------------------------|---
| Friday 8:00-9:00 AM         | Room 1  
| Thread: College and University |  
| Presider: Shiyu Liu         |  

**Exploring Students' Perceptions of Their Biology Learning Environment: Two Years of a Five-Year Study at a Historically Black Institution**  
Catherine Martin-Dunlop (Morgan State University)  
This mixed-methods evaluative study assessed students’ perceptions (N=354) of their undergraduate biology learning environment at a Historically Black Institution in the mid-Atlantic region of the United States. Perceptions were compared between year one and year two of the study, and actual perceptions were compared with what students would prefer in an ideal environment. Seven variables describing the learning environment were measured using the new, 50-item Active Biology Learning Environment Survey–ABLES. Also, two scales assessed students’ attitudes and one scale assessed Academic Self-Efficacy.

**College Biology Students: Age and Contexts of First Evolution Learning Experiences**  
Lisa Borgerding (Kent State University) Rajlakshmi Ghosh (Kent State University) Vanessa Klein (Montclair State University)  
This study explores the age and contexts of college students’ first evolution learning experiences. Sixty-two students from three college biology courses were interviewed. Two main findings emerged. Evolution learning occurs earlier and in a wider range of contexts than presently addressed within the science education literature.
Exemplification in Science Instruction: Teaching and Learning through Examples
Alandeom Oliveira (State University of New York at Albany) Adam Brown (University of Ottawa)
We examine the exemplification practices of a university instructor during a biology lecture on animal behavior. The instructor is shown to give procedural, conceptual, and analytical examples characterized by a unique focus, form, and functions (inductive articulation of generalities, deductive application of concepts, social positioning).

Traditional Paper Set Friday 8:00-9:00 AM Room 2

Thread: Curriculum, Pedagogy, and Assessment Presider: Brendan Callahan

Building Student Networks: Towards a Connectivist Analysis of Classroom Learning Environments
Gerald Ardito (Pace University)
This paper is a report on the findings of an action research study conducted on a middle school with eighth grade students who were participating in a blended, self-directed Biology course. This study develops a methodology for applying Connectivist learning theory to a blended learning environment.

The pedagogical potential of drawings: Investigating first graders’ demonstrations of understanding through images in a carnivorous plant unit
Rachel Wilson (Appalachian State University) Leslie Bradbury (Appalachian State University)
In a multimodal, integrated science-language arts unit focusing on carnivorous plants (CPs), first-graders demonstrated their knowledge through drawings. We will share our findings of the potential of using drawing in early elementary science units and how these findings have impacted our instruction in our elementary science methods courses.

Implications of Degree Modifications and an Innovative Science Artifacts Portfolio in a Secondary Education Program: Phase 2
Christina McDaniel (Mississippi State University) Ryan Walker (Mississippi State University)
An assessment of a secondary science education program indicated that 100% alignment with NSTA standards was essential. Therefore, 100% curriculum alignment resulted in degree modifications as well as the introduction of an innovative science artifact portfolio. This study analyzes the impact of these program changes on student learning.

Traditional Paper Set Friday 8:00-9:00 AM Room 3

Thread: Educational Technology Presider: Sara Raven

Uncovering Ecojustice within an online learning environment
Stacey Britton (University of Mississippi) Amber Carpenter-McCullough (University of Mississippi)
As educational practices continue to evolve, science teacher educators have begun to use interactive tools to encourage student interaction in higher education. This study examined the interaction of the students in order to explain meanings contained within the reality of each individual student within the Google community virtual environment.
Snapshots of Science: Implementing Instagram in a Science Classroom
Lauren Serpagli (Teachers College Columbia University) Felicia Moore Mensah (Teachers College Columbia University)
This study reports the findings from a high school AP Biology class and students’ reactions to using Instagram in the classroom as an instructional tool. The study explored the impact Instagram had on the learning experience of the 10 participating students, how it was used, and how it increased the reach of the classroom teacher.

Sewing In the Science: Using Electronic Textiles and Maker Space Technologies to Improve Science Teacher Education
Colby Tofel-Grehl (Utah State University)
This paper discusses findings of a recent study that explored the use E-textiles and Three-D printing technologies to provide students with a novel approach to teaching secondary science in a hands-on fashion and improve attitudes towards inquiry and making within the science classroom.

<table>
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<tr>
<th>Traditional Paper Set</th>
<th>Friday 8:00-9:00 AM</th>
<th>Room 4</th>
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<tr>
<td><strong>Thread: Equity and Diversity</strong></td>
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<td>Presider: Nate Carnes</td>
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<td>Teaching and Assessing Students with Significant Cognitive Disabilities</td>
<td>Lori Anderse (University of Kansas)</td>
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<td>Little research exists about the teaching of science to students with significant cognitive disabilities. New alternate science standards increase expectations for these students. This presentation will describe specific cognitive challenges associated with this population and the challenges in teaching science to this population.</td>
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<td>Academic Acceleration and Science, Technology, Engineering, and Mathematics (STEM) Education: Research and Practices Concerning STEM Acceleration</td>
<td>Lori Ihrig (University of Iowa)</td>
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<td>Opportunities for high-ability students—extending beyond STEM exposure—are crucial for developing STEM talent and leadership. Acceleration is a research-supported method for challenging gifted youth and developing high-level talent. This presentation provides research-based responses to common reasons for not accelerating gifted K–12 STEM students.</td>
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<td>The Capacity of Social Network Analysis to Provide Insights into Equitable Science Achievement</td>
<td>Julianne Wenner (Boise State University) John Settlage (University of Connecticut)</td>
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<td>We examined the characteristics of various science-related networks in elementary STEM schools that have been successful in closing science achievement gaps. Our findings indicate there is a great deal of variation in the characteristics of the different science networks, and that social capital may play a role in equitable science achievement.</td>
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### Traditional Paper Set  
**Friday 8:00-9:00 AM  
Room 5**

**Thread: Science Teacher**

**Attitudes of Elementary Teachers about Teaching Elementary Science**  
Tonia Sprinkle (Teachers College Columbia University)  
This study reports findings of elementary teacher’s self-efficacy about teaching elementary science. Included are implications that professional learning communities might have if study groups and job embedded professional development are implemented on a daily basis, and evident during classroom instruction with support from leaders and teachers.

**Prevalence and Predictors of Out-of-Field Teaching in the First Five Years**  
Ryan Nixon (Brigham Young University) Richard Ross (University of Georgia) Julie Luft (University of Georgia)  
This study explores the prevalence and predictors of out-of-field (OOF) teaching among new science teachers by following 137 teachers across their first five years in the classroom. Results indicate that OOF teaching is common and that OOF teaching is predicted best by a combination of teacher, school, and student factors.

**Changes in Teachers’ Beliefs about Reformed Science Teaching, Pedagogical Discontentment, and Classroom Practices Concerning Inquiry-Based Instruction**  
Rommel Miranda (Towson University) Julie Damico (Baltimore County Public Schools)  
This study investigates the extent to which teachers’ beliefs about reformed science teaching and learning, pedagogical discontentment, and classroom practices concerning inquiry-based instruction changes following participation in a year-long RET-PLC professional development program. The study findings can inform science teacher education and PD.

### Traditional Paper Set  
**Friday 8:00-9:00 AM  
Room 6**

**Thread: Pre-Service Teacher**

**No Student Teacher Left Behind: The Lessons Learned from a Physically Handicapped Science Student Teacher**  
Catherine Koehler (Southern Connecticut State University) David Moss (University of Connecticut)  
This qualitative case study explores the student teaching experience of Adam, a 24-year old secondary pre-service, science teacher inflicted with Duchenne muscular dystrophy. This study followed Adam for one year, secondary science methods through student teaching. The lesson learned will assist anyone involved in teacher education preparation.

**Learning to teach: experiential learning strategy to facilitate science learning and teaching for pre-service teachers**  
Line Saint-Hilaire (Queens College/CUNY)  
The design and implementation of three science lessons within a methods course served as tools to train teachers to teach elementary students using an inquiry-based method of instruction. Teachers
reflected on the process of learning and the model of instruction used, comparing their own experience as students and as teachers.

**Science Majors Reflecting on Science Education Summer Internships**
Nicole Glen (Bridgewater State University)
This presentation will showcase themes found from analyzing the weekly reflections of science majors who worked at summer science education internships. The interns learned about working with young students and the teaching profession, and common themes resulted regardless of their intention to enter K-12 teaching afterward.

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<th>Syllabus Sharing</th>
<th>Friday 8:00-9:00 AM</th>
<th>Room 7</th>
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<tr>
<td><strong>Adapting an Inquiry-Based Course Concerning Force and Motion to the Online Environment: Successes and Challenges</strong></td>
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<td>April Adams (Northeastern State University)</td>
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<td>This graduate-level, inquiry-based science content course for teachers is a guided elective requirement for the M.Ed. in Science Education online degree. The process of converting this physics course to an online environment will be discussed as well as how to engage students in inquiry in an asynchronous, online learning environment.</td>
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<td><strong>Exploring the Impact of a Sustainability-focused Environmental Science Content Course on Elementary Pre-service Teachers</strong></td>
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<td>Mahsa Kazempour (Penn State University - Berks Campus) Aidin Amirshokoohi (DeSales University)</td>
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<td>This qualitative study explores the impact of a reform-based sustainability-focused environmental science course on elementary pre-service teachers’ views and attitude toward science and the environment, willingness to take action to resolve environmental issues, and willingness and confidence in teaching science and environmental education.</td>
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<td><strong>Using culturally relevant/responsive teaching to frame science methods course</strong></td>
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<td>Vanessa Dodo Seriki (Loyola University Maryland)</td>
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<td>This presentation will provide details about the frameworks and instructional strategies used in the development and implementation of a culturally relevant science methods course. The purpose was to help PSTs develop an understanding of how race, ethnicity, language, culture, and socioeconomics impact the teaching and learning of science.</td>
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<td><strong>Teaching, Learning and Leading with Schools and Communities</strong></td>
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<td>Jenna Carlson (Loyola University Chicago) Lara Smetana (Loyola University Chicago)</td>
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<td>In this Syllabus Sharing presentation, we introduce Loyola University Chicago’s teacher preparation program with a specific focus on the design of this field-based program and its developmental growth model and outcomes from elementary and secondary science teacher candidates’ experiences across three selected instructional semester sequences.</td>
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An Overview of STEM Education: An Online Course for Elementary Teachers
Kathryn “Annie” Arnone (University of Missouri)

The presenter of this syllabus share has been working to develop an online professional development course for elementary teachers focused on STEM Education. In this session attendees will receive the syllabus from this course, along with the design rationale and major assignment descriptions.

Experiential Session  Friday 8:00-9:00AM  Room 8

Thread: STEM Education

STEM Identity Development: An Engagement in STEM, Society, and Self
Marco Nava (Los Angeles Unified School District) Imelda Nava (University of California, Los Angeles)

We propose an experiential session where we address personal experiences in shaping STEM identity. Participants reflect on their own personal experiences as well as societal messages in analyzing their own STEM identity.

Round Table  Friday 8:00-9:00AM  Room 9

Thread: STEM Education

Teachers’ Changing Conceptions of STEM over the Course of Long-Term Professional Development
Valarie Akerson (Indiana University) Enrique Galindo (Indiana University) Brent Gilles (Indiana University)

This presentation shares the conceptions that teachers who participated in one and a half years of STEM professional development held over the course of the program. Teachers’ conceptions of STEM changed and refined over time, to believing that real world STEM problems would enable improved content understanding for their students.

NSTA Affiliate Workshop  Friday 8:00-9:00 AM  Room 11

Instructional Materials from NSTA: How Are They Made and What is their Impact (Panel Discussion)
Facilitators: Eric J Pyle (James Madison University) Flavio Mendez (NSTA Learning Center)
NSTA has produced a wide range of materials that have been of use to science teacher educators at all levels. This panel session will host three NSTA authors who will share the impact of these materials on students.

Meet the Board  Friday 9:15-10:15 AM  Room 10
What Is Socio-political Consciousness and What’s It Doing in a Nice Field like Science Teacher Education?
Facilitator: Felicia Moore Mensah (Teachers College, Columbia University)

In this workshop presentation, socio-political consciousness, one major tenet of culturally relevant pedagogy (Ladson-Billings, 1995, 2014; Milner, 2011; Villegas & Lucas, 2002) will be discussed and applied in the context of science teacher education. Participants will engage in discussion and activities first to unpack the meaning of socio-political consciousness (SPC) and what it looks like in science education. With a focus on science teacher educators, the session will stimulate ASTE members to 1) integrate SPC into their methods courses or professional development; 2) be leaders in forming a collective group to push back against policies or legislation that are harmful to science teacher education or science education in general; and 3) become conscious about the political nature of education.

Preparing Science Teacher Candidates for the edTPA: Providing Scaffolding for the edTPA Commentaries
Julie Contino (American Museum of Natural History) Elaine V. Howes (American Museum of Natural History) and Natasha Cooke-Nieves (American Museum of Natural History)
In this workshop participants will examine one scaffold developed to aid secondary science teacher candidates in understanding and completing one component for the edTPA, a performance-based assessment required for teacher certification in NY and other states. Participants will then develop scaffolds for the edTPA commentaries that will be shared. *Participants are asked to bring a computer to the workshop.*

Evaluation Link: [https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2krzaH5v7][uportland.qualtrics.com]

Developing partnerships with scientists: The phenomenon for improving science teaching in the middle grades
Rose Pringle (University of Florida) Lynda Hayes (University of Florida) Natalie King (University of Florida) Jennifer Mesa (University of West Florida)
We examined how four scientists engaged in the delivery of formal science courses for middle grade science teachers experienced the phenomenon of partnership within the context of a NSF-MSP. Four major themes emerged from the qualitative analysis of interviews and provided a description of the lived experiences of the participants.
Supporting doctoral students with no K-12 teaching experience in becoming highly-qualified science teacher educators.
Robert Idsardi, Jr (University of Georgia) Barbara Crawford (University of Georgia)
This study explored what experiences might supplement traditional doctoral programs in science education for students with no K-12 teaching experience to prepare them to be highly qualified science teacher educators.

Parenting 101: Insight into the Role of a Field Based Instructor
Jared Allen (Indiana University) Meredith Park Rogers (Indiana University)
Employing self-study methodology this study seeks to understand the relationship between PCK and identity development of a novice teacher educator. Discussion is also provided on how a community of practice can enhance the self-study experience for recognizing tensions in PCK and identity development and considering methods for addressing them.

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<td><strong>Thread: Curriculums, Pedagogy and Assessment</strong></td>
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<td>Presider: Phillip Boda</td>
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Investigating Science Teacher Candidates’ Assessment Practices Using EdTPA
David Kimori (University of Minnesota) Barbara Billington (University of Minnesota) Gillian Roehrig (University of Minnesota)
In this study three science teacher candidates’ field experience in assessing students is documented. Findings indicate that science teacher candidates make deliberate effort in giving students feedback that can guide students for further learning but they struggle with strategies that can encourage students use the feedback given to them.

The Impact of High-Stakes Testing on Biology Curriculum
Aressa Coley (Mississippi State University) Gabe Posadas (Mississippi State University) Ryan Walker (Mississippi State University)
The use of high-stakes testing in the United States has increased drastically over the last few decades resulting in several unintended consequences. One of the most severe outcomes is a narrowed or reduced curriculum. Using Mississippi’s SLDS, researchers analyzed the impact of high-stakes testing on biology curriculum.

Identifying purposes and exploring decisions: An investigation of two early career physical science teachers’ use of interactive formative assessment.
Aaron Musson (University of Nebraska – Lincoln) Elizabeth Lewis (University of Nebraska-Lincoln)
Teachers use formative assessment to evaluate and guide students’ conceptual understanding, to sustain engagement and build efficacy. This study focused on interactive formative assessment (IFA) practices employed by two third-year physical science teachers, their purposes for using IFA, and factors that inform their response to student needs.
### Thread: Educational Technology

**Presider: Yohanis de la Fuente**

**Examination of moderators of student cognition, affect, and learning outcomes using Serious Educational games, Serious Games and Simulations in the science classroom**

Richard Lamb (Washington State University) Leonard Annetta (George Mason University) Jonah Firestone (Washington State University-Tri Cities) David Vallett (University of Nevada-Las Vegas) Marina Shapiro (George Mason University) Ben Matthews (George Mason University)

This meta-analytic study examines and identifies factor contributing to increases in student science content learning for secondary and tertiary level students. Specifically this analysis compares science based Serious Educational Games, Serious Games, and Simulations and discusses differences between the modes and makes recommendations.

**The impact of Adventure Learning on pre-service science teachers’ TPACK**

Joshua Ellis (Michigan Technological University) Emily Dare (Michigan Technological University) Gillian Roehrig (University of Minnesota)

This study utilizes an explanatory embedded case study methodology (Yin, 2014) to observe the effect of an Adventure Learning experience on pre-service science teachers’ TPACK. Results indicate an increase in teachers’ ability to identify and create pedagogically-grounded TPACK strategies for their future science instruction.

**Digital Notebooks: How Does Use in a Methods Course Impact Perceptions and Use with Elementary Students**

Lori Fulton (University of Hawaii at Manoa) Seungoh Paek (University of Hawaii at Manoa)

Note taking applications for tablet devices increase potential for meaningful integration of science and technology through the use of digital notebooks. We will share findings related to pre-service teacher candidates’ use of digital notebooks during a STEM methods course and how they then incorporated digital notebooks into a summer science camp.

### Thread: Equity and Diversity

**Presider: Maria Rivera Maulucci**

**Developing Pre-Service Teacher Pedagogical Expertise for Integrating Science and Diversity Education**

Marco Bravo (Santa Clara University) Jorge Solis (University of Texas at San Antonio) Eduardo Mosqueda (University of California-Santa Cruz)

This presentation reports on results from a longitudinal study aimed at reforming teacher education programs addressing culturally and linguistically diverse (CLD) students in elementary classrooms. Observational results shows promise of the intervention used for assisting pre-service teachers to enhance their science teaching.
Preparing Tomorrow’s Teachers Through First-Hand Perspectives of Ability in an Inclusively-Designed Science Methods Course
Christopher Atchison (University of Cincinnati) Christina Carnahan (University of Cincinnati) Katelyn Tagg (University of Cincinnati)
This presentation contributes to the practice of pre-service teacher preparation in the area of inclusive instructional design through the development of an innovative science learning community that includes pre-service general and special education majors and students with moderate intellectual disabilities.

Multicultural Competency and Awareness in Pre-service Science Teacher Education: A Tale of Two Cohorts
Sara Raven (Kent State University) Lisa Borgerding (Kent State University)
Diversity in the U.S. school system has increased dramatically over the last twenty years, yet the diversity of teachers has remained largely the same. In this study, we assessed pre-service science teacher cohorts’ multicultural awareness and acceptance using surveys and interviews over a series of two years.

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<td>Thread: Science Teacher Professional Development</td>
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The Next Generation Science Classroom: A Teacher-Lead Model for Effective PD
Patricia Bills (Northern Kentucky University) Madh Kulkarni (Center for Integrative Natural Science and Mathematics) Reeda Hart (Center for Integrative Natural Science and Mathematics)
The Next Generation STEM Classroom project is an embedded, 2-part professional development program for elementary teachers. Participants observe a live, inquiry-based STEM lesson, and then regroup without students to review what they observed in a separate session. Here, we present survey data and report on outcomes of the PD.

Science Teacher Motivations for Repeat Attendance at University Outreach Center Professional Development Programs
Julie Bokor (University of Florida) Kent Crippen (University of Florida)
Adult learning theory provides a lens to investigate perceptions of science teachers who are repeat attendees at PD programs. Findings revealed three themes: (1) they perceive dual identities; (2) relationships with program coordinators facilitate continued participation; and (3) contextual constraints do not hinder participation.

How Do Science Teachers Choose Professional Development?
Beverly DeVore-Wedding (University of Nebraska-Lincoln) Julie Thomas (University of Nebraska-Lincoln)
Professional development (PD) providers turned to science teachers to learn about the PD they sought. Q-sort and focus group methods organized participants (N=29) into three typologies: Scientist, Veteran, and Entrepreneur. Details of these teacher types’ perceived needs will add to the research literature and help guide future PD models.
### Thread: Pre Service Teacher

Presider: Deb Hemler

Joel Donna (University of Wisconsin-River Falls) Sarah Hick (Hamline University)

This mixed-methods study investigates the use of an educative curriculum by pre-service teachers as a way to build science content knowledge alongside pedagogical content knowledge. Pre-service teachers who taught elementary students using the curriculum showed larger increases in content knowledge than those in the control group.

**Using "Personal Science Story" podcasts to build understanding of students and academic language**

Jennifer Kreps Frisch (Kennesaw State University) Neporcha Cone (Kennesaw State University) Brendan Callahan (Kennesaw State University)

A podcasting assignment, in which pre-service teachers are asked to write and produce “personal science” stories, was used in both elementary and secondary methods courses. The presentation will discuss the assignment and what it showed about our candidates’ understandings of science, students, and academic language.

**Celebration of Learning: Teacher created Science Videos that Engage and Explain!**

Mark Guy (University of North Dakota) Steven Ternes (University of North Dakota) Richard Hechter (University of Manitoba, Canada)

This research explored pre-service elementary teachers’ creation of science concept videos with a goal of enhancing their science conceptual understanding and pedagogical knowledge. Findings indicate the activity was valuable for the teachers developing worthwhile, creative, and collaborative science experiences for themselves and future students.

### Thread: Science Teacher Professional Development

Presider: Brooke Whitworth

**Promoting the Successful Implementation of Experience gained from an RET Programs in classroom Teaching to Improve student learning.**

Fayez Alshehri (University of South Florida) Allan Feldman (University of South Florida) Vanessa Vernaza-Hernandez (University of South Florida)

This paper explores the experiences and lessons learned by science teachers from their participation in RET programs and their contribution to the successful transfer of knowledge from teachers to their students in such a manner that they can engage in effective active science practices.

**Learning from a state professional development conference for science teachers: Beginning secondary science teachers’ experiences**

Shannon Dubois (Valparaiso University) Jennifer Maeng (University of Virginia) Randy Bell (Oregon State University)

Little is known about the role of conferences on science teacher learning and development. To contribute to the knowledge in this area, this research studied beginning secondary science teachers’
experiences at a state conference. Implications for science teacher educators pertain to encouraging and supporting new teachers to attend conferences.

**Can Short, Immersive Environmental Experiences Provide Effective Teacher Professional Development?**
Renee Clary (Mississippi State University) Ryan Walker (Mississippi State University) Kimberly Carroll (Mississippi State University) Kenneth Anthony (Mississippi State University)
We researched 3 immersive professional development programs that targeted pre-service (N=7) and in-service teachers (N=43, 23) in 2-5 day programs. Analyses revealed that all immersive experiences resulted in positive gains in teachers’ perceptions for teaching science as inquiry, and incorporating natural outdoor environments within instruction.

### Experiential Session
Friday 9:15-10:15 AM
Room 8

**Thread: Science Teacher Professional Development**

**Video Pedagogies and Tools for Engaging in Ambitious Science Teaching Core Practices**
Deb Morrison (TREE Educational Services) Adam Geller (Edthena)
This workshop will examine how science educators can use video with preservice and inservice teachers to develop ambitious teaching core practices. Participants will explore tools for engaging in and decomposing their experiences of two video pedagogies: screening of video on a core practice and video professional learning communities.

### Roundtable
Friday 9:15-10:15 AM
Room 9

**Thread: Policy and Reform**

**Bridging the ‘Next Generation Gap’ – Teacher Educators Enacting the NGSS**
Kathryn “Annie” Arnone (University of Missouri) Deborah Hanuscin (University of Missouri) Nazan Bautista (Miami University)
Windshitl et al. (2014) suggest teacher educators take substantive steps to engage in reforms by enacting a unit of instruction consistent with the NGSS for K12 students. The presenters of this roundtable session have been acting on the above recommendations, and will share the ‘wisdom of practice’ generated throughout this process.

### Coffee Break
Friday 10:00 – 10:30 AM
Tuscany Foyer
Documenting Long-term Environmental Impacts of Industrialization and Land Use Change with Ice Cores and Chemistry

Dr. Joe McConnell, Professor / Researcher, Desert Research Institute

Archived in polar ice sheets and glaciers are rich records of past climate, precipitation, atmospheric chemistry, and other environmental parameters. Scientists at the Desert Research Institute use state-of-the-art instrumentation and novel continuous analytical methods to develop detailed chemistry records from ice cores largely focused on small particles and droplets in the air and precipitation called aerosols. These aerosols include desert dust, sea spray, soot and other compounds from forest fires, sulfur and heavy metals from explosive volcanism, as well as emissions from industrial activities during recent decades and centuries. Aerosols play important roles in the Earth’s radiation budget and so climate change, but unlike long-lived greenhouse gases, aerosols only stay in the atmosphere for days to weeks so arrays of ice core aerosol records are needed to document and understand past changes. We present a range of aerosol records from a developing array of ice cores from the Arctic and Antarctic, and use them to document and assess the environmental impacts of human activities such as fossil fuel burning, smelting, and land clearing on the Earth system during the past three millennia.

LUNCH  
Friday 12:00 – 1:30 PM

On Your Own

Forum Meetings  
Friday 12:30-1:20 PM

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<td>Inclusive Science Education Forum</td>
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College General Chemistry Students’ Conceptions of Phases of Matter
James Nyachwaya (North Dakota State University)
This study explored college general chemistry students’ understanding of physical states in the context of a chemical reaction, and the extent to which they drew on the kinetic molecular theory (KMT) in their explanations. The study also sheds light on the progression of students’ ideas of matter, beyond pre-college ideas that focus of phases of matter.

Inquiry-based Professional Development for General Chemistry Laboratory Teaching Assistants: Changes in Teaching Assistants’ Knowledge, Beliefs and Confidence
Lindsay Wheeler (University of Virginia) Jennie Chiu (University of Virginia) Jennifer Maeng (University of Virginia) Randy Bell (Oregon State University)
This mixed methods study set in an undergraduate inquiry-based general chemistry laboratory context examined changes in TAs’ beliefs, confidence and content knowledge following a professional development. Results from the study help understand how to support TAs with varied experiences in their instruction.

Engineering in the Elementary Grades: The Current State and Future Directions
Jacob Pleasants (Iowa State University) Christopher Spinler (Iowa State University) Joanne Olsen (Iowa State University)
With the publication of the Next Generation Science Standards, elementary teachers must now integrate engineering into science instruction. The current state of knowledge regarding effective engineering education at the elementary level will be discussed, as well as the key implications for teachers and teacher educators.

Examining the Challenges an Urban High School Biology Teacher has Implementing Scientific Argumentation for the First Time
Brent Gilles (Indiana University) Gayle Buck (Indiana University)
The purpose of this case study was to examine a secondary teacher as she implements scientific argumentation in her AP Biology classroom for the first time. Our findings suggest that teachers need help building new concepts with previous knowledge and understanding how argumentation compliments existing curriculum.

The Teacher Education Implications of a Study of Exemplary Science Fair Programs
Kimberly Murie (John Brown University) William McComas (University of Arkansas)
Research on exemplary science fair and science research programs in 9-12 high schools can help inform science educators about best practices that could be emulated for other schools desiring to begin or enhance a science research program. This research also supports including science research in pre-service science teacher programs.
STEM Education in Malaysia: Reviewing the Current Physics Curriculum
Muhammad Abd Hadi Bunyamin (University of Minnesota-Twin Cities / Universiti Teknologi Malaysia)
Fred Finley (University of Minnesota-Twin Cities)
This study focuses on STEM education in Malaysia by reviewing the current physics curriculum using content analysis method. The primary finding was that there is a need to revise the national science education philosophy because it does not explicitly tell about STEM. Thus, the future science curricula should use STEM perspectives.

Themed Paper Set  
Friday 1:30-2:30 PM  
Room 3

Thread: Educational Technology

Designing Online Science Teaching and Learning Environments
Alec Bodzin (Lehigh University) Robert Marsteller (Lehigh University) William Farina (Lehigh University) David Anastasio (Lehigh University) Raghida Sharif (Lehigh University)
This paper set presents three initiatives for designing fully online and hybrid science teaching and learning environments. The presentation describes curriculum approaches, design principles, digital content, and learning tools designed to promote science teaching and learning. Implications for professional development will be discussed.

Traditional Paper Set  
Friday 1:30-2:30 PM  
Room 4

Thread: Equity and Diversity  
Presider: Catherine Koehler

Examining the Cultural Congruence of Specific National Elementary Education Standards with Children Antecedent Knowledge
Walid Shihabi (Tulsa Community College) Edmund Marek (University of Oklahoma)
This study explores the impact of religious practices, which are pertinent to observing the sun’s position and moon phases, on astronomy-related national elementary education standards of elementary school age American Muslim students. This should aid in designing culturally responsive and contextually relevant instruction to this minority group.

Exploring Sociocultural Influences on Science Teaching in an Aboriginal Context
Stefano Di Tommaso (University of Western Ontario) Isha DeCoito (University of Western Ontario) Wanja Gitari (University of Toronto)
Science curricula tend to ignore Indigenous values, reducing Aboriginal participation in science and technology. This study explores teachers’ views on science teaching and learning in an Aboriginal school in Ontario, Canada. Findings highlight the need for increased relevance, knowledge transfer, and teacher confidence in Aboriginal schools.
**Detailing Teachers’ Pedagogical Decisions when Designing Culturally Responsive Science Instruction**

Julie Brown (University of Minnesota-Twin Cities)

This case study describes the actions taken and pedagogical design decisions made by four high school life science teachers as they constructed culturally responsive science instructional materials when participating in a professional development program. Implications are shared for enhancing teachers’ pedagogical design capacities to this end.

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<td><strong>Thread: Science Teacher Professional Development</strong> Presider: Susan Hawkins</td>
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**Impact of research experiences on secondary science teachers’ teaching beliefs and practices.**

Jessica Wayson (University of Northern Iowa) Sarah Boesdorfer (Illinois State University) Dawn Del Carlo (University of Northern Iowa)

Secondary science teachers were surveyed about their research experiences, teaching practices, beliefs and student data usage. Differences between science teachers with research experience and those without, between novice teachers with and without research experience and between teachers with educational or scientific research experience emerged.

**Reflection on Science Teaching Practices in the Context of NGSS after Participation in a Vertically Articulated Professional Learning Community**

Amanda Gunning (Mercy College) Peter Hillman (Mercy College) Meghan Marrero (Mercy College) Amanda Jaksha (New York Hall of Science)

This qualitative case study of 20 teachers enrolled in a two-year fellowship examines effective professional development models and leadership development in practicing science teachers. The focus of this paper centers on professional learning communities that are orientated to align with the vertical progressions of knowledge emphasized in NGSS.

**The Impact of a Professional Development Program on Elementary Teachers’ Practice and How Context Variables Influenced such Practice: A Case Study**

Sandra Yarema (Wayne State University)

This case study investigated how context variables influenced the impact of a professional development program on the participant teachers’ practice. Results support the implication that adequate support must be provided for teachers to implement what was learned to enact any effective science education reform at the elementary school level.

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**Leading the Way: Utilizing Master Teachers in Science Teacher Preparation Programs**

Keith Sheppard (Stony Brook University) Linda Padwa (Stony Brook University) Caren Gough (Stony Brook University)
This paper describes an innovative practice for science teacher preparation programs that incorporates master teachers into the program’s methods courses. The master teachers work with the methods classes over a period of two years and help to provide insights into the rigors of real world of the classroom for pre-service science teachers.

**Integrating science with other elementary subjects: From faculty committees to practicum training**
Bryan Nichols (Florida Atlantic University) Lori Dassa (Florida Atlantic University)
This presentation, by a science methods instructor and the practicum coordinator, will highlight lessons learned about meaningful subject integration during an interdisciplinary restructuring of a teacher education program. The data come from interdisciplinary faculty committees as well as the concerns of new teachers.

**Interdisciplinarity: A Key Component for Teaching Science**
David Wojnowski (Georgia State University) Christy Visaggi (Georgia State University)
An Earth Science/Life Science course has been collaboratively taught by faculty from the Department of Geosciences and the Department of Early Childhood and Elementary Education with an interdisciplinary approach for the last four years. Techniques derived out of collaborative planning and instruction from the past four years will be shared.

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<td><strong>Presider: Jennifer Mesa</strong></td>
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**Developing Coherent Conceptual Storylines: Two Elementary Challenges**
Deborah Hanuscin (University of Missouri) Kelsey Gillstrom (University of Missouri) Kathryn “Annie” Arnone (University of Missouri) Dante Cisterna (University of Missouri)
Roth et al. (2011) found lessons that link science content ideas and activities to a central learning goal are positively associated with student learning; however, teachers often struggle to design lessons that feature a coherent conceptual storyline. We highlight two common challenges elementary teachers face in developing conceptual storylines.

**The Next Generation STEM Classroom: An Embedded Elementary Professional Development Program**
Patricia Bills (Northern Kentucky University) Madhura Kulkarni (Center for Integrative Natural Science and Mathematics) Reeda Hart (Center for Integrative Natural Science and Mathematics)
The Next Generation STEM Classroom project is an embedded, 2-part professional development program for elementary teachers. Participants observe a live, inquiry-based STEM lesson, and then regroup without students to review what they observed in a separate session. Here, we present survey data and report on outcomes of the PD.

**Examining Early Childhood Teachers’ Subject Matter Knowledge and Pedagogical Content Knowledge for Teaching Scientific Explanations**
Heidi Masters (University of Wisconsin-La Crosse) Meredith Park Rogers (Indiana University-Bloomington)
This study explores changes three K-2 teachers make to their Subject Matter Knowledge and Pedagogical Content Knowledge for teaching scientific explanations. Implications will be discussed regarding the influence these knowledge components can have on teachers’ willingness and ability to support their students with this scientific practice.

**Traditional Paper Set**

**Friday 1:30-2:30 PM**

**Thread: Mixed**

**Presider: Mike Borowczak**

**The Development of Pre-service Science Teachers Competencies for Teaching about Renewable Energy Technology as Context and Concept**

Allison Antink-Meyer (Illinois State University) Matt Aldeman (Illinois State University)

The purpose of this investigation was to explore the ways pre-service teachers’ conceptual understandings about electric circuits and energy technologies influence their planning for instruction about renewable energy technologies.

**The Effect of Meta-Cognitive Activity and Action on Assessment, Pedagogy, and Curricular Choices: An Urban Science Educator’s 3-Year Longitudinal Self-Study**

Phillip A. Boda (Teachers College, Columbia University)

This self-study highlights tangible moments in an urban science educator’s practice that influenced his perceptions of what students learned, how he taught, and what bodies of knowledge were deemed important to teach. Data suggest that meta-cognitive activity and action facilitated conceptual, epistemic, and socio-cultural growth over three years.

**Peer Mentoring in a Pre-service Science Teacher Program**

Lisa Neesemann (Teachers College, Columbia University)

To combat retention issues and effectively prepare pre-service teachers, I have created a mentoring program for use during teacher education preparation. Focusing on a peer mentoring model in which both members of the dyad are of equal positionality leads to authentic feedback, open communication, and a meaningful teacher preparation experience.

**Roundtable**

**Friday 1:30-2:30 PM**

**Thread: Science Teacher Professional Development**

**Emerging Practices within a Teacher-Scientist Community**

Nermeen Dashoush (Teachers College, Columbia University)

This study draws upon Communities of Practice as a theoretical framework to help establish a community between an elementary teacher and a scientist. They set out to create a science unit for a mixed kindergarten and first grade science program.
Committee of Regional Units / Directors Mtg. Friday 1:30 – 2:30 PM
Facilitator: David T. Crowther (University of Nevada, Reno). ASTE Regional Directors Chair

Town Hall Meeting  Friday 1:30-2:30 PM
Room 11

Embedded Workshop  Friday 1:30-3:30 PM
Room 12

Using the NSTA Learning Center as an Online Textbook for Teaching Science Pre-service Teachers
Flavio Mendez, Al Byers, Kate Baird, Kathy Sparrow, William Veal, Jacqueline McDonnough, and Meredith Vaughn
Learn about the Learning Center, NSTA’s online portal, and how it can be used to create a customized online textbook to teach science pre-service teachers. Register to the portal, create a course landing page, add resources to your library, and ask questions to professors who are using this platform. Please bring your own wifi accessible device.

Evaluation Link: https://uportland.qualtrics.com/SE/?S=SV_aaTf2F2krzaH5v7[uportland.qualtrics.com]

Traditional Paper Set  Friday 2:45-3:45 PM
Room 1

Thread: Student Learning P-12
Presider: Angela Chapman

Relationship between Teachers’ Beliefs and Practice of Review Lesson and Student Learning: A Study on Chemistry Teaching and Learning in China
Su Gao (University of Central Florida)
Review lesson in teaching process presumably influences the quality of teaching and student learning. This study explores the relationship between chemistry teachers’ review lesson and student performance drawing on data from a Chinese high school. It found that all three teachers conducted review lesson in different manner.

Investigating the longitudinal impact of high school physics instruction on female students’ physics identities
Jianlan Wang (Florida International University) Zahra Hazari (Florida International University) Cheryl Cass (North Carolina State University) Robynne Lock (Texas A&M University-Commerce)
In this case study, we comprehensively compared the instruction of two physics teachers from the viewpoints of outside observers, students, and the teachers themselves, through which we identified the features of the instruction that have the most lasting positive influences on female students’ physics identities.
Thread: Preservice Teacher

Educating Future Urban STEM Teachers: A Longitudinal Study of a Research-Based Urban Residency Model
Pamela Fraser-Abder (New York University) Colin Hennessy Elliott (New York University) Shruti Krishnamoorthy (New York University) Pravan Kuntmala (New York University)
The themed paper set will inform science teacher preparation using an urban science teacher residency model. A theoretical framework supported by mixed methods analysis of the program will address provisions for content, pedagogical, emotional, and social needs of student teachers.

Traditional Paper Set  
Thread: Science Teacher Professional Development  
Presider: Heidi Wiebke

Non-Western Teacher’s Understanding Nature of science (NOS)
Min Jung Lee (Teachers College, Columbia University) Felicia Moore Mensah (Teachers College, Columbia University)
This paper addresses the Asian Chemistry teacher’s view on Nature of Science (NOS). The findings urge the Asian science teacher educators to improve Asian teachers’ understanding of NOS and more communication between the western and non-western science education community.

Investigating what Differentiates Developing and below Inquiry Lessons from Proficient and Above Inquiry Lessons: Classroom Patterns that Inform Future Practice
Jeff Marshall (Clemson University)
This quantitative descriptive study examines how the classroom patterns of inquiry lessons differ between at least proficient inquiry lessons and below proficient lessons.

Inquiry-Based Instruction: A Possible Solution to Improving Student Learning
Jeff Marshall (Clemson University) Julie Smart (Clemson University) Daniel Alston (Clemson University)
Effective professional development can substantially guide teacher transformation toward greater quantity and quality of inquiry-based instruction. These transformations were shown to improve student performance far beyond what was expected when compared to a virtual comparison group of similarly matched students and to students of non-participants.

Encouraging Creativity While Teaching Diverse Future Gifted Scientists: A Panel Discussion Relevant to Teaching Pre-Service and In-Service Teachers
Melissa Demetrikopoulos (Institute for Biomedical Philosophy) John Pecore (University of West Florida) Trudi Gaines (University of West Florida) Jennifer Mesa (University of West Florida) Erin Peters-Burton (George Mason University) Lisa Martin-Hansen (California State University-Long Beach)
These papers explore the interplay of creativity and giftedness in teaching science and science teacher preparation. Creativity separates good scientists from truly great scientists who open new avenues of
investigation and provides a mechanism for differentiated instruction for students across the intellectual spectrum including GAT students.

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<tr>
<th>Traditional Paper Set</th>
<th>Friday 2:45-3:45 PM</th>
<th>Room 5</th>
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<tbody>
<tr>
<td><strong>Thread: Pre-service Teacher</strong></td>
<td><strong>Presider: Krista Adams</strong></td>
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<tr>
<td><strong>Investigating Freshman Year Early Childhood Education Majors’ Open-Mindedness</strong></td>
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<td>Nazan Bautista (Miami University) Thomas Misco (Miami University)</td>
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<td>This study aimed to identify the pre-service early childhood teachers who lack open-minded thinking dispositions as they enter the early childhood education program, monitor if and how they develop open-mindedness dispositions, and investigate the factors that positively or negatively impact the development of their open-mindedness.</td>
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| Designing Early Childhood Science Methods Consistent with A Framework for K-12 Science Education | | |
| Meredith Reinhart (University of Toledo) Cindy Richard (University of Toledo) Joan Kaderavek (University of Toledo) Charlene Czerniak (University of Toledo) | | |
| This presentation will describe the metacognitive framework, inquiry and engineering activities, and assessment methods used for designing and teaching an early childhood science methods course (K-3) consistent with A Framework for K-12 Science Education. Initial study results, syllabus, lesson plans, and data recording sheets will be provided. | | |

| Pre-service Elementary Teachers’ Science Content Conceptions and Views | | |
| Sherri Brown (University of Louisville) Bill Thornburgh (University of Louisville) Pam Jett (University of Louisville) | | |
| Elementary pre-service teachers’ (n=352) science content conceptions and their explanations for those conceptions were assessed upon entry to an elementary science methods course. Additionally, a subsample (n=118) provided their views toward science through descriptive words and drawings. Data analysis, findings and implications will be presented. | | |

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<th>Themed Paper Set</th>
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<tr>
<td><strong>Thread: Policy and Reform</strong></td>
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<tr>
<td><strong>Humanitas Emptor: Reconsidering Trends and Policy in Science Teacher Education</strong></td>
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<td>Dana Zeidler (University of South Florida) Sami Kahn (University of South Florida) Michael Clough (Iowa State University) Joanne Olson (Iowa State University) Benjamin Herman (University of Missouri-Columbia) Mark Newton (University of South Florida) Troy Sadler (University of Missouri-Columbia)</td>
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<td>We are facing a plethora of educational mandates, trends and policies in science teacher education. Such issues are intricately connected with STEM-related initiatives. This paper set examines key deleterious issues that have emerged unchecked and seemingly embraced unwittingly by the greater science education community and the public at-large.</td>
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Engaged in will have purpose and meaning. This presentation summarizes touchstone development embody. The use of touchstones increases the likelihood that the cur

**Thread: History, Philosophy, and Nature of Science**

**Addressing Interactions Between Science and Religion in Science Teacher Education**

Joe Shane (Shippensburg University of Pennsylvania) Ian Binns (University of North Carolina-Charlotte) Ronald Hermann (Townson University) Lee Meadows (University of Alabama-Birmingham) Matthew Benus (Indiana University Northwest)

An overview of the historical interactions between science and religion will be provided as well as a synopsis of anti-evolution movements and disparities between scientists and the general public with regard to religious belief. Suggestions for addressing science-religion interactions in science teacher education will be the focus of the session.

**Roundtable**

**Friday 2:45-3:45 PM**

**Room 9**

**Thread: Science Teacher Professional Development**

**CREST Touchstones for STEM Teacher Professional Learning**

Regina Toolin (University of Vermont)

Touchstones represent the common principles and norms that excellent STEM teaching should embody. The use of touchstones increases the likelihood that the curriculum work that teachers are engaged in will have purpose and meaning. This presentation summarizes touchstone development and outcomes for the 2015 CREST PD Program for STEM teachers.

**Embedded Workshop**

**Friday 3:00-5:00 PM**

**Room 10**

**Reviewing for ASTE (Sponsored by the Publications Committee)**

Norman G. Lederman (Illinois Institute of Technology) Judith S. Lederman (Illinois Institute of Technology)

Reviewing for the journal – This session offers new and experienced conference attendees a chance to learn the "ins and outs" 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.

**Coffee Break**

**Friday 3:00-4:00 PM**

**Tuscany Foyer**

**Traditional Paper Set**

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

**Room**

1

**Thread: Student Learning P-12**

**Presenter: Karl Yung**

**The Modern Classroom for Science and Technology: Teaching and Learning in the Shadows of Time, Standards, and Testing**

Elizabeth Allison (University of South Alabama) Jenice Goldston (University of Alabama)

This study examines student and teacher perceptions of multiliteracies, student voice, and scientific practices. The discussion will focus on the “modern classroom” with teacher and student
perspectives of innovations in technology juxtaposed with increased accountability for teaching mandated standards and high-stakes testing.

Students’ perceptions of the classroom instruction of their early career science teachers
Benjamin Campbell (University of Georgia) Julie Luft (University of Georgia)
We present results from a site-based study of the instructional practices and classroom interactions of two first-year middle school teachers. Using student focus-group interviews as the primary data source, findings are guided by a phenomenological inquiry into students’ experiences of being in instruction.

Project ReCharge: Energy Efficiency with Real-Time Data
Catherine Pozarski Connolly (University of Nevada, Reno) David T. Crowther (University of Nevada, Reno) Jacque Ewing-Taylor (University of Nevada, Reno)
The results of the first year of Project ReCharge, the creation and implementation a middle and high school energy curriculum focusing on collection and use of real-time electrical consumption data through electrical monitoring hardware. The curriculum integrates inquiry techniques with STEM lessons and addresses the three-dimensions of the NGSS. This reports initial results of an NSF I-Test Project.

Traditional Paper Set Friday 4:00-5:00 PM Room 2

Thread: STEM Education Presider: Barbara Rascoe

Transplanted Stems: Teachers' changing beliefs about STEM at a new elementary STEM school
Jonah Firestone (Washington State University) Judith Morrison (Washington State University) Laura Grant (Washington State University)
A study of teachers at a new elementary STEM school sheds light on the changing understanding and beliefs that teachers, new to STEM. Findings from the qualitative analysis of observations and interviews with the teachers indicate that their beliefs about STEM develop slowly and integration of mathematics is surprisingly difficult.

A Work in Progress: The Evolution of Teacher Conceptions of STEM Education Throughout an Intensive, 3-Week-Long Professional Development
Elizabeth Ring (University of Minnesota) Emily Dare (Michigan Technological University) Elizabeth Crotty (University of Minnesota) Gillian Roehrig (University of Minnesota)
This study investigated the ways teachers’ models of integrated STEM education were influenced throughout an intensive, 3-week-long professional development program. Knowing that teacher conceptions of integrated STEM vary widely in education, we attempt to understand experiences in professional development that can influence these conceptions.
Learning from Elementary Teachers’ Experiences Integrating Science and Engineering
Kristina Tank (Iowa State University) Tamara Moore (Purdue University) Bhaskar Upadhyay (University of Minnesota)
With increasing national attention on the inclusion of engineering into science classrooms, it is important to better understand how this is being translated into classroom practice. This paper describes teachers’ experiences with constructing and implementing an integrated science and engineering unit in their elementary classrooms.

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<th>Traditional Paper Set</th>
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<tr>
<td>Thread: Science Teacher Professional Development</td>
<td>Presider: Sarah Boesdorfer</td>
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<tr>
<td>Development of a Systems Thinking-based Model for Enhancing Teachers’ Understanding of the Nature of Authentic Science and Engineering Research</td>
<td>Annmarie Ward (Penn State University)</td>
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<td>This paper describes the Modeling Authentic STEM Research (MASTER) Model, a systems thinking-based model for helping teachers understand the complex nature of authentic science and engineering research and how to use it to design and implement classroom lessons and projects as a better alternative to the traditional Scientific Method.</td>
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<td>Developing Scientific Discourse in the Elementary Classroom</td>
<td>Lisa Gross (Appalachian State University) Shanan Fitts (Appalachian State University)</td>
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<td>Elementary teachers (Grades 3-5) participate in a project developed to promote science inquiry and academic language development for economically disadvantaged and English language learners (ELLs). The project’s goals and preliminary outcomes will be the focus of this presentation.</td>
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<td>Professional Development, School Context, and Elementary Science Teaching: Examining Conditions for Sustainable Instructional Change</td>
<td>Judith Sandholtz (University of California-Irvine) Cathy Ringstaff (WestEd)</td>
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<td>In this session, researchers report findings from an NSF-funded study investigating long-term impacts of professional development on K-2 science teaching. Researchers specifically examine how contextual factors varied across schools and influenced participating teachers’ instructional decisions two and three years after the program ended.</td>
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<tr>
<td>Thread: Pre-service Teacher</td>
<td>Presider: Kathryn Watkins</td>
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<td>Incorporating Environmental Service Learning into a Project-Based Learning Course for Pre-Service Mathematics and Science Teachers</td>
<td>David Sparks (University of Texas at Arlington)</td>
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<td>The University of Texas at Arlington UTeach capstone course, Multiple Teaching Practices, incorporated a service learning component as a pilot study. While visiting the River Legacy Living Science Center,</td>
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students contributed volunteer hours, developed Project-Based Learning units, and participated in a qualitative evaluation of their experiences.

**Deconstructing the Silos of Physical and Life Sciences: Illustrating Disciplinary Core Concepts and Modeling the use of NGSS Sample Tasks for 7-12th grade classrooms**

Peter Hillman (Teachers College, Columbia University) Jessica Riccio (Teachers College, Columbia University) Lisa Neesemann (Teachers College, Columbia University)

Pre-service teachers need to be familiar with NGSS while being able to integrate it both pedagogically and practically in their future classrooms. We present a unique approach to teaching methods classes that breaks down the traditional silos of content to allow pre-service teachers to practice implementing the crosscutting themes of NGSS.

**An investigation of high impact practice experiences on high school science teachers**

Brendan Callahan (Kennesaw State University) Michael Dias (Kennesaw State University)

This study investigates the incidence and effect of high impact practices on science education graduates' teaching habits. We will report both large scale NSSE and qualitative interview data to indicate both the type and impact of these practices along with a discussion of the implications for science teacher education.

**Traditional Paper Set**

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<th>Friday 4:00-5:00 PM</th>
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**Thread: Ethnoscience and Environmental Education**

**Presider: Allan Feldman**

**A Conceptual Framework for Worldviews Related to Socio-Environmental Systems**

Teresa Shume (North Dakota State University)

A conceptual framework that contextualizes worldviews in relationship to the nature of socio-environmental systems will be presented. Ontological and epistemological distinctions between anthropocentrism, technocentrism, ecocentrism, and panism will be described.

**A Case Study of Elementary Pre-Service Teachers Experiencing an STSE-based Science Methods Course**

Aidin Amirshokoohi (DeSales University)

The Science, Technology, Society, Environment (STSE) framework has been touted as a key approach to achieving scientific literacy. This presentation will focus on a case study of a group of elementary pre-service teachers in an STSE-based science methods course and will be of major interest to ASTE members.

**Engaging Students with Dynamic Models: Peruvian Food Chain Jenga**

Beau Hartwe (Texas Christian University) Daniella Biffi (Texas Christian University) Yohanis de la Fuente (Texas Christian University) Morgan Stewart (Texas Christian University) Melissa Patterson (Texas Christian University) Molly Weinburgh (Texas Christian University)

A game format (Peruvian Food Chain Jenga [PFCJ]) was used to introduce models and food chains. The PFCJ engaged 5th graders in thinking about the disciplinary core idea of ecosystems. A pre/post-test
design was implemented to investigate how use of the PFCJ as a model impacts students’ conceptualization of food chains. Results will be presented.

**Traditional Paper Set**  
**Friday 4:00-5:00 PM**  
**Room 6**

**Thread: History, Philosophy, and Nature of Science**  
**Presider: Bridget Mulvey**

**Investigating the Development of Pre-service Teachers' Nature of Technology Pedagogical Views**
Hallie Edgerly (Drake University) Jerrid Kruse (Drake University) Jaclyn Easter (Drake University)
While the nature of science (NOS) is deeply researched, the nature of technology (NOT) lacks presence in the literature. Yet, aspects of the NOT are necessary for informed citizenry and for the understanding of socio-scientific issues. This study explores changes in pre-service teachers’ views on NOT and effectively teach NOT in science classrooms.

**Investigating the Development of Pre-service Teachers' Nature of Science Pedagogical Knowledge**
Jaclyn Easter (Drake University) Jerrid Kruse (Drake University) Colin Seebach (Drake University) Hallie Edgerly (Drake University) Neal Patel (Drake University)
Benefits from learning the nature of science (NOS) are numerous. Yet, inclusion of NOS in K-12 classrooms continues to be rare. While pre-service teachers’ NOS learning is commonly reported, the present study seeks to understand how NOS pedagogical (NOSP) knowledge develops during a NOS course.

**Historical Case Studies for Teaching Geoscience: Braiding History, Inquiry, and Model-Based Learning**
Glenn Dolphin (University of Calgary) Wendy Benoit (University of Calgary) Jessica Burylo (University of Calgary) Emily Hurst (University of Calgary) Simon Wiebe (University of Calgary)
Our team has developed four historical case studies for teaching geoscience concepts and NOS. We piloted the cases in several different post-secondary introductory science courses and collected data from students experiencing of all four of the cases. Preliminary results show development of NOS understandings. The cases are free for use, online.

**Experiential Session**  
**Friday 4:00-5:00 PM**  
**Room 7**

**Thread: College & University Science Education**

**Designing an NGSS-aligned Curriculum on Energy and Electricity for Teachers**
Karen King (University of Missouri) Deborah Hanuscin (University of Missouri) Jesse Kremenak (University of Missouri)
Given the shifts required of K-12 under NGSS, it is inevitable that change is also required in universities that prepare teachers. In this experiential session, we’ll engage participants in a unit on Energy & Electrical Circuits designed for a specialized content course for teachers, emphasizing conceptual and pedagogical shifts.
**Experiential Session**  
Friday 4:00-5:00 PM  
Room 8  

**Thread: Educational Technology**  

**Using code and Google Earth to understand patterns and scale**  
Lori Henrickson (Clark County School District) Kristoffer Carroll (Southern Nevada Regional Professional Development Program)  

In this experiential session we will discuss the implications of, and provide a hands-on experience with, using Google Earth at the middle school level to address spatial reasoning and target understanding of Crosscutting Concepts of scale and patterns as they are defined in the Next Generation Science Standards.

**Roundtable**  
Friday 4:00-5:00 PM  
Room 9  

**Thread: Science Teachers Professional Development**  
Presider: Julie Bokor  

**Our Neighborhood: A Place for Heightening Emotional Energy in Science Education**  
Kristin Cook (Bellarmine University) Gayle Buck (Indiana University)  

In this cross case analysis focusing on the emotional energy inspired by place-based curricula, we provide science teacher educators who are interested in enhancing emotional engagement through place-based instruction with practical applications and theoretical underpinnings that could enhance their own practice or research efforts.

**Special Experiential Session**  
Friday 4:00-6:00 PM  
Edge Nightclub  

**Science and Dance – An Experiential Workshop: A Body in Motion**  
Adam Johnston (Weber State University) Erik Stern (Weber State University)  

A Body in Motion is a 50-minute performance by a university dance company that has been developed by a science educator, a choreographer, and the collaboration of dancers and consultants. This performance/workshop portrays parallel practices and crosscutting concepts in dance and science and exemplifies how these can be used by teachers.

**Regional Meetings**  
Friday 5:15-6:00 PM  

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<td>Saturday 7:00-8:00 AM</td>
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<td>Saturday 8:00-9:00 AM</td>
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<tr>
<td>Thread: College &amp; University Science Education</td>
<td>Implementing Team-based Learning and Case Studies to Foster Critical Thinking in the Science Classroom</td>
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<td>Presider: Glenn Dolphin</td>
<td>Sandra Westmoreland (Texas Woman’s University) Jacque Garcia (Eagle Mountain Saginaw ISD)</td>
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<td>Science teachers are increasingly being expected to teach critical thinking skills and the “practices of science” without a supportive curriculum. In this presentation we will share practical lessons we have learned and teaching tools we have designed as result of implementing Team-based Learning using Case Studies in a college science classroom.</td>
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<td>STEM Faculty Project: India and USA Collaboration</td>
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<td>Karen Irving (Ohio State University) Anil Pradhan (Ohio State University) Sultana Nahar (Ohio State University)</td>
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<td>This proposal reports on the second year of a collaborative international project between a USA University and an Indian University to produce world class STEM professors for institutions in India and to promote STEM collaboration. The two year program combines STEM research and pedagogical elements to prepare STEM PhDs for university teaching.</td>
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<td>Reinforcement of Lecture Topics in the Laboratory: An Analysis of Current Practices</td>
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<td>Andrea Rediske (University of Central Florida) Malcolm Butler (University of Central Florida)</td>
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<td>Current research indicates that close alignment of lecture and laboratory topics in introductory science courses is an effective method for reinforcement of concepts. However, it is unclear if lecture and lab topics are aligned in undergraduate institutions around the US. This pilot study explores current practices at various institution types.</td>
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<td>How to Engage and Inspire Yourself and Your Students: Promoting STEM Literacy, 21st Century Competencies, Backward Design, and Deep Student Understanding Through the Use of Problem-Based Learning</td>
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<td>Linda Plevyak (University of Cincinnati)</td>
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<td>This presentation will discuss STEM literacy and 21st century competencies, highlight effective approaches in teaching STEM, discuss the use of PBL and how it can be used in a STEM classroom and share examples of STEM lessons that were developed using the three stages of the Backward Design (understanding by design-UbD) model.</td>
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Empirically Supporting School STEM Culture as a Cultural Aspect within a School Community
Chris White (Clemson University) Jeff Marshall (Clemson University)
School STEM Culture is a cultural aspect within a school’s overall culture defined as the beliefs, values, practices, resources and challenges in STEM fields as perceived by stakeholders within the school community. Thus study uses the STEM-CAT, an instrument used to measure STEM Culture, to support the definition of the construct empirically.

Leaving Schools Behind: The Impact of School Setting and Working Conditions on STEM Teacher Retention and Transfer
Pamela Harrell (University of North Texas) Karthigeyan Subramaniam (University of North Texas) Elisabeth Pope (University of North Texas)
This study examines how school setting and workplace variables impact a STEM teachers’ decision to transfer schools or leave teaching. Results expose the role of school discipline as it relates to teacher migration and attrition.

Traditional Paper Set Saturday 8:00-9:00 AM Room 3
Thread: Mixed Presider: Elaine Howes

Changing Teacher Identities via a Teacher as Researcher PD Model
Julie Kalnin (University of Portland) Patricia Morrell (University of Portland)
This study examined the impact of a longitudinal professional development experience on teacher identity. The PD focused on climate change and followed a teacher as researcher model. Our findings describe how the teachers’ identities evolved over time as they navigated three communities of practice: field-based science research, university-based.

Piloting a Views on Learning Progressions Survey with Elementary Teachers being taught Science Content
John Pecore (University of West Florida) Laura Carruth (Georgia State University) Elizabeth Jeffress (Georgia State University)
This presentation aims to illustrate research findings of a two-day interactive professional development workshop for elementary teachers. This workshop was designed to teach neuroscience concepts and learning progressions. During the workshop, researchers piloted a Views on Learning Progressions survey.

A Qualitative Analysis for Visual Data Applied to a Conceptual Change Model Framework
Kevin Finson (Bradley University) Jon Pederson (University of Nebraska-Lincoln)
Emergent data from a PreK-16+ book on visual data use in science classrooms were compared to a Vosniadou-style framework to determine the degree to which the framework accommodated for multiple visual applications as a test of the veracity and applicability of the conceptual framework to visual data utilization in science instructional settings. Results showed a close match.
Thread: Pre-service Teacher Preparation

Inter-Disciplinary Lesson Planning in Science and Social Studies around Controversial Socioscientific Issues by Pre-service Elementary Teachers
Stephen Burgin (University of Arkansas) Brandon Butler (Old Dominion University) William McConnell (Virginia Wesleyan College) Mark Diacopoulous (Old Dominion University)
This presentation will highlight co-instruction by science and social studies educators aimed at impacting the ways in which pre-service elementary teachers think about and plan for the teaching of controversial socioscientific issues. Findings revealed a slight gain in ability to plan for the teaching of controversial SSIs in elementary settings.

Flipping the Large Lecture Physical Science Content Course for Pre-service Teachers: Student and Instructor Perceptions of a Focus on Inquiry and Pedagogy in a Science Content Course
Stacy McCormack (Indiana University)
This study focuses on a redesign of a large lecture style physical science content course for pre-service elementary teachers. Using a flipping technique with inquiry focused pedagogical strategies we sought to understand how the approach was received with regards to improving learning, as perceived by both the instructor’s and students’ reactions.

Using the Popular ‘Serial’ Podcast to Explicitly Teach Argumentation to Pre-service Teachers
Mandy Biggers (Penn State University)
Learn how one science methods course used the popular podcast ‘Serial’ to teach argumentation practices to middle level pre-service teachers. Through use of the Claim, Evidence, Reasoning framework alongside the podcast, pre-service teachers applied their argumentation skills to classroom lessons in science, math, and social studies.

Thread: Science Professional Development

Professional learning of K-6 teachers in science through collaborative action research: An Activity Theory Analysis
Karen Goodnough (Memorial University)
The study seeks to describe and understand the professional learning of three teachers who used collaborative action research in the context of a larger PD program. CHAT or Cultural Historical Activity Theory is used as a lens to examine the activities and tools that constituted their activity system.

Conducting collaborative inquiry: A New Form of Teacher Training
Qingna Jin (University of Alberta)
Collaborative inquiry conducted by teachers themselves, as a new form of teacher training, is designed and examined in this study, highlighting an interdisciplinary approach to problem solving. The results
revealed that it could be an effective and a complementary way to the theory-based lecture, the main form of teacher training.

**A Model of Collaboration between Researchers and Practitioners: Growing an Urban Elementary STEM Professional Developer within Life Science**
Erica Smith (The John Hopkins University) Carolyn Parker (The Johns Hopkins University) David McKinney (The John Hopkins University)
Our paper describes the development of two urban elementary teachers as STEM professional development (PD) facilitators. This study explored how STEM teachers utilize their experiences in PD and teaching expertise to design content-specific PD. Findings from this study inform how to foster collaboration between researchers and practitioners.

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<td><strong>Thread: Pre-service Teacher Preparation</strong></td>
<td>Presider: Eric Pyle</td>
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**Making Science Relevant with Environment-Based Lessons in a Pre-Service Elementary Science Methods Course**
Carol Johnston (Mount Saint Mary’s University)
This study continues the exploration of the use of environment-based lessons to make science more relevant and reduce the fears of teaching science for pre-service elementary teachers. The inclusion of these inquiries did not affect candidates' lesson planning, but did improve their attitudes toward seeing science as relevant to their lives.

**Teaching Elementary Science Methods in an Online Environment**
Jon Yoshioka (University of Hawaii at Manoa) Lori Fulton (University of Hawaii at Manoa)
This session examines the design of a blended online elementary science methods course where the online modules were designed to focus on learning and teaching science as a practice. Teacher candidates’ perceptions of the course will be shared as well as the impact the course had on their efficacy and knowledge of science content and pedagogy.

**Teaching Pre-service Secondary Teachers to Teach Science Using Modeling Instruction**
Sheila Dean (University of Illinois)
Modeling Instruction is a model-based and research-based pedagogical approach to secondary science education. A redesigned teacher preparation program focusing strongly on Modeling Instruction will be described and preliminary student survey data collected to assess student perceptions of the program and of Modeling Instruction will be presented.
### Experiential Session  
**Saturday 8:00-9:00 AM**  
**Room 7**

**Thread: Educational Technology**  
**Using Genius Hour to Inspire STEM Teaching and Learning**  
Sarah Bloms (St. Vrain Valley School District, Longmont CO)

This hands-on experimental session will engage participants in a brief introduction of the Google-inspired Genius Hour structure and supporting technology. Educators will experience the stages of a typical project using free technology tools, while discovering ways Genius Hour inspires STEM integration in genuine ways.

### Experiential Session  
**Saturday 8:00-9:00 AM**  
**Room 8**

**Thread: Student Learning P-12**  
**Development of Assessment Rubrics to Evaluate Students' Explanation/Argumentation Skills**  
Narmin Ghalichi (University of Minnesota) Michele Koomen (University of Minnesota) Gillian Roehrig (University of Minnesota) Jonathan Andicoechea (University of Minnesota) Sarah Weaver (University of Minnesota)

This experiential session's goal is to present our research team's development and pilot testing of rubrics that could be used by teachers in assessing students' scientific explanation/argumentation skills.

### Roundtable  
**Saturday 8:00-9:00 AM**  
**Room 9**

**Thread: Pre-service Teacher**  
**Faculty Views on the Curriculum Mapping Process of an Urban Teacher Preparation Program**  
Daniel Wolff (American Museum of Natural History/Teachers College, Columbia University) Rosamond Kinzler (American Museum of Natural History)

This study documents faculty views on the purpose and value of a curriculum mapping effort at a residency-based Master of Arts in Teaching program that was designed to increase program cohesion and alignment. Using a constructivist grounded theory approach, four themes emerged: reflection, expectations, collaboration and common understanding.

### Embedded Workshop  
**Saturday 8:00-10:00 AM**  
**Room 10**

**Exploring Racial Consciousness in Science Education**  
Lisa M. Martin-Hansen (California State University Long Beach) Alberto J. Rodriguez (Purdue University) Nicole M. Joseph (University of Denver)

The workshop focuses upon the experiences of two science education faculty members who teach pre-service science teachers to challenge their beliefs and assumptions about their students and colleagues of different races and ethnicities.

Evaluation Link: [https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2krzaH5v7](https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2krzaH5v7)
Reframing Early Childhood Science Activities to Address the NGSS and STEM Approaches
Christine D. Tippett (University of Ottawa) Todd M. Milford (University of Victoria)
This workshop reframes early childhood play-based science activities to meet engineering design standards from NGSS and STEM approaches. Participation will involve hands-on investigations of STEM teaching techniques in the process of developing activities from an existing science curriculum. Handouts provided; Moomaw’s (2013) book *Teaching STEM in the Early Years* will be available for purchase at a discounted price ($30 instead of $39.95 plus shipping and taxes). *Please bring your own wifi accessible device.*

Evaluation Link: [https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2krzaH5v7](https://uportland.qualtrics.com/SE/?SID=SV_aaTf2F2krzaH5v7)

Oversight Committee Meeting  
Saturday 8:00 – 9:00 AM  
Room 12

Traditional Paper Set  
Saturday 9:15-10:15 AM  
Room 1

**Thread: College & University Science Education**

**Naturalistic Inquiry of SoTL Conference Impact on Faculty Practices**
Katie Brkich (Georgia Southern University) Tom Koballa (Georgia Southern University) Christopher Brkish (Base-2 Group Inc.) Jessica Render (Georgia Southern University)
This study is part of a multiyear investigation examining 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.

**Transition from Science Teacher to Science Teacher Educator: An International Perspective grounded in Self-study methodology**
Ranu Roy (Indiana University-Bloomington) Meredith Park Rogers (Indiana University-Bloomington)
This study investigates tensions an international doctoral student experienced during her first year teaching an elementary science methods course. Differences in perceptions of instruction between her and her students, along with implications for supporting international students’ reflective practice to navigate these differences will be shared.

**Preparing Science Teacher Educators: designing and developing a doctorate in teacher education**
Jessica Riccio (Teachers College Columbia University) Felicia Moore Mensah (Teachers College Columbia University) Lisa Neesemann (Teachers College Columbia University)
We set out to examine our program’s preparation of doctoral students for their goals as teacher educators. Through an initial survey of graduates, on to focused interviews and a finally a Mentoring and Education Forum, we have gone back to examine effectiveness in preparing teacher educators for their end goals.
Conceptualizing STEM Integration Units that Correlate to Student Achievement Gains with Engineering
Elizabeth Crotty (University of Minnesota) Julie Brown (University of Minnesota) Selcen Guzey (Perdue University) Aran Glancy (University of Minnesota) Elizabeth Ring (University of Minnesota) Tamara Moore (Purdue University)
K-12 teachers design STEM units in concert with University content instructors, district curriculum coordinators and STEM specialists. The units are then implemented in the following academic year. This paper presents findings regarding student understanding of engineering based on the level of engineering integration in the curriculum unit.

Teacher’s Reactions to and Utilization of a STEM Coach
Michael Giamellaro (Oregon State University) Debbie Siegel (Oregon State University)
A STEM Coach was embedded in a rural school district to support a transition to K-12 inclusive, integrated STEM project-based learning as part of a research-practice partnership (RPP). The STEM Coach role evolved over the course of the launch year and was monitored through teacher and coach journals, interviews, school observations and a social network.

Coaching Partnership with Science Teachers: Support for the Implementation of STEM Integrated Curriculum
Gillian Roehrig (University of Minnesota) Tasneem Anwar (University of Minnesota)
This exploratory case study focuses on the instructional coaching support provided to the science teachers during the pilot phase of a yearlong project. The study provides evidence of developing a strong scaffold for teachers through coaching partnership.

Next Gen TARSC: Developing Tools to Support Teacher Learning and Application of NGSS
Corinne Lardy (California State University, East Bay) Christine Lee (California State University, East Bay) Rachelle DiStefano (California State University, East Bay) Michele Korb (California State University, East Bay) Danika LeDuc (California State University, East Bay)
Next Generation Tools for Analyzing and Refining Science Curriculum (TARSC) is an NSF-funded project that is creating tools to aid educators unpack and apply the three dimensions of NGSS to their science teaching. This presentation will describe the tools, their development, and preliminary data on their impact on in-service teacher learning.
STEM Learning In Middle Grades By Technology Mediated Integration Of Science And Mathematics: Results of Project SMILE
Pradeep Dass (Northern Arizona University)
Come learn about how the use of InspireData software enabled integration of science and mathematics in ways that foster student participation in inquiry and problem solving. The growth in participating teachers’ understanding and instructional enactment of these practices will be shared, which help realize the vision of the NGSS.

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<tr>
<th>Traditional Paper Set</th>
<th>Saturday 9:15-10:15 AM</th>
<th>Room 4</th>
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<tbody>
<tr>
<td>Thread: Pre-service Science Teacher Preparation</td>
<td>Presider: Patricia Morrell</td>
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Prospective Elementary Teachers’ Beliefs about Informal Science Instruction: An Intervention Study
Sumreen Asim (University of North Texas) Karthigeyan Subramaniam (University of North Texas)
This presentation reports on prospective teachers’ beliefs about informal science teaching before and after the implementation of an intervention. The intervention consisted of three designed learning environments and microteaching sessions framed by the National Research Council’s six strands of learning science in informal environments.

Pre-service Teachers’ Conceptual Understanding and Intended Use of 21st Century Competencies in Their Future Science Classroom
Kate York (The University of Texas at Dallas)
This study examined pre-service science teachers’ conceptual understanding and intended use of 21st century competencies in their future science classroom. Findings suggest pre-service teachers value the inclusion of these skills in their future classroom, but would prefer earlier exposure and more opportunities to practice during their coursework.
Secondary Science Teacher Science Writing Instruction Efficacy Beliefs
Carrie Miller-DeBoer (University of Oklahoma) Timothy Laubach (University of Oklahoma)
Writing instruction is emphasized throughout the curriculum, but low writing instruction efficacy (WIE) often blocks secondary science teachers from integrating writing into their science classrooms. This explanatory sequential mixed methods study investigated science teacher WIE beliefs and identified antecedents to high WIE beliefs.

Impacts of Science Teacher Engagement in Engineering Research on Beliefs About Classroom Instruction
Nancy Morabito (St. John’s University)
This case study focuses on three participants in a program designed to engage teachers in engineering research. Differences between the participants’ thinking about the way(s) in which the practices of science and engineering should be addressed in the classroom prior to and following participation in the program are described. Beginning with folklore and sequentially ending with fact-based information books. Krista L Adams (University of Nebraska-Lincoln) Kathy Phillips (University of Nebraska-Lincoln)

Are Beginning Science Teachers in Over Their Heads? How beginning teachers handle the complexities of teaching science while facing institutional constraints
Jesse Wilcox (Grand View University), Lori Ihrig (University of Iowa), Michael Clough (Iowa State University), Joanne Olsen (Iowa State University)
This qualitative study explores the relationship between beginning teachers’ science teaching practices, the institutional constraints they face, and how teachers make sense of their experiences in the induction years

Using Photovoice to Explore Environmental Sustainability across Cultures
Kristin Cook (Bellarmine University) Alan Brown (University of Kentucky) Genny Ballard (Centre College)
This study involves a cross-cultural exchange between study abroad students and community members in Costa Rica through the use of photovoice. Results indicate the experience broadened all participants’
understanding of environmental sustainability as well as inspired critique of socio-scientific issues of personal relevance and impact.

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<th>Experiential Session</th>
<th>Saturday 9:15-10:15 AM</th>
<th>Room 7</th>
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<tr>
<td>Thread: College &amp; University Science Education</td>
<td>Presider: Catherine Martin-Dunlop</td>
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**If It Is So Easy, Why Not Do It? A Study Examining Change in Students’ Conceptions of Scientists Using Multimedia Films**

Mark Bloom (Dallas Baptist University) Catherine Koehler (Southern Connecticut State University) Ian Binns (University of North Carolina at Charlotte)

This study investigates strategies to foster change in students’ conceptions of the scientist using mainstream films commonly viewed in science classrooms. The results suggest, the intervention of films plus explicit/reflective discussion successfully improved students’ conceptions of scientists, particularly in gender and places to work.

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<th>Experiential Session</th>
<th>Saturday 9:15-10:15 AM</th>
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<tr>
<td>Thread: Curriculum, Pedagogy, and Assessment</td>
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**Moving Towards 3-Dimensional Assessment: Using Hands-on Performance Tasks to Assess Mastery of Both the Science Practices and DCIs**

Deborah Tucker (Independent Science Education Consultant) Grant Gardner (Assessment Services, Inc.)

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.

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<tr>
<th>Roundtable</th>
<th>Saturday 9:15-10:15 AM</th>
<th>Room 9</th>
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<tr>
<td>Thread: Pre-service Teacher Preparation</td>
<td>Presider: Vanessa Dodo Seriki</td>
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**Academic language development in science classroom**

Hui-Ju Huang (California State University-Sacramento) Yu-Teh Lin (National Taiwan University)

The presentation will report a study on teacher candidates’ knowledge about science academic language. The presentation will also discuss and demonstrate strategies that allow students to practice language skills, and to use academic language in the inquiry process.

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<tr>
<th>Equity Committee Meeting</th>
<th>Saturday 9:15-10:15 AM</th>
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| Coffee Break | Saturday 10:00-11:00 AM | Tuscany Foyer |
Development and validation of a two-tiered instrument to identify alternative conceptions in ecology
Angelique Troelstrup (Middle Tennessee State University) Katherine Mangione (Middle Tennessee State University) Jwa Kim (Middle Tennessee State University)
A previous study investigating biology majors’ misconceptions in ecology revealed that biology majors retain alternative conceptions and highlighted the need for a reliable instrument to identify misconceptions. Researchers will share their experiences and analysis of the piloting of a two-tiered instrument to identify ecology misconceptions.

Teaching Pre-Service Elementary School Teachers about Common Ancestry through exploration of Local Tree Diversity
Yael Wyner (City College of New York, CUNY) Jennifer Doherty (University of Washington) Janice Koch (Hofstra University)
This presentation describes the impact of a life science content course on pre-service elementary school teachers’ understanding of local tree diversity in the context of the patterns of evolution.

Do Eighth Grade Students in an iSTEM Cohort Perceive Science, Math, & The Field of Engineering Differently than Traditional 8th grade students?
Donna Farland-Smith (The Ohio State University) Vinta Tiarani (The Ohio State University)
Eighth grade students in two cohorts, iSTEM and Traditional (N=146) were asked to complete a modification of the Draw An Engineer at Work Test (DAET).

Engineering Integrated Science (EIS) As A Potential Direction For Reforming Technical High School Science In South Korea
Younkyeong Nam (Sungkyunkwan University) Seoung-Hey Paik (Korea National University of Education) Sun-Ju Lee (Korea National University of Education)
This study investigated the effect of engineering integrated science (EIS) curricula on first year technical high school students’ attitudes toward science and perceptions of engineering. The results showed that the EIS curriculum positively affected the students’ attitude toward science and understanding of engineering practice.
The Design and Implementation of Integrated Science Technology, Engineering and Mathematics (Stem) Instruction in the Middle School Science Classroom
Celestin Ntemngwa (University of Houston-Downtown) Steve Oliver (University of Georgia)
In this study we sought to a) investigate how Science and Technology teachers restructure their middle school science curriculum and instruction in order to incorporate STEM objectives into science classroom activities using a teaching approach emphasizing robotics equipment and b) analyze the teachers and student perceptions of the instruction.

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<tr>
<th>Traditional Paper Set</th>
<th>Saturday 10:30-11:30 AM</th>
<th>Room 3</th>
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<tbody>
<tr>
<td>Thread: Science Teacher Professional Development</td>
<td>Presider: Michael Giamellaro</td>
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Science Education Against Drug Abuse Partnership (SEADAP) program: Year One in North Carolina
Rhea Miles (East Carolina University)
The purpose of Science Education Against Drug Abuse Partnership (SEADAP) is to develop and implement an inquiry-based program to teach the pharmacology of drug addiction to students and to expose middle and high school students to biomedical research.

Chinese High School Chemistry Teachers’ Conceptions and Teaching Practice of Standards and Implications for Implementing NGSS
Xinying Yin (California State University-San Bernardino)
This study explored Chinese high school chemistry teachers’ current conceptions and teaching practices of the reformed curriculum standards, and the findings provided implications for Chinese science education, the implementation of NGSS in the U.S. and standard-based education at large.

Exploring Online Teacher Professional Development to Introduce Integration of STEM
Tasneem Anwar (University of Minnesota)
This study offers a design-based research to design, implement, improve and suggest evidence-based heuristics for STEM specific, effective, and sustainable online teacher professional development in an international context. This exploratory case study generated design principles for online teacher professional development.

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<th>Traditional Paper Set</th>
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<th>Room 4</th>
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<tbody>
<tr>
<td>Thread: Pre-service Teacher Preparation</td>
<td>Presider: Ibrahim Yeter</td>
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Teacher preparation matters! Teachers’ classroom practices 2-5 years after having completed an intensive secondary science teacher education program
Michael Clough (Iowa State University) Joanne Olson (Iowa State University)
This session presents a research-based secondary science teacher education program and evidence of its efficacy, including several studies that have investigated graduates’ teaching practices two to five
years after having completed the program. These will be discussed in light of the IMPPACT and SALISH projects’ findings.

**Middle School Pre-Service Teachers’ Sense of Self-Efficacy in Relation to Authentic Learning Experiences**

Robin Dever (Kent State University Geauga) Sue Clemente (Kent State University Geauga)

The connection between pre-service middle school teachers’ involvement in an authentic, environmental education project and their sense of self-efficacy is explored. This project involving a university, local park system, and a middle school centered on an archaeological dig. In depth demonstration of project/research will be given.

**Teacher Candidates' Views on Course Evaluations: An Exploratory Case Study**

Nate Carnes (University of South Carolina)

This preliminary interpretative study investigates three middle level teacher candidates’ perspectives on course evaluations and factors that influence their ratings.

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<tr>
<th>Traditional Paper Set</th>
<th>Saturday 10:30-11:30 AM</th>
<th>Room 5</th>
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<tbody>
<tr>
<td><strong>Thread: Science Teacher Professional Development</strong></td>
<td>Presider: Muhammad Abd Hadi Bunyamin</td>
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**Observation as Professional Experimentation: Evidence from science teacher noticing**

Shelly Rodriquez (The University of Texas) Steven Fletcher (St. Edwards University)

A teacher noticing framework is used to explore the attention of science teachers while observing pre-service teachers. Findings show that teachers use noticing to engage in professional experimentation. The data also documents the emergence of “pivotal moments” when, through observation, teachers recognize the need for change in their own practice.

**Next generation ready: Professional development and practices of middle school science teachers supporting students in explaining phenomena**

Jennifer Mesa (University of West Florida) Rose Pringle (University of Florida) Natalie King (University of Florida) Lynda Hayes (P.K. Younge Developmental Research School)

This presentation will share the design and implementation of a comprehensive professional development program for middle school science teachers, and describe how participating teachers used two instructional practices essential for implementing the NGSS: supporting students in using evidence to make claims about phenomena, and sense-making.

**Approximations of Practice: Supporting teachers' professional noticing of student ideas**

Meredith Vaughn (San Diego State University) Donna Ross (San Diego State University) Kathy Williams (San Diego State University)

Eliciting and responding to students’ scientific ideas is an important but challenging teaching practice. In this session, we share results and lessons learned from a weeklong professional development where experienced secondary teachers collaboratively practiced these skills with a small group of students.
### Recruiting Outstanding STEM Students to Teach

Dionne Jackson (Hendrix College)

This three-year study examined the recruitment of STEM majors into an undergraduate teacher licensure program that required a commitment to teach in high-need school districts. The STEM teacher rate of recruitment for the three years of the research was 33%, as compared to 13% three years prior to the study and 5% 10 years prior.

### Trends in Research on Blended Learning in K-12 Science Education

Kent Crippen (University of Florida) Julie Bokor (University of Florida) Gayle Evans (University of Florida)

This study involved a systematic review of 90 papers from the peer-reviewed research journals in science education from 2000-2014 that met the inclusion criteria for blended learning in the context of K-12 science education. The research questions were related to the demographic, methodological and topological trends in these studies.

### Experiential Session: Storm Chasers

Mohammed Qazi (Tuskegee University) Shaik Jeelani (Tuskegee University) Alicia Curry (Tuskegee University) Michael Curry (Tuskegee University) Carol Banks (Tuskegee University)

Climate change is responsible for increased frequency of violent weather which impacts daily lives. It is thus important for students to study weather patterns at an early age. This hands-on middle school course module focuses on the teaching of key scientific concepts that collectively explain the formation of catastrophic weather events.

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<th>Experiential Session</th>
<th>Saturday 10:30-11:30 AM</th>
<th>Room 8</th>
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<tr>
<td>Thread: Equity and Diversity</td>
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Examining the Difference between Culturally Relevant and Culturally Responsive Teaching: A Science Education Perspective.

Janice Underwood (Old Dominion University) Felicia Moore Mensah (Teacher’s College-Columbia University) Steven Myran (Old Dominion University)

The differences between culturally relevant pedagogy and culturally responsive pedagogy will be discussed and examples will be presented. This interactive experience will also include explicit conversations about racism, the achievement gap, colorblindness, and how to implement a process for reflection of personal bias for both teacher educators and pre-service teachers.

**Round Table**

**Saturday 10:30-11:30**

**Room 9**

**Thread: Pre-service Science Teacher Preparation**

**Strategies for recruiting and retaining pre-service science teachers.**

Ronald Hermann (Towson University) Cody Sandifer (Towson University) Jim Selway (Towson University)

There is an ongoing shortage of highly qualified physics teachers across the US. In recent years we tripled the number of students in physics teacher education programs at Towson University. We offer tangible suggestions based on the lessons we learned in hopes that other universities may have greater success with recruitment and retention.

**Business/Awards Luncheon**

**Saturday 11:45 AM-1:30 PM**

**Ballroom**

Annual business meeting, ASTE Award presentations, passing of the gavel, and 2016 ASTE Reno Conference preview.

**ASTE Board Meeting**

**Saturday**

**Board Room**
### ASTE Awards

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Name and Affiliation</th>
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<tbody>
<tr>
<td>1973</td>
<td>Gerald Krockover, Purdue Univ.</td>
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<tr>
<td>1974</td>
<td>No Award Given</td>
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<tr>
<td>1975</td>
<td>Vincent Lunetta, 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>
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<tr>
<td>1978</td>
<td>Harold Jaus, Univ. of Illinois-Chicago</td>
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<tr>
<td>1979</td>
<td>Roger W. Bybee, BSCS</td>
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<td>1980</td>
<td>Anton Lawson, Arizona State Univ.</td>
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<tr>
<td>1981</td>
<td>No Award Given</td>
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<tr>
<td>1982</td>
<td>James A. Shymansky, Univ. of Iowa</td>
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<td>1983</td>
<td>William R. Capie, Univ. of Georgia</td>
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<td>1984</td>
<td>No Award Given</td>
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<tr>
<td>1985</td>
<td>James Dudley Herron, Purdue Univ.</td>
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<tr>
<td>1986</td>
<td>Charles R. Coble, East Carolina Univ.</td>
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<tr>
<td>1987</td>
<td>John Penick, Univ. of Iowa</td>
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<td>1988</td>
<td>James Barufaldi, Univ. of Texas</td>
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<td>1989</td>
<td>Lawrence F. Lowery, Univ. of California</td>
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<td>1990</td>
<td>William C. Kyle, Jr., Purdue Univ.</td>
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<td>1991</td>
<td>Barry Fraser, Curtain Univ. of Technology, Australia</td>
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<td>1992</td>
<td>No Award Given</td>
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<tr>
<td>1993</td>
<td>Cheryl Mason, San Diego State Univ.</td>
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<td>1994</td>
<td>Patricia Simmons, Univ. of Georgia</td>
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<td>1995</td>
<td>J. Preston Prather, Univ. of Virginia</td>
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<td>1996</td>
<td>Sandra Abell, Purdue Univ.</td>
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<td>1997</td>
<td>Bonnie Shapiro, Univ. of Calgary</td>
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<td>1998</td>
<td>William F. McComas, Univ. of Southern California</td>
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<td>1999</td>
<td>J. Preston Prather, Univ. of Virginia</td>
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<td>2000</td>
<td>Wolff-Michael Roth, Univ. of Victoria</td>
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<td>2001</td>
<td>John Settlage, Cleveland State Univ.</td>
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<td>2002</td>
<td>No Award Given</td>
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<tr>
<td>2003</td>
<td>Ronald Bonnstetter, Univ. of Nebraska (10+ yrs.)</td>
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<tr>
<td>2004</td>
<td>Kenneth Tobin,</td>
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<td>2005</td>
<td>Larry Yore, Univ. of Victoria (10+ yrs.)</td>
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<tr>
<td>2006</td>
<td>Penny J. Gilmer, Florida State Univ. (10+ yrs.)</td>
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<td>2007</td>
<td>G. Nathan Carnes, Univ. of South Carolina (10 yrs.)</td>
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<tr>
<td>2008</td>
<td>Kathryn Scantlebury, Univ. of Delaware (10+ yrs.)</td>
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<td>2009</td>
<td>Deborah Tippins, Univ. of Georgia (10+ yrs.)</td>
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<td>2010</td>
<td>Catherine Milne, New York University (10 yrs.)</td>
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<td>2011</td>
<td>Julie A. Luft, Arizona State Univ. (10+ yrs.)</td>
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<tr>
<td>2012</td>
<td>Randy L. Bell, Univ. of Virginia (10 yrs.)</td>
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<tr>
<td>2013</td>
<td>Rebecca Schneider, University of Toledo (10+ yrs.)</td>
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<tr>
<td>2014</td>
<td>Lynn Bryan, Purdue University (10+ yrs); Carla Johnson, University of Cincinnati (10 yrs)</td>
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<tr>
<td>2015</td>
<td>Alec Bodzin, Lehigh University (10+ yrs); Deborah Hanuscin, University of Missouri (10 yrs)</td>
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<tr>
<td>2016</td>
<td>Gail Jones, North Carolina State University (10+ yrs); Rose Pringle, University of Florida (10+ yrs)</td>
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<tr>
<td>2017</td>
<td>Erin Peters-Burton, George Mason University (10 yrs)</td>
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Outstanding Mentor (Award II)

1997  John Penick, Univ. of Iowa  
1999  Norman Lederman, Oregon State Univ.  
2000  Robert K. James, Texas A & M Univ.  
2001  Robert E. Yager, Univ. of Iowa  
2002  Walter S. Smith, Ball State Univ.  
2003  Larry Enochs, Oregon State Univ.  
2004  Catherine Yeotis, Wichita State Univ.  
2005  Sandra Abell, Univ. of Missouri-Columbia  
2006  Tom Koballa, Univ. of Georgia  
2007  Kenneth Tobin, Graduate Center of the City Univ. of New York  
2008  Dana Zeidler, Univ. of South Florida  
2009  Lloyd Barrow, University of Missouri  
2010  Kathryn Scantlebury, Univ. of Delaware  
2011  Gerry Saunders, Unity College  
2012  Alec Bodzin, Lehigh University  
2013  Julie Luft, University of Georgia  
2014  Gillian Roehrig, University of Minnesota  
2015  Pat Obenauf, West Virginia University  
2016  Randy Bell, Oregon State University

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

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


2009  *Expanding the Ways in Which Urban Students Participate in Science Education: Rituals, Transactions, and Fundamental Interactions*. Christopher Emdin (Columbia Univ.)

2010  *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)

2011  *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)

2012  *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
If You Can’t Say Something Nice: A Design-Based Research Approach Investigating the Social Interactions of New Science and Math Teachers Using a Video Annotation Tool, Joshua Ellis, Tasneem Anwar, Justin McFadden, & Gillian Roehrig from the University of Minnesota STEM Education Center
2015  The Use of Journal Clubs in Science Teacher Education" Dr. Karen A. Tallman, Springfield College and Dr. Allan Feldman, University of South Florida
2016

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, Aquariums 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.)
and Cheryl L. Mason (San Diego State Univ.)


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, both of 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 (Humanities, ARTs, and Social Sciences): Developing Perspective-Taking Skills for Socioscientific Reasoning, Sami Kahn & Dana Zeidler, University of South Florida.

2016  No award given
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