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Welcome to the 24th ASTE International Conference!

On behalf of the North Central Region, we extend our warmest welcome to Des Moines and the annual meeting of ASTE. We hope that you take full advantage of the many opportunities to learn, network, and enjoy all that this great city has to offer.

Our keynote speakers were carefully selected to engage us in important thought and conversation about issues facing science teacher education. Dr. Diane Ravitch and Dr. Sara Vispoel bring perspectives from policy, assessment, and classrooms that will broaden our understanding and inform our work. In addition to paper and poster presentations, consider attending professional development workshops and engaging with our exhibitors. Each has something to offer our community, and we appreciate their support of ASTE.

We are pleased to kick off our new journal, *Innovations in Science Teacher Education*, with a breakfast on Thursday, sponsored by the Iowa Pork Producers Association. Our Thursday evening poster session and ASTE reception will be held at the World Food Prize Hall of Laureates. Over a century old and fully-restored, this magnificent former Carnegie library will provide the perfect setting to engage with research and conversation. The Barn Owl Band, featuring local Iowa talent, will complete the atmosphere. Shuttle service is provided and will begin at 5:15 pm. If you like to walk, the Hall of Laureates is a short 5 blocks east of the hotel.

When lunch is on your own, you don’t even need a coat to find good food. Head out on the extensive skywalk system toward the Kaleidoscope Hub or in any direction you choose, and you’ll find many great options right in the skywalk. If you’re feeling adventurous, grab a coat and head out on the D Line with a map in hand. This shuttle drops off at a number of tasty venues that are sure to please!

Here in Des Moines, you can find great food, live music (jazz, blues, and many more!), fun shopping (we recommend the East Village, particularly Raygun), outdoor ice skating at the Brenton Skating Plaza, our renowned sculpture park, the Science Center of Iowa, and the country’s largest YMCA. Coupons are available at the kiosk provided by the Convention and Visitors Bureau near the escalator on the second floor. If you wish to borrow a coat, just sign one out and return it when you’re done.

We encourage you to take full advantage of your time with us, and have a wonderful conference!

Joanne Olson & Jerrid Kruse
ASTE 2017 Conference Co-Chairs
Greetings Conference Participants,

Welcome to Des Moines, Iowa, for our 2017 annual international conference! I know that each of you will take advantage of this unique opportunity to grow as a scholar and science teacher educator, and I hope you will also take the time to help your colleagues do the same.

In the midst of all the unrest and turmoil in the world, I remain optimistic (although sometimes cautiously!) that we will turn the corner towards a global beloved community, where science teaching and learning take their rightful places as critical to the environment we want for all. This year’s conference can be viewed as mission critical in driving the conversation and actions needed to make the world a better place.

An event of this magnitude would not be possible without the diligence, invaluable insights, and creativity of many of your ASTE colleagues. The majority of the conference planners volunteer their time, talents and treasures to make our conference an excellent outlet for your scholarship and professional development. When you encounter one of them, please be sure to thank them!

Do take the time to connect with friends and colleagues, meet someone new, learn a new idea, and build on your solid base as a science teacher educator. Our children, teachers of science, leaders and community members expect nothing less of us. Moreover, I am confident that our ASTE is up to the challenge.

See you around the hotel and Des Moines!

Science educationally yours,

\[\text{Signature}\]

Malcolm B. Butler, Ph.D.

ASTE President
Types of Concurrent Sessions at ASTE 2017

**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.

**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 p.m.-6:30 p.m. in Cedar Rapids, repeated Thursday, 8:00 a.m.-9:00 a.m. in Cedar Rapids.

Town Hall Meeting – This is an opportunity to share ideas about ASTE with board members and is open to all conference attendees. Join us Friday at 1:30-2:30 p.m. in Cedar Rapids.

Interviewing Room - Members wishing to interview potential candidates may sign up to use the Sioux City Room on a first-come first-served basis. The room will be available between other sessions and open Wednesday through Saturday. Please limit use to no more than one hour at a time. The sign-up time sheet will be posted outside the room and at the Registration Desk.

ASTE Publications – Meet the Editors/submitting to the journal-Meet and talk with the editors of journals. Editors will provide information about acceptance rates, submission guidelines, and upcoming monographs and journal issues.

- Innovations – Thursday, January 12, from 1:00 p.m.-2:00 p.m. in Davenport
- JSTE – Friday, January 13, from 9:15a.m.-10:15a.m. in Salon G
- CITE – Saturday, January 14, from 8:00a.m.-9:00a.m. in Salon H

Forum Meetings – All forum meetings will be Saturday during 7:00 a.m.-7:50a.m.. 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. The Equity Committee will meet twice, Thursday at 7:00 a.m. and Saturday at 9:15 a.m. in Sioux City. The Oversight Committee will meet Saturday from 8:00 a.m.-9:00 a.m. in Sioux City.

Regional ASTE Meetings – The ASTE regions will meet as individual groups on Friday at 5:15 p.m. - 6:15 p.m. See the program for locations.

Regional Directors Meeting - (ADDED) The regional directors will meet on Friday at 8:00- a.m. - 9:00 a.m. in Cedar Rapids.

Women in Science Education Forum and Dinner – Join your friends at the annual dinner. This is a ticketed event.
2017 Thread Coordinators

Rachel Wilson & Lindsay Wheeler  College and University Science
Jaimie Foulk  Curriculum, Pedagogy, and Assessment
Ingrid Weiland & Kristin Cook  Equity and Diversity
Paula Magee & Brooke Whitworth  Preservice Science Teacher Preparation
Sue Ann BOTTOMS & Devarati Bhattacharya  Science Teacher Professional Development
Su Gao  Student Learning P-12
Catherine Koehler  Policy and Reform
Mark Bloom  History, Philosophy, and Nature of Science
Shelly Rodriguez & Seema Rivera  Educational Technology
Cathy Wissehr  Informal Science Education
Sharon Schleigh  STEM Education
Vanessa Dodo Seriki  Ethnoscience & Environmental Education

2017 Professional Development Workshop Reviewers

Britton, Stacey  Dare, Emily  Mulvey, Bridget
Brownstein, Erica  Guzey, S. Selcen  Schwartz, Renee
Burrow, Andrea  Hanuscin, Deborah  Snow, Kathy
Contino, Julie  Hewitt, Patricia  Thompson, Stephen
2017 Proposal Reviewers

Krista Adams
Valarie Akerson
Jennifer Albert
Jared Allen
Daniel Alston
Tasneem Anwar
Scott Ashmann
Matthew Benus
Daniel Bergman
Devarati Bhattacharya
Barbara Billington
Ian Binns
Alice (Jill) Black
Margaret Blanchard
Alec Bodzin
Sarah Boesdorfer
Lisa Borgerding
Mike Borowczak
Leslie Bradbury
Julie Brown
Sherri Brown
Erica M. Brownstein
Stephen Burgin
Andrea Burrows
Brenda Capobianco
Jenna Carlson
Nate Carnes
Daniel Carpenter
Tina Cartwright
Robert Ceglie
Dante Cisterna
Julie Contino
Emily Dare
Jeni Davis
Yohanis de la Fuente
Michael Dias
Shannon Dubois
Joshua Ellis
Donna Farland-Smith
Allan Feldman
Kevin Finson
Jaimie Foulk
Frederick Freking
Jennifer Frisch
Gavin Fulmer
Su Gao
Anne Gatling
Brent Gilles
Rory Glass
Amanda Glaze
Nicole Glen
Aimee Govett
Lisa Gross
Amanda Gunning
Rita Hagevik
Jonathan Hall
Deborah Hanson
Susan Hawkins
Deb Hemler
Ben Herman
Tiffany Hill
Peter Hillman
Rebecca Hite
Elaine Howes
Lori Ihrig
Tobias Irish
Karen Irving
Karl Jung
Natalie King
Vanessa Klein
Merrie Koester
Rudolf Kraus
Richard Lamb
Corinne Lardy
Felicia Leammukda
Lindsay Lightner
Christine Lotter
Jingjing Ma
Katherine Mangione
Meghan Marrero
Lisa Martin-Hansen
Heidi Masters
Maria Rivera Maulucci
Jennifer Mayo
Stacy McCormack
Christina McDaniel
Wayne Melville
Jennifer Mesa
Helen Meyer
Jamie Mikeska
James Minogue
Rommel Miranda
Bridget Mulvey
Gil Naizer
Vanashri Nargund-Joshi
Suzanne Nesmith
Bryan Nichols
Ryan Nixon
Celestin Ntemngwa
James Nyachwaya
Erin Pearce
John Pecore
Matthew Perkins
Erin Peters-Burton
Stephanie Philipp
Jacob Pleasants
Eric Pyle
Cassie Quigley
Melanie A. Reap
Elizabeth Ring
Jose Rios
Rona Robinson-Hill
Gillian Roehrig
Danielle Ross
Ranu Roy
Line Saint-Hilaire
Dane Schaffer
Sharon Schleigh
Kathleen Schmidt
Lesley Shapiro
Carrie-Anne Sherwood
Manali Sheth
Teresa Shume
Mandy Smith
David Sparks
Morgan Stewart
Debra Stork
Michael Svec
Karen Tallman
Kristina Tank
Stephen Thompson
William Thornburgh
Peggy Tilgner
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<tr>
<td>Christine Tippett</td>
<td>Sandra Westmoreland</td>
<td>Cathy Wissehr</td>
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<td>Angela Webb</td>
<td>Jeanna Wieselmann</td>
<td>Francine Wizner</td>
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<td>Jillian Wendt</td>
<td>Jesse Wilcox</td>
<td>Sandra Yarema</td>
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**2017 Presiders (Updated Jan. 9, 2017)**

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STATE UNIVERSITY

Drake UNIVERSITY

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(Awards)
Exhibitors

And a special thanks to all those who have helped to make this conference a success.
## Conference at a Glance

### Wednesday, January 11

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<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tr>
<td>1:00 p.m. – 7:00 p.m.</td>
<td>Preconference Workshops</td>
<td>Check Program</td>
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<tr>
<td>4:00 p.m. – 9:00 p.m.</td>
<td>Registration</td>
<td>Second Floor</td>
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<tr>
<td>5:30 p.m. - 6:30 p.m.</td>
<td>Presider Training</td>
<td>Cedar Rapids</td>
</tr>
<tr>
<td>Noon – 9:00 p.m.</td>
<td>ASTE Board Meetings</td>
<td>Sioux City</td>
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### Thursday, January 12

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<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>6:30 a.m. – 8:00 a.m.</td>
<td>Breakfast with Iowa Pork Producers</td>
<td>Des Moines Exhibit Hall</td>
</tr>
<tr>
<td>6:45 a.m. – 7:45 a.m.</td>
<td>Fun Run/Walk</td>
<td>Hotel Lobby at 6:30 a.m.</td>
</tr>
<tr>
<td>8:00 a.m. – 9:00 a.m.</td>
<td>Presider Training</td>
<td>Cedar Rapids</td>
</tr>
<tr>
<td>8:00 a.m. – 9:00 a.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
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<tr>
<td>9:15 a.m. – 10:15 a.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
</tr>
<tr>
<td>10:00 a.m. – 10:30 a.m.</td>
<td>Coffee Break</td>
<td></td>
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<tr>
<td>10:30 a.m. – Noon</td>
<td>Dr. Sara Vispoel, ACT, Inc.</td>
<td>SALON D &amp; E</td>
</tr>
<tr>
<td>Noon – 1:00 p.m.</td>
<td>Lunch on own</td>
<td></td>
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<tr>
<td>1:00 p.m. – 2:00 p.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
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<tr>
<td>2:15 p.m. – 3:15 p.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
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<tr>
<td>3:00 p.m. – 3:30 p.m.</td>
<td>Coffee Break</td>
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<tr>
<td>3:30 p.m. – 4:30 p.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
</tr>
<tr>
<td>5:30 p.m. – 8:00 p.m.</td>
<td>Poster Reception and Interactive Exhibits</td>
<td>World Food Prize Hall of Laureates</td>
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<tr>
<td>Busses-Hotel Lobby</td>
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### Friday, January 13

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:30 a.m. – 8:00 a.m.</td>
<td>Breakfast</td>
<td>Des Moines Exhibit Hall</td>
</tr>
<tr>
<td>7:00 a.m. – 7:50 a.m.</td>
<td>Committee Meetings</td>
<td>See Program</td>
</tr>
<tr>
<td>8:00 a.m. – 9:00 a.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
</tr>
<tr>
<td>9:15 a.m. – 10:15 a.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
</tr>
<tr>
<td>10:00 a.m. – 10:45 a.m.</td>
<td>Coffee Break</td>
<td></td>
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<tr>
<td>10:45 a.m. – 12:15 p.m.</td>
<td>Dr. Diane Ravitch, New York University</td>
<td>SALON D &amp; E</td>
</tr>
<tr>
<td>12:15 p.m. – 1:30 p.m.</td>
<td>Lunch on Own</td>
<td>Cedar Rapids</td>
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<tr>
<td>1:30 p.m. – 2:30 p.m.</td>
<td>Town Hall Meeting</td>
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<td>1:30 p.m. – 2:30 p.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
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<tr>
<td>2:45 p.m. – 3:45 p.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
</tr>
<tr>
<td>3:30 p.m. – 4:00 p.m.</td>
<td>Coffee Break</td>
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<tr>
<td>4:00 p.m. – 5:00 p.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
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<tr>
<td>5:15 p.m. – 6:15 p.m.</td>
<td>Region Meetings</td>
<td>See Program</td>
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<tr>
<td>6:30 p.m. – 8:30 p.m.</td>
<td>WISE Dinner</td>
<td>See Program</td>
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### Saturday, January 14

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<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>6:30 a.m. – 8:00 a.m.</td>
<td>Breakfast</td>
<td>Des Moines Exhibit Hall</td>
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<tr>
<td>7:00 a.m. – 7:50 a.m.</td>
<td>Forum Meetings</td>
<td>See Program</td>
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<tr>
<td>8:00 a.m. – 9:00 a.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
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<tr>
<td>9:15 a.m. – 10:15 a.m.</td>
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<td>10:00 a.m. – 10:30 a.m.</td>
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<tr>
<td>10:30 a.m. – 11:30 a.m.</td>
<td>Concurrent Sessions</td>
<td>See Program</td>
</tr>
<tr>
<td>11:45 a.m. – 1:30 p.m.</td>
<td>ASTE Awards and Business Luncheon</td>
<td>SALON D &amp; E</td>
</tr>
<tr>
<td>2:00 p.m. – 7:00 p.m.</td>
<td>ASTE Board Meetings</td>
<td>Sioux City</td>
</tr>
</tbody>
</table>
WEDNESDAY, JANUARY 11, 2017

ASTE Pre-Conference Field Trip 2017  12:30 p.m.-7:30 p.m.  Hotel Lobby
Bonobos and Vino: Conservation, Cognition, Fermentation  $35

Come join us as we explore conservation and communication with primates at the Ape Cognition and Conservation Initiative, followed by a VIP Tour and Wine Tasting at Jasper Winery. The trip will conclude with dinner at the Iowa Taproom, showcasing Iowa craft beers and excellent food. Space is limited to 30 people.

ASTE Executive Committee Meeting  12:00 p.m.-2:00 p.m.  Sioux City

Workshop  4:00 p.m.-5:00 p.m.  Salon H

Get Connected at ASTE with Guidebook and Twitter

Josh Ellis (Michigan Technological University), David Slyhuis (James Madison University), Cindy Kern (Quinnipiac University).

This year, ASTE is embracing the use of Guidebook and Twitter for conference attendees to enjoy a live digital conference schedule and connect with one another using social media. This workshop will guide ASTE members in how to make the most of the conference using these websites and apps. All ability levels are welcome!

Presider Training  5:30 p.m.-6:30 p.m.  Cedar Rapids

Meta Van Sickle, College of Charleston

ASTE Board Meeting  5:00 p.m.-9:00 p.m.  Sioux City
**THURSDAY, JANUARY 12, 2017**

<table>
<thead>
<tr>
<th>Event</th>
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<tr>
<td><strong>Fun Run/Walk</strong></td>
<td>6:30 a.m.</td>
<td>Hotel Lobby</td>
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<td>Meet in the Lobby</td>
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<tr>
<td><strong>BREAKFAST with Iowa Pork Producers</strong></td>
<td>6:30 a.m.-8:00 a.m.</td>
<td>Des Moines Exhibit Hall</td>
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<td><strong>Equity Committee Meeting</strong></td>
<td>7:00 a.m.-8:00 a.m.</td>
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<td><strong>Presider Training</strong></td>
<td>8:00 a.m.-9:00 a.m.</td>
<td>Cedar Rapids</td>
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<td>Meta Van Sickle, College of Charleston</td>
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<tr>
<td><strong>Worship</strong></td>
<td>8:00 a.m.-9:30 a.m.</td>
<td>Salon H</td>
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<tr>
<td><strong>Language and Literacy, Multimodality, and STEM</strong></td>
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<td>Mark McDermott (University of Iowa) Christine Tippett (University of Ottawa) Todd Milford (University of Victoria)</td>
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<tr>
<td>Language in science is of interest to educators and researchers; a growing emphasis on STEM lends urgency to integrate language use in STEM learning environments. Infusing language and literacy in K-12 STEM instruction will be explored through a multimodal engineering activity. Science teacher education/research possibilities will be discussed.</td>
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<td><strong>Traditional Paper Set</strong></td>
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<td>Council Bluffs</td>
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<tr>
<td><strong>Policy and Reform</strong></td>
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<td>Presider: Erin Peters-Burton</td>
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<tr>
<td><strong>Collaborative inquiry and the shared workspace of professional learning communities</strong></td>
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<tr>
<td>Dan Carpenter (Texas Tech University) Brenda Bartlett (Texas Tech University)</td>
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<td>Professional learning communities provide a venue for problem solving in a collaborative inquiry process. Educators self-direct their learning and transform practice in the shared workspace. The shared workspace include physical and intellectual interactions that shape learning. Findings point to physical and intellectual discourse that lead to learning in the collaborative inquiry process.</td>
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<tr>
<td><strong>What is the effect of an integrative STEM curriculum on literacy development?</strong></td>
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<tr>
<td>Beth Van Meeteren (University of Northern Iowa / Regents' Center for Early Developmental Education) Sohyun Meacham (University of Northern Iowa) Sarah Vander Zanden (University of Northern Iowa)</td>
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<td>Researchers conducted a small study in four rural midwest kindergarten and first grade classrooms to compare students’ progress in literacy development between a control classroom (high quality literacy instructional program ), and an intervention classroom (a high quality integrative STEM and literacy</td>
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program). Analysis revealed the children’s growth in intervention classroom outperformed children in the control classroom in four out of five literacy measures.

**Videocases for Science Teaching Analysis Plus (ViSTA Plus): Initial Findings from a 3-year Program Preparing Elementary Teachers to Teach Science**

Christopher Wilson (BSCS) Molly Stuhlsatz (BSCS) Connie Hvidsten (BSCS) Betty Stennett (BSCS)

Findings from the ViSTA Plus elementary science teacher preparation program. ViSTA Plus embeds video-based analysis of practice to support learning of both science content and pedagogical practices in a methods course along with analysis of videos stemming from participants’ student teaching and 1st year teaching experiences in synchronous online study groups.

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<tr>
<th>Traditional Paper Set</th>
<th>8:00 a.m.-9:00 a.m.</th>
<th>Davenport</th>
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<tr>
<td><strong>Student Learning P-12</strong></td>
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<td>Presider: Bryan Nichols</td>
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</table>

**STEM and FCS: An Integrative Approach**

Melissa Zinser (University of Nevada, Reno) Melissa Jurkiewicz (University of Nevada, Reno) David Crowther (University of Nevada, Reno)

The purpose of this study was to investigate the effects of STEM integration on students’ academic achievement in a Family and Consumer Sciences classroom. A total of 177 eighth grade students from six classes were involved in the study. The experimental group was instructed through the integration of STEM whereas the control group was traditionally instructed.

**Integrating Arts into Science: Findings from a Review of the Literature**

Kathryn Green (North Carolina State University) Kathy Trundle (North Carolina State University) Maria Shaheen (Primrose Schools)

Educators can enhance young learners’ natural interest in science by integrating arts into science learning. This study synthesizes previous empirical studies and theoretical literature published on arts integration, focusing on how the arts are integrated into science teaching, and the efficacy of arts integration for science learning.

**Investigating Student Success at an Innovative Project-based High School**

Judith Morrison (Washington State University Tri-Cities) Janet Frost (Washington State University Spokane) Chad Gotch (Washington State University Pullman) Amy Roth McDuffie (Washington State University Tri-Cities) Bruce Austin (Washington State University Pullman)

Factors affecting student success at a STEM project-based learning (PBL) high school were investigated in this study. An overview of the research project including findings on teacher-student relationships and recommendations for teacher education will be presented.
Small Group Roundtable 8:00 a.m.-9:00 a.m.  DM Exhibit Hall

STEM Education

Using Robotics and Game Design to Promote Spatial Ability and Computational Thinking

Jacqueline Leonard (University of Wyoming) Andrea Burrows (University of Wyoming)

This research report examines teaching and learning among rural teachers and students who participated in formal and informal STEM clubs. Students learned to program LEGO & EV3 robots and made computer games using Scalable Game Design software. Findings reveal teachers engaged students in high-quality STEM learning and students’ spatial ability and computational thinking strategies improved.

Traditional Paper Set 8:00 a.m.-9:00 a.m. Dubuque

Educational Technology

An Exploration of Scientists’ Perceptions of Motivation, Influences, and Characteristics as Scientist Mentors in a Remote Learning Environment

Gina Childers (North Carolina State University) Catrina Adams (Botanical Society of America) Claire Hemingway (National Science Foundation) Chad Jordan (North Carolina State University)

This study explores scientists’ motivations and their influences to volunteer as science mentors to teach students about plant science in a remote learning environment. Helping students learn and love of teaching motivated mentors. Effective mentor characteristics were reported as showing enthusiasm and encouraging students.

Examination of cognitive demand and cognitive dynamics: A comparison of pedagogical approaches in science teaching and learning using Functional Near Infrared Spectroscopy

Richard Lamb (University at Buffalo) Leonard Annetta (Eastern Carolina University) Jonah Firestone (Washington State University Tricities) Xiufeng Liu (University at Buffalo) Ren Liu (University at Buffalo)

The Next Generation Science Standards (NGSS) have increased the focus on the use of cognitive strategies in the science classroom. This increased focus has created the need to examine claims regarding pedagogical approaches, such as cognitive demand and cognitive dynamics, that impact underlying cognitive functions. This analysis compares science based Serious Educational Games, laboratory based learning, and lecture based instruction.

The Utility of 3-D, Haptic-Enabled, Virtual Reality for Learning Complex Biological Systems: Students’ Understanding of the Human Heart

Rebecca Hite (Texas Tech University) Gail Jones (North Carolina State University) Gina Childers (North Carolina State University) Megan Ennes (North Carolina State University) Katherine Chesnutt (North...
Carolina State University) Mariana Pereyra (North Carolina State University) Emily Cayton (North Carolina State University) Rebecca Stanley (North Carolina State University)

The heart is a complex biological system presenting numerous misconceptions for all learners. This study examines students’ understandings of the heart after participating in a 3-D, haptic-enabled, virtual reality lesson. Results suggest that these technologies avail to the learner superior representations and unique experiences, enhancing their understanding of complex biological systems.

Experiential Session 8:00 a.m.-9:00 a.m. Salon A

Curriculum, Pedagogy, and Assessment

A Course Focused on Restructuring Science Activities: Structure, Activities and Evidence of Success

Michael Clough (Iowa State University)

This session presents a course that prepares preservice/inservice teachers to restructure common directive activities and readings so they mentally engage students and promote science practices.

Traditional Paper Set 8:00 a.m.-9:00 a.m. Salon B

Preservice Science Teacher Preparation Presider: Mandy Smith

What Are the Science Teaching Self-Efficacy Beliefs of Paraprofessionals Enrolled In an Alternate Route Teacher Certification Program?

Lindsay Lightner (Washington State University) Judith Morrison (Washington State University)

Alternate route teacher certification programs for paraprofessionals are often based on the belief that paraprofessionals’ work experiences will help them become effective teachers quickly, but it is unclear whether these backgrounds help them teach elementary science well. This study investigates the science teaching self-efficacy beliefs of paraprofessionals in an alternate route program.

Impacts of a practicum-based professional development model on teacher and student learning

Dante Cisterna (University of Missouri) Deborah Hanuscin (University of Missouri) Kelsey Lipsitz (University of Missouri) Delinda Van Garderen (University of Missouri)

This paper reports preliminary findings of a practicum-based professional development (PD) model designed to enhance elementary teachers’ knowledge and practice in physical science topics and pedagogical strategies. We provide evidence of the PD impact on teacher content knowledge and pedagogy, and student learning.
Science Methods in Hybrid and Face-to-Face Environments: Perceptions of Elementary Teacher Candidates

Jon Yoshioka (University of Hawaii at Manoa) Lori Fulton (University of Hawaii at Manoa)

This session examines a science methods course delivered in different learning environments, hybrid and face-to-face. Data were collected from teacher candidates enrolled in each section in order to compare and contrast the two formats. Analysis of the teacher candidates’ perceptions of and efficacy for teaching elementary science will be shared.

Traditional Paper Set 8:00 a.m.-9:00 a.m.  Salon E

Mixed  Presider: Christine Lotter

Does the Reform in the Science Programme of the Colleges of Education Reflect in Junior Secondary School Classrooms? (Moved to Saturday due to travel issues)

Cecilia Boakye (University of Cape Coast) Joseph Ghartey Ampiah (University of Cape Coast)

This study explored the influence of the science curriculum of the colleges of education in Ghana on the instructional practices of selected newly qualified science teachers at the Junior Secondary School level (JHS; age 12-15 years). We explored whether the 2007 reform in the training of science teachers in the colleges of education reflected in the instruction of 5 newly qualified teachers (NQTs) at the JHS level as it was intended.

Teachers’ positive and practical risk taking when learning to teach science through engineering design

Brenda Capobianco (Purdue University) Anne Dooley (Purdue University)

This longitudinal case study examines risk-taking among three generations of elementary teachers learning to teach science through engineering design. Data included interviews, teacher reflections, implementation plans, and classroom observations. Results and implications suggest a continuum of positive, practical risks and benefits associated with teaching science through design.

Tensions and Lessons in Integrating Literacy into a STEM-based Curriculum

Jonah Firestone (Washington State University) Judith Morrison (Washington State University) Sarah Newcomer (Washington State University)

In this presentation we focus on some of the struggles and tensions for teachers at a new elementary STEM school as they work to integrate both STEM and literacy instruction together. This challenge is becoming more prevalent with the advent of the Common Core State Standards (CCSS) and the push for STEM instruction as more and more, teachers are being asked to teach STEM via a focus on informational text.
Ethnoscience and Environmental Education

Finding a Place for Concept Maps in Education for Sustainability

Hillary Mason (University of Colorado Denver) Katrina Marzetta (University of Colorado Denver) Bryan Wee (University of Colorado Denver)

We present a model of education for sustainability that supports learning and promotes equity in elementary classrooms. We describe an innovative curriculum at an urban, public ‘green school’ and highlight the use of concept maps adapted for an interdisciplinary unit on ecosystem interactions. Findings show increased conceptual understanding, especially for English language learners.

Teachers Selection of Visual Models for Teaching Systems Thinking

Tammy Lee (East Carolina University) Gail Jones (North Carolina State University) Katherine Chesnutt (North Carolina State University) Bonnie Glass (East Carolina University)

The complexity of science necessitates the use of visual models when teaching systems thinking. This study examined teachers’ selection of visual models as pedagogical tools and explored how in-service and pre-service elementary teachers proposed the use of visual models in lesson plans. In particular, this study examined elementary teachers’ planning and use of models in the context of systems thinking.

Reimagining Pedagogical Content Knowledge for the 21st Century

Scott Slough (Stephen F. Austin State University)

Technological Pedagogical Content Knowledge (TPACK) is a theoretical framework that has enjoyed widespread applications as it applies to the integration of technology in the teaching and learning process. This paper reviews TPACK and introduces 21st Century Pedagogical Content Knowledge (21st Century PCK), to clarify the discourse surrounding teaching and learning with technology.

Prospective elementary science teacher beliefs as expressed in metaphor

Michael Svec (Furman University)

Metaphors can provide teacher educators with insight into the beliefs of pre-service teachers. This descriptive study examines metaphors of undergraduates in an elementary science methods course near the end of their teacher preparation. Dominate metaphors tended toward the child as passive receiver. Few demonstrated metaphors consistent with inquiry, constructivist, or social pedagogies.
The forum will include exploration of opportunities for graduate student service in ASTE and election of new graduate student officers.

**Graduate Student Forum**  9:15 a.m.-10:15 a.m.  Sioux City

**Traditional Paper Set**  9:15 a.m.-10:15 a.m.  Council Bluffs

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

**Understanding Learning Processes and Outcomes of Teachers in a Professional Development Course about the Nature of Science**

Erin Peters-Burton (George Mason University) Jordan Goffena (George Mason University) Susan Poland (George Mason University)

This paper focused on the processes related to NOS learning by conducting four case studies with cross case analysis using a self-regulated learning microanalysis in a PD experience. Teachers’ misalignment between their individual goals and the learning outcomes helped the instructor identify teacher difficulty and informed the PD design.

**Science Teachers' Knowledge about Science, Technology and Engineering as a Support for Integrated Instruction**

Allison Antink-Meyer (Illinois State University)

Just as nature of science (NOS) has been demonstrated to require explicit, reflective instruction, it can be assumed that science teachers’ knowledge about engineering and technology are as well. The issue in science teacher education addressed in this study related to teachers’ knowledge about science, technology and engineering needed for subject integration in the secondary science classroom.

**Biology Undergraduates' Perceptions of Nature of Science and Scientific Inquiry**

Lin Xiang (Weber State University)

The study documented students’ perceptions of NOS and SI from up to 2000 undergraduate students’ perceptions before and after an introductory biology lab unit that was designed to help students explicitly reflect on NOS and SI. Our results revealed significant differences between undergraduate students and biologists’ perception of SI and provided empirical evidence on undergraduate students’ misconception of NOS.
Argumentation: An Approach to Address Student Misconceptions in Science Learning

Gina Rosa (University of Nevada, Reno) David Crowther (University of Nevada, Reno) Adam Kirn (University of Nevada, Reno)

Misconceptions hold a heavy influence on students’ acquisition of new concepts. It is imperative that these prior conceptions are recognized as an influence on future student learning. This study explored the effectiveness of the instructional approach of argumentation in addressing third grade students’ prior conceptions in science learning.

Climate Change: Middle and High School Students’ Conceptions

Tina Cartwright (Marshall University) Deb Hemler (Fairmont State University) Paula Magee (Indiana University - Indianapolis)

This study used survey data to determine middle and high school students’ understanding of weather, climate and climate change. Analysis of the survey data (taken over a four year period) will be discussed. Content areas where students struggled will be highlighted and recommendations for areas to focus for instruction will be shared.

Visualizing Moon’s Orbital Tilt in 3D: An Innovative Way To Teach Both Lunar Phases and Eclipses

Mark Guy (University of North Dakota) Timothy Young (University of North Dakota) Delphine Banjong (University of North Dakota)

This paper presents an innovative approach to helping students better understand how both Moon phases and eclipses occur by constructing their own 3D model of the Moon’s orbital tilt using everyday materials. A sample of the orbital tilt model will be presented along with suggested instructional approaches for its use in the classroom. Educational benefits of this creative model will also be discussed.

Preservice Science Teacher Preparation

Allowing our Professional Knowledge of Pre-Service Teacher Education to be Enhanced by Self-Study Research: Turning a Critical Eye on Our Practice

Presiders: Gayle Buck (Indiana University) Valarie Akerson (Indiana University)

Discussant/Presenters: Allan Feldman (University of South Florida) Norman Lederman (Illinois Institute of Technology) Judith Lederman (Illinois Institute of Technology)
Thursday, January 12, 2017

Presenters: Tony Bartley (Lakehead University) Gary Holliday (University of Akron) Maria Wallace (Louisiana State University) Brenda Capobianco (Purdue University) Molly Weinburgh (Texas Christian University) Mark Bloom (Dallas Baptist University) Gil Naizer (Texas A&M University-Commerce)
Sumreen Asim (Indiana University Southeast) Brent Gilles (Indiana University) Nidaa Makki (University of Akron)

This session highlights chapters from a recent ASTE sponsored book on the implications of self-studies in science teacher education. There is an overview about the importance of self studies in science teacher education, followed by a breakout session to interact with individual chapter authors. The session will conclude with discussion of implications on science teacher education.

Experiential Session 9:15 a.m.-10:15 a.m. Dubuque

Educational Technology

Literacy and Science: How to produce personal science story podcasts with teachers and students

Jennifer Frisch (University of Minnesota- Duluth) Brendan Callahan (Kennesaw State University)
Neporcha Cone (Kennesaw State University)

This experiential session will give participants a chance to begin creating a personal science story podcast episode. Facilitators will break participants into story circles to tell personal stories and integrate science concepts, connect stories to language functions and academic vocabulary, and practice working with Audacity. Laptops/ tablets recommended but not necessary.

Experiential Session 9:15 a.m.-10:15 a.m. Salon A

STEM Education

The Super Gene Brothers: DNA versus RNA

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

This module effectively uses nuances of the Super Mario Brothers video game to meet a 7th grade Life Science Content standard: Identify differences between deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Participants (typically 7th grade students) use candy, music and other non-conventional approaches to design and understand DNA and RNA models.
Helping Teachers Understand Big Data

Anna Lewis (USFSP)

The collection and analysis of big data - high volume, high velocity, and high variety data streams (3HV) is transforming the research world and the marketplace. Yet teaching big data techniques is not yet prevalent in the classroom, in curricula, or informal science education. This paper examines a PD model that helps teachers to introduce and incorporate 3HV data in their own science classrooms.

Understanding Rural Science and Mathematics Teacher Leadership

Christine Lotter (University of South Carolina) Jan Yow (University of South Carolina) Adam Sokol (University of South Carolina) Leigh D’Amico (University of South Carolina)

In this presentation, we present findings from the first year of a rural mathematics and science teacher leadership professional development program. Twenty teachers participated in the program aimed at improving teacher retention, instructional practice, leadership, and student learning. We discuss teachers’ and principals’ conceptions of rural teacher leaders and their influence on community and student resources.

Relational-Cultural Theory as a Lens to Understanding Science Teacher Induction: A Case Study of a Newly Hired Alternative Licensed Science Teacher’s Relationships and Resilience

Angela Webb (Louisiana State University)

This presentation considers the induction experiences of a newly hired, alternatively licensed science teacher through the lens of Relational-Cultural Theory to develop a deeper understanding of the relational aspects of induction support and teacher resilience.

Assessing the Needs of Site-based Mentors and School Administrators as a Means of Improving Partnerships for Science Teacher Development

Gayle Evans (University of Florida) Kent Crippen (University of Florida) Gloria Weber (University of Florida) Rochelle McTureous (University of Florida)

We conducted a survey of secondary science teachers regarding experiences and perceptions of mentoring PSTs, and the influence of several factors in their decisions about whether to mentor. In addition, interviews with school based administrators sought to learn about their perceptions of mentoring and their school climate regarding interns.
Launching a Networked Improvement Community to Facilitate NGSS Understanding in Secondary Science Teacher Preparation Courses

Corinne Lardy (California State University, East Bay) Michelle Sinapuelas (California State University, East Bay) Rachelle DiStefano (California State University, East Bay) Christine Lee (Virginia Commonwealth University) Michele Korb (California State University, East Bay)

This presentation describes the formation and first six-months of activity of a community of preservice science teacher educators from seven universities working together to improve NGSS-focused education in their teaching methods courses. Results pertaining to members’ interactions and shift in understanding and teaching practices will be presented.

It’s Like Herding Cats: A State Wide Initiative to Address the Next Generation Science Standards

Catherine Koehler (Southern Connecticut State University) Todd Campbell (University of Connecticut) Joanna Badara (University of Bridgeport) Marsha Bednaski (Central Connecticut State University) Jeffrey Thomas (Central Connecticut State University) Cindy Kern (Quinnipiac University) David Moss (University of Connecticut) Theresa Bruckerhoff (CERUS)

In this proposal, we will describe phase I of the CoSEPT (Connecticut Network of Science Educators and Preservice Teachers) project and how we were able to develop a strong IHE professional development learning community (PLC) to work toward a goal of developing a preservice science teacher pipeline in Connecticut.

Traditional Paper Set 9:15 a.m.-10:15 a.m. Cedar Rapids

STEM Education

Outsourcing STEM: Implications for the Design of Elementary STEM Teacher Preparation

Carol Rinke (Marist College) Gabriella DeCenzo (Marist College)

This study examines the outcomes of a six-credit STEM methods block for elementary teachers. Using mixed methods, we analyzed the suitability of our STEM preparation model for school settings and found the majority of STEM instruction took place outside of the general education classroom. Implications for STEM teacher credentials are discussed.

Preparing Elementary Pre-service Teachers to Integrate STEM

Erin Evans (University of St. Francis)

This presentation presents significant findings on how the inclusion of an Integrated STEM Unit that was authentically planned and taught by elementary pre-service teacher candidates at a local partner school supported positive changes in the pre-service teachers’ perceptions of, confidence toward, and abilities in designing and teaching integrated STEM lessons to elementary students.
Integrating Engineering Design with the Existing Curriculum: Balancing Structure, Agency, and Authenticity

Maria Rivera Maulucci (Barnard College) Stefania Macaluso (Barnard College) Roya Heydari (Teachers College, Columbia University).

This paper explores how six preservice-inservice teacher teams created engineering design units connected to the existing science curriculum during their participation in a 14-week science methods course/professional development seminar.

20-Year Analysis of Science Education Faculty Positions

Lloyd Barrow (University of Missouri)

A casual-comparative analysis of science education faculty positions. The comparison involves all Carnegie ranked institutions plus impact of the recession. The purpose of this study was to analyze characteristics of science education faculty positions at domestic higher education institutions. The data from 1992-3 academic year served as a baseline for the study. Academic year 2002-3 was prior to the recession and 2012-3 was post recession. Therefore, providing a longitudinal impact.

Mixed-Methods Analysis of Science Teacher Educator Professional Development Practices

Tyler St. Clair (SUNY Potsdam) Jennifer Maeng (University of Virginia) Lindsay Wheeler (University of Virginia) Randy Bell (Oregon State University)

This five-year mixed-methods study explored a variety of approaches to science teacher educator professional development (PD). For most learning objectives, participants’ showed significant pre-to-post gains, which were maintained after one year. Participants revealed a variety of themes regarding perceived strengths and weaknesses of the PD.

Using Self-Study to Systematically Examine the Teaching Practices of an Experienced Science Educator

Leslie Bradbury (Appalachian State University) Tracy Smith (Appalachian State University)

In this presentation, I will share my experiences engaging in a self-study focused on the match between my beliefs and practices in an elementary science methods course. I will discuss the process of self-study and how I enacted it in my context, including the importance of a critical friend, as well as insights gained about my instruction.
Small Group Roundtable 9:15 a.m.-10:15 a.m. Salon F

Curriculum, Pedagogy, and Assessment

New Science Teachers Learning to Elicit and Work with Students’ Ideas: Investigating a Science Teaching Core Practice in High-Need Urban Settings

Elaine Howes (American Museum of Natural History) Jamie Wallace (American Museum of Natural History)

The study described in this roundtable presentation is one of a set of case studies exploring how our graduates apply what they learn in their preservice program and associated induction to their teaching in urban high-need schools. This particular case study describes how two of our graduates intentionally elicit students’ thinking, and what use they make of students’ ideas in their planning and instruction.

COFFEE BREAK 10:00 a.m – 10:30 a.m.

KEYNOTE 10:30 a.m.-12:00 p.m. Salon D, E

Dr. Sara Vispoel, American College Testing, Inc.

Best Teaching Practices vs. Standardized Test Performance—Which is more Important?

Sara Vispoel is a former high school biology teacher, an NABT Outstanding Biology Teacher award winner, and has a Ph.D. in Educational Measurement and Statistics. Dr. Vispoel is the Senior Director in Assessment Design at ACT, Inc. and is one of the original committee members who authored the Common Core State Standards.

LUNCH 12:00 p.m.-1:00 p.m.

On your own – the Rock River Grill and City Center Lounge are in the hotel. Three food courts with local fare and shopping are less than five minutes away via the Skywalk – just exit the hotel via the Skywalk, turn right, and walk about 100 meters – you’ll find three floors of choices!

NSTA Affiliate Session 1:00 p.m.-2:00 p.m. Sioux City

Teacher Preparation Standards to Meet the NRC Framework for K-12 Education: A Town Hall Meeting

Facilitators: Eric J Pyle, Patricia Morrell, William Veal, Gillian Roehrig, Michael Clough, Joanne Olson, Meredith Rogers
A joint NSTA/ASTE Ad-Hoc Committee has been updating preservice teacher preparation standards to correspond with NRC’s A Framework for K-12 Science Education. We seek your input and comments on this important work.

**Workshop**

1:00 p.m.-3:00 p.m.  
Salon H

**If You Build It.....Constructing Valuable Field Experiences for PST**

Paula MaGee (Indiana University-Purdue University Indianapolis) Tina Cartwright (Marshall University) Deb Hemler (Fairmont State University)

Join us as we explore best practices in science teacher education field. This workshop will focus on all areas of science teacher education field experience including elementary, secondary, after school, culturally relevant teaching and international experiences. Opportunity to participate in field experience publication.

**Innovations**

1:00 p.m.-2:00 p.m.  
Davenport

Journal Editors: Ronald Hermann and Rommel Miranda

Come to this session to meet, interact with, and hear the views of the journal editors for *Innovations in Science Teacher Education*. This session is targeted toward science educators interested in learning about publishing in the official practitioner journal of ASTE. The editors will provide an overview of the journal and submission guidelines, and discuss key points about the journal to assist authors that are considering Innovations as a publication opportunity. Attendees will benefit by asking questions about manuscript preparation, qualities that are found in a publishable manuscript, the review process, responding to peer reviewers’ comments, serving on the editorial review board, or any other publication concerns.

**Traditional Paper Set**

1:00 p.m.-2:00 p.m.  
Cedar Rapids

**Ethnoscience and Environmental Education**  
Presider: Kristie Gutierrez

**Post-Secondary Students’ Empathy Expressed through Experiencing Place-Based Yellowstone Contentious Environmental Issues Instruction**

Benjamin Herman (University of Missouri-Columbia) Dana Zeidler (University of South Florida) Mark Newton (University of South Florida)

This investigation showed how undergraduate students, experiencing SSI instruction embedded within a place-based contentious environmental issues (CEI) course in the Greater Yellowstone Area developed and extended empathy to entities impacted by CEI.

**Qualitative Explorations of Preservice Elementary Teachers’ Conceptualizations of the Environment**

Rachel Wilson (Appalachian State University)
This study describes 3 tasks given to PSETs at the beginning of an environmental literacy course to qualitatively explore their conceptualizations of the term “environment” and the constructs of knowledge, personal meanings, and behaviors. Word associations, narratives of experiences, and personal activity maps were completed by 78 PSETs at the beginning of an environmental literacy course.

**Environmental Consciousness and Behavior Development Through Experiential SSI Instruction**

Mark Newton (University of South Florida) Benjamin Herman (University of Missouri) Dana Zeidler (University of South Florida)

This study investigates students’ development of environmental consciousness and its association with environmental behaviors after completing an experiential environmental education course with embedded SSI instruction. Students were either environmentally conscious and willing to engage in environmental behaviors or environmentally conscious and unwilling to engage in environmental behaviors.

**Experiential Session**

1:00 p.m.-2:00 p.m.  Council Bluffs

**Equity and Diversity**

**Preparing early childhood educators to make science learning meaningful for dual language learners in preschool contexts**

Leslie Moore (The Ohio State University) Mandy McCormick Smith (Capital University)

This session focuses on preparing early childhood educators to make science learning meaningful for preschool children who speak many languages. Participants will interact with preschool science concepts through the pre-k learning cycle for science (Authors, in press) with emphasis on incorporating linguistically responsive approaches through thematic learning (Authors, 2016).

**Small Group Roundtable**

1:00 p.m.-2:00 p.m.  DM Exhibit Hall

**Science Teacher Professional Development**

**The Benefits and Challenges of using Participatory Action Research as a form of Professional Development for Science Faculty**

Morgan Presley (Drury University) Deborah Hanuscin (University of Missouri)

This presentation discusses the benefits and challenges of using participatory action research (PAR) as a form of professional development for science faculty. Several benefits, challenges and recommendations were found.
Synergistic Physical Experiment and Interactive Simulation (SPEIS) Program to Improve Pre-Service Elementary Teachers’ Self-Efficacy in Teaching Science

Soon Chun Lee (Wichita State University)

Synergistic Physical Experiment and Interactive Simulation (SPEIS) program that uses a combination of physical experiments and interactive simulations showed its effects on preservice elementary teachers’ conceptual understanding in science content and self-efficacy in teaching science. The SPEIS program can also be implemented into a K-12 STEM class and a undergraduate STEM course.

Examining Preservice Teachers’ Technology Self-efficacy: Impact of Mobile-based Physics Curriculum

Meera Chandrasekhar (University of Missouri) Deepika Menon (Towson University) Dorina Kosztin (University of Missouri) Douglas Steinhoff (University of Missouri)

We describe a quasi-experimental study of a mobile-technology-based physics curriculum, Exploring Physics, on a preservice elementary science content course. The unique affordances of this curriculum, and its effect on preservice teachers’ technology self-efficacy and confidence in using mobile technologies for their teaching will be discussed.

Characterizing Preservice Science Teachers’ Technology Integration Practice

Lyrica Lucas (University of Nebraska-Lincoln)

This study begins to examine how preservice science teachers in a graduate-level teacher education program negotiate technology integration in their teaching practice during internship. Preliminary findings show a limited set of activities that typify student teachers’ enactment of technology integration and point to supports and constraints that influence their use of classroom technologies.

Refracting environment-related educational curriculum through Gaian lens

Narmin Ghalichi (University of Minnesota) Gillian Roehrig (University of Minnesota)

Current educational scholarship demonstrates the need for the progressive educational curriculum that would frame teaching and metacognitive skills within an ethical framework. This proposal is committed to exploring a new ideology of the Gaian perspective as a way of infusing humanistic
conception into the curricular sequence and amalgamating multiple knowledge domains into a unified curriculum.

### Traditional Paper Set 1:00 p.m.-2:00 p.m. Salon B

**Science Teacher Professional Development**

*How teacher confidence to facilitate Student-driven negotiation is impacted by participation in PLC Groups and Summer Workshop Experiences*

Mason Kuhn (University of Northern Iowa) Mark McDermott (University of Iowa)

This paper describes a study where teacher confidence to facilitate student-driven negotiation in a science classroom was measured in a group of Kindergarten through Grade 8 in-service teachers throughout a three-year professional development (PD) program. The authors developed a unique PD model, based on a research-supported approach, where teachers received instruction during a five-day summer workshop and follow-up support during the school year through professional learning communities (PLC).

**Learning to Like It: Curricular Change and Teacher Emotion**

Rudolf Kraus (Rhode Island College) Lesley Shapiro (Classical High School)

Organizational change literature provides a new perspective for examining the NGSS. This research compares teachers’ feelings about change to a more general model of organizational change. This is of interest to those implementing professional development for the NGSS while avoiding pitfalls noted by previous scholarship.

**Induction and its Impact on Beginning Science Teachers’ Reform-based Beliefs and Practices**

Joshua Ellis (Michigan Technological University) Elizabeth Ring (University of Minnesota) Julie Brown (University of Minnesota) Gillian Roehrig (University of Minnesota)

An explanatory embedded multiple case study design (Yin, 2013) was used to assess how six science teachers understood and enacted reform-based strategies within their K-12 classrooms. Results reveal a surprising degree of variation in how new science teachers’ beliefs about and enactment of reform-based teaching practices change during their first year of participation in a teacher induction program.

### Traditional Paper Set 1:00 p.m.-2:00 p.m. Salon C

**Preservice Science Teacher Preparation**

*Learning to Teach ELL Students Science: Case studies of Two Preservice Biology Teachers’ Experiences*

Jonathan Hall (University of Central Florida) Su Gao (University of Central Florida)
This case study explored two preservice biology teacher’ experiences as they learned how to teach English Language Learners (ELLs). This study focuses on participants’ development in knowledge about science inquiry and science instructional approaches for ELLs.

**Longitudinal Changes in Pre-Service Science Teachers’ Identity to Teach in High-Needs Schools**

Meredith Kier (College of William and Mary) Jason Chen (College of William and Mary)

This qualitative study investigates the “high needs science teacher identity” of six students involved in the Robert Noyce Scholarship program at a southeastern teacher preparation program. Programmatic elements are identified that influence this identity.

**Science Teaching Orientations: How Do Pre-Service Elementary Teachers’ Orientations Change Over The Course of a Semester-Long Science Methods Class?**

William Thornburgh (University of Louisville) Sherri Brown (University of Louisville)

Pre-service teachers’ (PSTs) pedagogy toward science teaching was evaluated pre- and post-science methods course. The course design is to teach science concepts that will be taught during elementary school and promote inquiry. The results indicated that the methods course influenced changes in POSTT scores to more inquiry instruction among PSTs.

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<td><strong>Using Incongruity to Teach Topics in Ecology</strong></td>
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<td>Francine Wizner</td>
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<td><strong>Project ReCharge: An Energy Efficiency Curriculum with Real-Time Data</strong></td>
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<td>Catherine Pozarski Connolly (University of Nevada, Reno) David Crowther (University of Nevada, Reno)</td>
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Results of the first two years 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 aligned to the three-dimensions of the NGSS.
Impact of Socioscientific Issues on Middle School Students’ Character and Values for Global Citizens
(Canceled)

Wardell Powell (University of Massachusetts, Amherst) Dana Zeidler (University of South Florida)

Students’ social and moral compassion and socioscientific accountability played a major role in developing character and values for global citizens.

Small Group Roundtable 1:00 p.m.-2:00 p.m. Salon F

Preservice Science Teacher Preparation

Science Content-Focused Coaching: Seeing is Believing

Jeni Davis (University of South Florida)

The purpose of this study was to investigate how content-focused coaching aided preservice teachers’ connection of science methods coursework and elementary field experiences. This study will tell the story of one science coaching cycle: how the cycle came to be, the work done throughout the coaching cycle, and what we learned about improving science teaching and learning.

Traditional Paper Set 1:00 p.m.-2:00 p.m. Salon G

College and University Science Education

Presider: Catherine Koehler

Co-teaching in Physical Sciences at the University Level: Positive Impacts of Combining Two

Kenneth Thompson (Department of Physical Sciences, Emporia State University) Mirah Dow (School of Library and Information Management Emporia State University)

Co-teaching the design of control variable experiment concepts and information and technology literacy skills to future teachers of science was investigated in the context of university classroom instruction. Learn how we used findings to modify instruction and secure Institute of Museums and Library Services funding for a new certificate program.

Explicit Instruction for the Development of Higher-Order Study Skills in Medical School Students

Brian Pinney (Des Moines University) Michelle Rogers-Johnson (Des Moines University) Shelby Herig (University of Iowa)

Many instructors seek to develop critical thinking within their students. This study seeks to explore the development of higher-order student study skills with explicit instruction paired with a study skills inventory assessment (pre-posttest LASSI). Measures of academic success for in- and out-groups are included as a measure of effectiveness.

Student Use of and Attitudes Towards the Textbook in an Introductory Biology Course
Alexia Rudolph (Arizona State University) Rachel Yoho (Arizona State University) Ying-Chih Chen (Arizona State University) Binaben Vanmali (Arizona State University)

The textbook is one of the most common components of a college course and is considered important for the student to interact with. The purpose of this study was to investigate student use of and attitudes towards the textbook in an introductory biology course. Results indicate students hold positive attitudes toward their textbook but are not necessarily using the textbook as intended by the professor.

**Workshop**

2:15 p.m.-4:15 p.m.  
Cedar Rapids

**Models of Collaboration in Support of Inclusive Science Teacher Education**

Christopher L. Atchison and Christina R. Carnahan (University of Cincinnati)  
Teresa Shume (North Dakota State University) Keri DeSutter (Minnesota State University Moorhead)  
Jenna Porter and Kathy Gee (California State University Sacramento)  
Submitted by Vanessa Dodo Seriki, Michele Koomen, and Sami Kahn

The Inclusive Science Education Forum and the Equity Committee have collaborated to host a two-hour embedded workshop focused on different models of collaboration in support of inclusive science teacher education. During this session three models will be shared and discussed in hopes that those who are interested in inclusive science education and inclusive education in general will explore unique models of collaboration that benefit preservice teachers as well as K-12 students. The workshop agenda and participants are as follows:

Collaboration 1: Preparing tomorrow’s teachers through first-hand perspectives of ability in an inclusively-designed science methods course.


**Workshop**

2:15 p.m.-4:15 p.m.  
Sioux City

**NSTA/CAEP Preservice Standards: Preparing Your Program Report**

Michael Dias (Kennesaw State University)

This workshop provides support for science teacher educators who lead candidate and program assessment efforts at their respective institutions. We will help participants understand the NSTA-CAEP Standards for Science Teacher Preparation through analysis of sample program data reports. Suggestions for program report preparation are included.

**Experiential Session**

2:15 p.m.-3:15 p.m.  
Dubuque

**College and University Science Education**
Musings on Unanswered Questions

Meta Van Sickle (University of Charleston) Merrie Koester (University of South Carolina Center for Science Education)

Through the imagery of music, the process of its composition, and the interpretative experience of its performance, we will introduce a STEAM education model we think can move students away from alienation and towards affiliation with science and STEM education. Such teaching foregrounds knowing as communal and value-laden, rather than as a static, detached, objective process of naming and identifying.

Traditional Paper Set

2:15 p.m.-3:15 p.m.

Equity and Diversity

Presider: Matthew Benus

How Picture Books on the National Science Teacher’s Association Recommend List Portray Scientists

Donna Farland-Smith (The Ohio State University) Kevin Finson (Bradley University) Cecile Arquette (Bradley University)

This study utilized the Draw-A-Scientist Test Checklist (DAST-C) to assess the illustrations of scientists in the most recent three years of NSTA Recommends book lists. A total of 15,778 images were contained in the 148 books from those lists, of which 1,676 were of scientists. ANOVA procedures revealed no significant differences in stereotypical elements across the three years of books. However, three notable stereotypical elements were present in large percentages in books from all years: predominance of male images, non-minority scientists, and scientists who were not youthful.

Let’s talk about talk: Discourse as a window into science identities and equity in education

Bryan Wee (University of Colorado Denver) Hillary Mason (University of Colorado Denver)

This study explores and validates science identities, embedded within life stories, of K-12 science teachers. Lived experiences in/out of science are an important aspect of equity, but so are the ways by which these stories are described. We use discourse analysis to understand how language, as a form of discursive practice, governs thinking and shapes identities vis-a-vis science.

The Science Story is the Power Story: Beginning Science Teacher Candidates on the Equitable Science Teaching Path with a Critical Science Book Club

Manali Sheth (Iowa State University) Melissa Braaten (University of Colorado Boulder)

The struggle to address the relationships between power, race, and science education continues to limit transformative science teaching. This conceptual paper argues for science teacher education practices and tools that support teacher candidates in critically analyzing science counterstories. We use examples from our methods course to demonstrate the potential to support equitable science teaching.
**Student Learning P-12**

Presider: Meg Blanchard

**Being and Becoming Scientists Today: Reclaiming a learner-scientist perspective for teaching and learning science**

Susan Kirch (New York University) Michele Amoroso (New York City Department of Education)

Science students are typically taught from a disciplinary perspective of science and viewed as people who need to learn a particular canon of information, methods and culture. We present a new perspective on science that places learner questions about the world at the forefront of teaching and learning and treats science as human activity.

**Exploring West African Immigrant Muslim Student Experience In and With Science**

Gifty Asamani (Teachers College Columbia University) Felicia Mensah (Teachers College Columbia University)

This study reports findings of four West African immigrant Muslim high school students’ perceptions and performances in science.

**Using Choice to Uncover the Role of Gender Stereotypes in High School Physics Assignments: Examining students’ interests, beliefs, conceptual understanding and motivations**

Samuel Wheeler (North Carolina State University) Meg Blanchard (NCSU)

This study investigates the role that student choice and gender stereotype have on student interests, beliefs, conceptual understanding and motivation toward learning physics in high school unit on Newton’s Laws. 73 students chose the context of the WebAssign problem (biological, traditional, sports) based on their interest. Results show changes in personal interest and sense making of physics problems.

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**Small Group Roundtable**

Presider: Meg Blanchard

**Curriculum, Pedagogy, and Assessment**

**Using Concept Maps as an Assessment Tool**
Researchers share the results of a study in which concept maps were utilized as an assessment tool documenting impact of science instruction on elementary aged students. Concept maps revealed science misconceptions and unexpected learning outcomes providing teachers valuable information on the effectiveness of instruction.

**Experiential Session**
2:15 p.m.-3:15 p.m.  
Salon A

**STEM Education**

**Using Corn as a Model Organism to Foster 3rd-grade Students’ Learning of Genetics and Inheritance**

Devarati Bhattacharya (K-16 STEM Education Fellow, School of Natural Resources, University of Nebraska, Lincoln) Erin Ingram (Curriculum Development Specialist, School of Natural Resources, University of Nebraska, Lincoln, NE) Cory Forbes (Associate Professor of Science Education, Coordinator, IANR Science Literacy Initiative, School of Natural Resources, University of Nebraska, Lincoln, NE)

We will provide hands-on experience of an activity from our standards-based, 3rd-grade science curriculum UniCORN (Understanding Inheritance in Corn). This curriculum focuses on plant growth, development, genetics and inheritance by using corn and corn growth systems as model organism. Research based insights about student understanding of genetics and inheritance will also be shared.

**Science Teacher Professional Development**

**An Experiential Session to Explore EMAT: An Online Resource for Lesson Analysis Professional Development for High School Science Teachers**

Susan Kowalski (BSCS) Betty Stennett (BSCS) Mark Bloom (BSCS) Karen Askinas (BSCS)

We will showcase an online lesson analysis-based professional development course for high school science teachers. The course includes a facilitation guide for PD leaders and can also be accessed by individual teachers. Participants will have the opportunity to log in and explore this freely available resource. Please bring a laptop computer.

**Preservice Science Teacher Preparation**

**Presider: Tonjua Freeman**

**Developing Scientist Collaborations to Enhance Preservice Elementary Teachers’ Subject Matter Knowledge for Teaching**

Krista Adams (University of Nebraska-Lincoln) Jenny Keshwani (University of Nebraska-Lincoln) Lisa Fanning (University of Nebraska-Lincoln)
The purpose of this paper is to discuss the modification of an elementary science methods course to develop pre-service elementary education majors' subject matter knowledge for teaching through collaborations with STEM faculty. We will discuss how can these partnerships be developed in pre-service teacher training and how can we support the preservice teacher in translating STEM research into classroom instruction?

**The Impact of a Triad-Based Student Teaching Semester using a STEM Researcher on Student Teachers’ Lesson Quality**

Joanne Olson (Iowa State University) Christopher Spinler (Iowa State University) Jacob Pleasants (Iowa State University)

Triads of a cooperating teacher, student teacher, and an engineer worked together over a semester to teach science and engineering lessons to primary students. This study assessed student teachers’ science lesson quality compared to a control group that consisted of student teacher/cooperating teacher pairs from the same elementary education program.

**Pre-Service Teachers’ Computer Science and Engineering Perspectives: What is This?**

Andrea Burrows (University of Wyoming) Mike Borowczak (Erebus Labs)

Computer science (CS) and engineering concepts are often absent from education-led initiatives. This study examined the views of 23 pre-service teachers (PST) regarding CS/engineering concepts. Findings show pre-service teachers (PSTs) have below average content knowledge in part recognition and skill sets, as well in use of crosscutting constructs in lesson development.

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**Fiction writing for science learning: A framework and call for new research**

Bryan Nichols (Florida Atlantic University)

An introduction to the use of student fiction writing (Grades 3 and up), based on Common Core narrative standards, to enhance science content knowledge, skills, and attitudes. It will include tips on generating writing prompts and use of new storytelling technologies. The framework will include NGSS links, implementation and sharing strategies, challenges, collaboration, and future research.

**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 informed their response to student needs.

**Multiple “Testing” and Evaluation Procedures Consistent with NGSS in a Methods Course for Preservice Teachers of Elementary Science** *(Canceled)*

Barbara Spector (University of South Florida)

Small Group Roundtable 2:15 p.m.-3:15 p.m.  
Salon F

**Student Learning P-12**

**Supporting Elementary Science Pedagogy: Finding P-8 Teachers' "Inner Scientist"**

Barbara Bohach (Luther College) Brigitta Meade (Luther College) Eric Baack (Luther College)

Science instruction is often squeezed from elementary curriculum due to demands of teaching reading and math. This impacts teachers' self-efficacy and subsequent willingness to model effective science teacher to pre-service elementary teachers. Summer workshops designed to support local teachers in their knowledge of science and level of confidence to implement NGSS Standards improved this situation.

Traditional Paper Set 2:15 p.m.-3:15 p.m.  
Salon G

**College and University Science Education**  
Presider: Daniel Bergman

**The role of science content courses in supporting preservice elementary teachers’ knowledge of curriculum**

Stacy McCormack (Indiana University) Meredith Park Rogers (Indiana University)

Two projects were designed for a physical science content course for preservice teachers to examine if their content knowledge, curricular role identity, and self-efficacy changed. This study shows that science content courses can contribute to the PCK of preservice teachers through curricular role identity and self-efficacy development.

**Prospective vs. Novice Teachers: Teaching Experience and Science Subject Matter Knowledge**

Ryan Nixon (Brigham Young University) Leigh Smith (Brigham Young University) Richard Sudweeks (Brigham Young University)

The subject matter knowledge (SMK) elementary teachers need to teach science may be developed through a variety of experiences, including coursework and classroom experience. We found novice
teachers displayed greater SMK than prospective teachers, who recently completed science coursework, suggesting the importance of teaching experience in the development of science SMK.

**The Impact of Teacher Science Content Knowledge on Student Achievement**

Aressa Coley (Mississippi State University) Gabriel Posadas (Mississippi State University) Katie Huston (Mississippi State University) Christina Hillesheim (Mississippi State University) Ryan Walker (Mississippi State University), Mike Maguigan, Mississippi State University

This presentation describes the relationship between teacher preparation and student achievement on MCT2 Science state achievement tests. It addresses influence of teacher licensure pathways and the importance of content and pedagogical knowledge on student success. The Mississippi SLDS and the research methodology used provides an answer to the nationwide problem of student test proficiency.

**Coffee Break**

3:00 p.m. - 3:30 p.m.

**Traditional Paper Set**

3:30 p.m.-4:30 p.m. Council Bluffs

**Equity and Diversity**

President: Felicia Leammukda

**A Work in Progress: The Evolution of Science Teacher Attitudes Toward Teaching Culturally Diverse Students Throughout a 4-Week-Long Summer Course**

Preethi Titu (University of Minnesota) Elizabeth Ring (University of Minnesota) Julie Brown (University of Minnesota) Gillian Roehrig (University of Minnesota)

This study investigated the influence of a 4-week-long summer course focused on equitable science instruction on in-service teachers’ attitudes of teaching culturally diverse students. Knowing teacher’s attitudes toward culturally diverse students vary widely, we attempt to understand how experiences in a summer course influence these attitudes.

**Growing elementary science teachers’ identities around ambitious, culturally responsive teaching**

Gale Seiler (Iowa State University) Katherine Richardson Bruna (Iowa State University)

This presentation reports on work done as part of an NIH-funded project called Young Scientists, Ambitious Teachers Improving Health in an Urban Ecosystem, which responds to the rapid ethnic and racial diversification occurring in America’s heartland. We focus specifically on the goal of improving science teaching among our preservice elementary education participants. Through data collected from observations, interviews, and documents of their capstone field experiences, we illustrate the ways in which they demonstrated culturally-responsive, ambitious teaching practices and related principles in
their teaching identities with respect to three emergent themes: Teacher as Talker, Teacher as Know, and Teacher as Believer.

**Traditional Paper Set 3:30 p.m.-4:30 p.m. Davenport**

**Informal Science Education**

**Investigating the Experiences of Middle School Students Participating in Four Rural, After-School STEM Career Clubs**

Margaret Blanchard (North Carolina State University) Kristie Gutierrez (NC State) Kylie Hoyle (NC State) Lauren Harper (NC State) Jason Painter (NC State) N. Scott Ragan (NC State)

This study investigates the experiences of 172 middle school students participating in after-school STEM Career Clubs at 4 rural, high poverty schools over 18 months. Students’ content knowledge, perceptions of the club, STEM interests, and interview data were analyzed to understand their club experiences and motivations to participate.

**Investigating Rural, Middle School Students’ Beliefs and Knowledge about Climate Change and their Cultural Worldviews during an After School STEM Club Intervention**

Kristie Gutierrez (North Carolina State University) Margaret Blanchard (North Carolina State University)

In this study, 96 underrepresented middle school students took part in a climate change intervention during three after school STEM club meetings. Pre and post data on climate change knowledge and beliefs were analyzed, as well as cultural worldviews. Students had significant positive changes in content knowledge, especially males, but not in beliefs. Students’ worldviews and their role will be discussed.

**Elementary Science Olympiad Coaches’ Motivations and Perceptions of the Impacts on Participating Students, School Culture, and Teaching Practices**

Kylie Hoyle (North Carolina State University) Jason Painter (The Science House-NC State) Kim Gervase (The Science House-NC State)

The paper studies 125 Science Olympiad coaches volunteer motivation and how they perceive the school’s involvement with Science Olympiad influencing the schools’ students, teachers and culture. Additionally, the study asks elementary teacher-coaches to determine if their involvement has had any impact on their teaching practices, confidence in teaching science, or science content knowledge.
Small Group Roundtable 3:30 p.m.-4:30 p.m. DM Exhibit Hall

College and University Science Education

Training the Next Generation of Public Intellectuals and Activists in Science Using Critical Race Pedagogy

Lisette Torres (Iowa State University and Nebraska Wesleyan University)

Using Critical Race Theory (CRT), this paper discusses a first-year undergraduate course designed to think through the history and future of science communication, public engagement, and activism as well as new pedagogical approaches to train the next generation of scientists.

Small Group Roundtable 3:30 p.m.-4:30 p.m. Dubuque

Interdisciplinary Professional Development

Developing Professional Development for NGSS and CCSS: Stories of Interdisciplinary Collaboration and Transformation

José Rios (UW Tacoma) Riki Thompson (UW Tacoma) Belinda Louie (UW Tacoma) Mei Zhu (Pacific Lutheran University)

Four university faculty members examined how their beliefs, knowledge, and practices were transformed as they provided professional development in NGSS and CCSS to K-12 teachers. Data sources included personal reflective essays, notes on group discussion meetings, and interviews. Through interdisciplinary collaboration, they improved K-12 professional development and their teaching practices.

Experiential Session 3:30 p.m.-4:30 p.m. Salon A

College and University Science Education

Preparing Science Teachers to Argue: Scientific Argumentation in the Classroom

Sharon Price Schleigh (East Carolina University) Stephanie Slater (Center for Astronomy & Physics Education Research (CAPER)) Carolyn Peruta (Sonoma State University) Brian Kruse (Astronomical Society of the Pacific)

Research driving the calls for implementing scientific argumentation in k-12 classrooms to reform science education will be shared in this interactive presentation. University faculty/PD providers will engage in an activity that highlights effective strategies for facilitating SA; and will discuss
implementation in methods courses and PD to encourage pre-service and in-service teachers to promote SA.

**Themed Paper Set** 3:30 p.m.-4:30 p.m.  Salon B

**Science Teacher Professional Development**

**Professional Learning Communities for Science Teacher Leadership, Self Efficacy, and Support.**

Peter Hillman (Mercy College/School of Education) Amanda Gunning (Mercy College/School of Education) Meghan Marrero (Mercy College/School of Education)

The need for effective professional development and support for practicing K-12 science teachers is critical. Our research group will share three papers that illustrate ways an effective professional learning community supports the development of science teacher self-efficacy, teacher leadership, and science teacher support and development in practicing K-12 science teachers.

**Traditional Paper Set** 3:30 p.m.-4:30 p.m.  Salon C

**Preservice Science Teacher Preparation**  
Presider: Elaine Lucas-Evans

**Elementary Science Teacher Knowledge about Physical Science: Using Teaching demonstrations and Lesson Plan Feedback to Improve Teacher Content Knowledge**

Pamela Harrell (University of North Texas) Elisabeth Pope (University of North Texas) Karthigeyan Subramaniam (University of North Texas) Ruthanne Thompson (University of North Texas)

This study investigated the use of teaching demonstrations associated with extensive lesson plan feedback as a method to improve elementary teacher knowledge about physical science. Results suggest that participants gained content knowledge as demonstrated using practice examinations and scores from the state licensure test.

**Mythbusting popular culture and social media towards developing new science learning experiences? Ready, Set, OK Go!**

Richard Hechter (University of Manitoba)

Are you trying to help preservice/inservice science teachers blend popular culture and social media with engaging inquiry-based science? So are we! Come join us as we share how students designed, delivered, critically deconstructed and then reflected upon new experiences for teaching and learning science using contexts like the music videos from the band OK Go, movie and television scenes, and YouTube clips!

**Preservice Elementary Teacher Planning Practices Around Students' Prior Knowledge**
Elaine Lucas-Evans (University of Pittsburgh)

Planning to teach is an integral part of being a teacher. Preservice elementary teachers (PSETs) must learn how to write lessons for their students in a wide range of subjects, including science. While research has shown that PSETs have limited science content knowledge, few studies have examined the their anticipation of students prior knowledge in their lesson plans.

Traditional Paper Set 3:30 p.m.-4:30 p.m. Salon D

Curriculum, Pedagogy, and Assessment

Presider: Valarie Akerson

Using Teaching Rehearsals to Prepare Preservice Teachers for Explanation-Driven Science Instruction

Heidi Masters (University of Wisconsin - La Crosse)

A quasi-experimental design was employed to explore whether teaching rehearsals would better prepare future elementary and middle school teachers to implement explanation-driven science instruction. The results from this study and implications for including teaching rehearsals within science methods curriculum will be discussed.

Pre-Service Teachers’ Understandings of Socioscientific Teaching and Learning in a Science Methods Course

Jaimie Foulk (University of Missouri)

Socioscientific Issues Teaching and Learning (SSI-TL) is one means by which K-12 classroom teachers might achieve the demands of NGSS; however, teachers’ learning about SSI-TL has not been well studied. We sought to teach pre-service teachers about SSI-TL, and to explore the ways their understandings of SSI-TL changed as a result.

Recognizing and evaluating student understanding from assessment work: A case of four secondary chemistry pre-service teachers.

James Nyachwaya (North Dakota State University)

This study explored four secondary pre-service chemistry students’ understanding of the particulate nature of matter, PNM, the extent to which the pre-service chemistry students were able to analyze and evaluate student drawings from chemistry education research literature, which were based on PNM, and how they would go about addressing any student misunderstandings, errors or misconceptions they saw.

Small Group Roundtable 3:30 p.m.-4:30 p.m. Salon F

STEM Education

Bridgette Fincher (Pittsburg State University) Cathy Wissehr (University of Arkansas) Jennifer Beasley (University of Arkansas)

A presentation of a mixed methods research study describing the perceptions of 14 Arkansan intermediate elementary teachers unfamiliar with teaching engineering and engineering practices after six months of integrated STEM professional development wherein the teachers designed and implemented grade level aviation STEM units using Wiggins and McTighe’s Understanding by Design curriculum model. Attention will be paid to the unique professional development needs of teachers during such a transitional state where the interplay between expectations, obligations, and expertise in teaching the old standards influence the teachers’ perceptions of the projected requirements of the NGSS’s two new content areas, engineering and technology.

**Poster Presentation**  
5:30 p.m.-8:00 p.m. World Food Prize Hall of Laureates

**Equity and Diversity**
**Mother Tongue as a Response to Maintaining Language Diversity and Preserving Ecological Knowledge in the Philippines**
Sophia Sun Kyung Jeong (University of Georgia) Deborah Tippins (University of Georgia) Purita P. Bilbao (West Visayas State University)

In the Philippines, Mother Tongue was chosen as the primary language of science instruction from preschool until at least Grade 3, a movement that occurred concurrently with the recent emphasis on the preservation of traditional ecological knowledge. We discuss the tensions of maintaining the language diversity and preserving ecological knowledge in the Philippines.

**Preservice Science Teacher Preparation**
**Impact of Robert Noyce Scholarship on Teacher Recruitment**
Patricia Morrell (University of Portland) Stephanie Salomone (University of Portland)

The University of Portland Noyce Program has been successful in attracting STEM majors to the teaching profession. Based on surveys and focus group interviews, we will share how the Program recruited STEM majors to the teaching as a profession, present what we feel have been successful program components and suggest areas for improvement.

**Preservice Science Teacher Preparation**
**Science Curriculum and Instruction for Diverse K-8 Classrooms: Integrating the Engineering Design Process**
Jenna Porter (CSU Sacramento)

The NGSS introduce disciplinary core ideas in engineering, technology and applications of science, as well as new science and engineering practices. The addition of these engineering focused dimensions demand a revision of science methods courses for preservice teachers. This poster illustrates a course redesign project for integrating the engineering design process in an elementary science methods course.
Science Teacher Professional Development
A Systematic Review of Engineering Design for Science Teacher Education
Jeffrey Radloff (Purdue University) Brenda Capobianco (Purdue University)

This poster presentation discusses the process and results of a systematic review of engineering design. Implications and future direction pertaining to the integration and operationalization of engineering design in science teacher education are discussed.

Preservice Science Teacher Preparation
Influential Factors that Support the Recruitment and Retention of Geoscience and Preservice Geoscience Education Majors
Rommel Miranda (Towson University) Joel Moore (Towson University) Ronald Hermann (Towson University) Kyle Hurley (Towson University) Kevin Wiechelt (Towson University)

This NSF-funded study sought to determine the motivational factors and challenges that affect the recruitment and retention of undergraduate geoscience majors and preservice secondary geoscience education majors in a large mid-Atlantic university.

Student Learning P-12
Mapping student interest in a constructivist elementary classroom
Ranu Roy (Indiana University, Bloomington) Meredith Park Rogers (Indiana University, Bloomington)

This study asks elementary students to discuss factors that sparked their curiosity and imagination and thus interested them to participate in a university-based community science program. Differences in students self-reported levels of interest with reference to becoming curious or using their imagination will be shared.

Equity and Diversity
Intersection of race/racism in the educational experiences of Asian American youth in the K-12 setting
Sophia (Sun Kyung) Jeong (University of Georgia) Deborah Tippins (University of Georgia)

This study focused on understanding how race and racism intersect with the educational experiences of Asian American students. The findings suggest that as long as the dominant educational discourse is framed by the obsession with the academic achievement gap, the model minority stereotype will continue to be perpetuated and the voices of Asian American students silenced. Given the subtle nature of microaggressions, research that examines the daily routines and actions of students, teachers, school staff in the K-12 setting is much needed.

Equity and Diversity
SciGirls Strategies: Gender Equitable Teaching Strategies in STEM-CTE
Barbara Billington (University of Minnesota/Twin Cities PBS) Leah Defenbaugh (Twin Cities PBS) Rita Karl (Twin Cities PBS) Brenda Britsch (National Girls Collaborative Project) Siri Anderson (St. Catherine University)

In the U.S., women remain significantly underrepresented in the STEM-CTE classes and careers. Through an online and face-to-face course for STEM and Career & Technical Education teachers and
school counselors, interview, journal, and observation data revealed an increased awareness and use of gender equitable strategies, the SciGirls 7.

**STEM Education**

**STEM Preparation for K-8 Teachers**
Susan Everett (University of Michigan-Dearborn) Jeff Bouwman (Gibraltar School District)

The presentation will focus on sharing the development of a university-level STEM certificate program for K-8 teachers which is designed to enhance students’ content knowledge, to focus on best practices for teaching and to successfully integrate the STEM disciplines. Course content, sample design activities and student reflections will be shared with the audience from one of the STEM classes.

**Preservice Science Teacher Preparation**

**Designing a seamless science teacher preparation program from pre-service through induction years.**
Brad Lanier (University of Cincinnati) Helen Meyer (University of Cincinnati)

Our poster shares how a collaborative team of urban science teachers and teacher education faculty revised the pre-service methods courses and identified PD topics for early career urban science teachers. We discuss the processes used and organized progression of essential topics for preparing and retaining urban secondary science teachers.

**Science Teacher Professional Development**

**Professional Development and Changes in Teacher Beliefs and Practice toward Argument-Based Inquiry: Interim findings from the 3-year Research Project**
Yejun Bae (The University of Iowa) Jee kyung Suh (The University of Iowa) Brian Hand (The University of Iowa) Soon-hye Park (North Carolina State University)

This study focuses on teacher changes in their beliefs and practices related to argument-based inquiry through a 3-year professional development project that emphasizes on shifting their instructional practices to more argument-based approaches. Interim findings from two years’ intervention include investigation of subject teachers’ improvement in their understandings of argument.

**College and University Science Education**

**Ability beliefs of students in an undergraduate chemistry inquiry context: Their role in mediating student attitudes and learning**
Lindsay Wheeler (University of Virginia) Amanda Gonczi (University of Virginia)

This quantitative study characterized how chemistry ability-related beliefs of students and their TAs mediated student outcomes in an undergraduate inquiry-based Chemistry course. Results indicated that TA ability-beliefs as well as student prior chemistry experience and beliefs influence student outcomes.

**College and University Science Education**

**Formative Assessment Classroom Techniques (FACTs) in Teaching Nutrition Concepts to Preservice Science Teachers** **[Canceled]**
Aris Reynold Cajigal (Mariano Marcos State University – College of Teacher Education) Aleli Martin (Mariano Marcos State University – College of Teacher Education)

Curriculum, Pedagogy, and Assessment
Analyzing Indian Teachers’ Knowledge about Science Teaching across Grade Levels
Vanashri Nargund-Joshi (New Jersey City University)

This study examines three Indian teachers’ science teaching orientations representing primary, middle-school and secondary grades. The study aims to understand the similarities and differences exist with their science teaching orientations and reasons behind it. The study utilizes framework of four knowledge components of PCK to compare the orientations.

STEM Education
Exploring Pre-Service Teachers’ Understanding of Integrated STEM Education Through the Derivation of Ampere’s Law
Kimberly Corum (Curry School of Education, University of Virginia) Joe Garofalo (Curry School of Education, University of Virginia)

Pre-service science and mathematics teachers were challenged to experimentally derive Ampere’s Law, which relates the magnetic field strength of a solenoid to current, wraps of wire, and solenoid length. I will share samples of their work, including derived models, solution strategies, and task reflections. I will also demonstrate task procedures and share suggestions for implementation.

Preservice Science Teacher Preparation
“The students call me the ‘science teacher!’” Cultivating future teacher leaders in K-8 science through enhanced undergraduate clinical experiences
Brigitta Meade (Luther College) Barbara Bohach (Luther College) Eric Baack (Luther College)

Preparing pre-service elementary educators to teach science requires overcoming multiple obstacles, including limited science coursework and low confidence in science skills. A four-year program increased educator confidence, time spent teaching science, and perceptions of leadership through increased science teaching experiences.

Science Teacher Professional Development
Exploring elementary teachers’ PCK including astronomical thinking practices after PDP of learning and teaching progression: in the cases of solar system and earth motion.
Young Shin Park (Chosun University) Jin Yeo Song (Bongsan Elementary School) Jun Ho Son (Munsan Elementary School)

The purpose of this study was to explore two elementary teachers’ PCK, operationally defined by knowledges of curriculum, teaching strategies and assessment in addition to the practices of astronomical thinking in teaching the content of ‘solar system’ and ‘earth motion’ after taking PDP about learning and teaching progression.
STEM Education
Gender Differences in Student Attitudes Towards Science in Secondary Classrooms with Resident Scientists.
Lisa Hanson (Texas State University) Julie Westerland (Texas State University)

This interactive paper describes secondary student gender differences towards science in a NSF GK-12 program in Texas, Project Flowing Waters, after students spent a year with resident scientists in their classrooms. We demonstrated significant gender differences in students’ attitudes towards science and scientists before and after their experiences with biweekly resident scientists.

Preservice Science Teacher Preparation
Preservice Teachers’ Conceptions and Enactments of Formative Assessment Before, During, and After a Secondary Science Methods Course
Melissa Jurkiewicz (Mercer University) Benjamin Ho (Alpine Academy)

This study examines 21 preservice teachers and their learning of formative assessment during a secondary science methods course. The aim of the study is to gain a better understanding of how preservice science teachers enact formative assessment and what they should know and be able to do in regards to formative assessment.

College and University Science Education
Continued psychometric evaluation of the English version of The Nature of Solutions and Solubility—Diagnostic Instrument (NSS—DI)
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) (Adadan & Savasci, 2012) was designed to assess students’ understanding of solution chemistry. Statistical findings from five psychometric tests used to evaluate evaluate the reliability and discriminatory power of the second implementation of the modified English instrument (NSS-DI V.2) will be presented.

Science Teacher Professional Development
Designing Educative Curriculum Materials for High School Genetics: Lessons Learned from Researcher-Practitioner Collaborations
Christina Restrepo Nazar (Michigan State University) Stefanie Marshall (Michigan State University) Kevin McElhaney (SRI International)

This study shares lessons learned from researcher-practitioner collaborations in designing educative curriculum materials for an inquiry-based high school genetics unit. By employing design-based implementation research, a third space was established in which researchers and teachers were able to align unit goals and learning outcomes for students while promoting teacher learning.
Ethnoscience and Environmental Education
Addressing Climate Change with Community-Based Common Problem Pedagogy
Beth Klein (SUNY Cortland)

This poster presentation will share an overview of a multidisciplinary common problem pedagogy project focused on climate change issues and how they can inform future economic and environmental vitality for a local community while building student problem solving skills.

Preservice Science Teacher Preparation
Pictorial Representations of Preservice Elementary Teachers’ Views about Science Teaching and Learning
William Medina-Jerez (University of Texas at El Paso)

This study describes the implementation of a pictorial-based strategy in the exploration of minority preservice elementary teachers (PSETs) conceptions about science teaching and learning. Central to this approach is the test of an alternative format (pictorial format) in assisting preservice teachers to analyze and reimagining their roles in science classrooms. Implications of this study invite science teacher educators to take into consideration the lived experiences and histories of their preservice teachers as crucial conditions for effective preparation of our future teachers working with minority students.

Preservice Science Teacher Preparation
Summer Research Fellowship for Undergraduate Preservice Teachers
Debra Stork (University of Dubuque) Adam Hoffman (University of Dubuque)

A review of the Chlapaty Summer Fellowship Program which funds undergraduate scholarly projects between undergraduate students and faculty in departments beyond the traditionally funded science research at a small college serving low SES, diverse, first generation students. Preservice science education research will be highlighted.

Informal Science Education
Using Museum Resources for Early Childhood Professional Development

In this poster, we describe an early childhood professional development program (ECPD) offered in a museum that addressed challenges around early childhood teachers’ knowledge of science and science teaching and attitudes toward science. Also, on this poster will be early childhood teachers and administrators reflections on their experience in the ECPD.
Preservice Science Teacher Preparation
Game as a Modeling: Prospective Teachers’ Implementation of Modeling Practice in Science Classrooms
Young Ae Kim (University of Georgia) Deborah Tippins (University of Georgia)

This study examined how two groups of preservice teachers implement modeling practice in their lessons. Secondary science preservice teachers carried out their science lesson plans using modeling practices in another science method course. The preservice teachers understood modeling as an active learning approach. The two focus groups viewed games as modeling using body movement for science learning.

College and University Science Education
Immigrant Science Professors in the American Classroom
Charles Hutchison (UNC Charlotte)

A significant number of college science professors in the U.S. are immigrants. Teaching in new pedagogical and social contexts, they face several instructional issues that are likely to impact their instruction. This study re-analyzes existing data on immigrant professors to confirm that immigrant science professors need to re-educate themselves in order to become proficient in U.S. classrooms.

Science Teacher Professional Development
A Model for Inservice Science Teacher Professional Development (Preschool through Grade 8) in a California Urban School District
Lisa Martin-Hansen (California State University, Long Beach) Susan Gomez Zwiep (California State University, Long Beach) Shay Fairchild (Noralk - La Mirada Unified School District) Mikala Rahn (Public Works) Youngjin Song (California State University, Long Beach)

Preliminary data has shown the Science Professional Academy (SPA) to be an effective model for teacher professional development with a two-week, two course summer intensive experience followed by instructional and lesson study cycles during the academic year. Evaluation data has shown growth in TK-8 teachers’ content knowledge and positive responses from teachers in terms of perceived benefit.

Student Learning P-12
Development and Validation of a Systems Thinking Measuring Instrument for High School Students
Hyundong Lee (Kyungpook National University) Hyonyong Lee (Kyungpook National University)

The purposes of this study were to develop an instrument to measure high school students’ systems thinking and to validate the scale. The factors of systems thinking were made up for 5 factors - Systems Analysis, Mental Model, Shared Vision, Personal Mastery, and Team Learning through analyses of related literatures and studies. 10 items per factor were constructed through pilot-test using exploratory factor analysis.

Graduate Student Mixer 7:30 p.m.-8:15 p.m.
Christina McDaniel (Mississippi State University) Jessica Riccio (Columbia University)
After the poster session Graduate students, potential employers, and seasoned professors are encouraged to attend for a time of informal conversations.
FRIDAY, JANUARY 13, 2017

Committee Meetings 7:00 a.m. – 7:50 a.m. TBA

- Publications Committee
- Long Range Planning Committee
- Elections Committee
- Conference Planning Committee/Conference Program Committee
- Membership Committee
- Oversight Committee
- Professional Development Committee
- Awards Committee

Regional Directors Meeting (ADDED) 8:00 a.m.-9:00 a.m. Cedar Rapids

Workshop 8:15 a.m.-10:15 a.m. Salon H

Blended Learning for Science Pre-Service Teachers
Flavio Mendez (National Science Teachers Association)

Dozens of professors have registered to use the National Science Teachers Association’s Learning Center (NSTA LC) as an online textbook to educate their students via blended learning solutions. Ask questions to professors and learn how to integrate the NSTA LC’s tools and resources with your course. Bring your syllabus.

Panel Discussion 8:00 a.m.-9:00 a.m. Salon G

Lessons Learned from Robert Noyce Scholarship Projects: A Panel Discussion
Eric J. Pyle (James Madison University and National Science Teachers Association), Meredith Kier, (College of William & Mary), Patricia Morrell (University of Portland)

The Robert Noyce Teacher Scholarship Program has sought to encourage talented STEM majors to become K-12 teachers for multiple years. This panel session will share lessons learned from different types of funded programs.

Traditional Paper Set 8:00 a.m.-9:00 a.m. Davenport

Mixed

Practices of Science and Developing Scientific Explanations with Independent Student Directed Science Fair Projects
Michele Koomen (Gustavus Adolphus College) Elizabeth Schutz (Gustavus Adolphus College) Alissa Hoffman (Gustavus Adolphus College)
This study reports on the process and development of middle school science fair projects. Our analysis revealed four key findings with important implications for science education and science teacher education.

Putting Conceptions into Practice: Understanding How Science Teachers Prioritize Aspects of STEM Integration in Curriculum Writing

Elizabeth Ring (University of Minnesota) Emily Dare (Michigan Technological University) Gillian Roehrig (University of Minnesota) Preethi Titu (University of Minnesota) Elizabeth Crotty (University of Minnesota)

This study used photo elicitation interviews (PEIs) to investigate what components of STEM in-service science teachers found fundamental to integrating STEM in the classroom, and explored how those conceptions of STEM influenced their development of integrated STEM curricula.

Exploring the impact of teachers’ recognition on high school students’ physics identity

Jianlan Wang (Florida International University) Zahra Hazari (Florida International University)

This explorative case study examines the impact of the recognition strategies of three high school physics teachers on their students’ physics identity regulation. This study explicates the integrated effect of explicit and implicit recognition in shaping students’ physics identity, and also posits the appropriate recognition strategies.

Equity and Diversity

What's in a name? The use of urban, suburban and rural in science education

Frederick Bradley (University of South Florida) Allan Feldman (University of South Florida) Stephanie Bauman (University of South Florida) Javier Areas (University of South Florida)

This paper uncovers the ways in which the terms urban, suburban and rural are used in the science education literature and presents an analytical framework for representing them. Results of using the framework to analyze science education research articles are presented, which indicate problems when they are not defined explicitly.

Educational Technology

‘IT’S BIGGER THAN HIP-HOP’: Twitter, Teachers, and Talking the Talk

Phillip Boda (Teachers College, Columbia University/CUNY) Yi Li (Teachers College, Columbia University)
This study examines to what extent scientific discourse practices are used on a social media platform by coding for a random sample of 500 tweets posted on Twitter using the hashtag HipHopEd. Through an analysis like this, professional development communities can start to build a more holistic view of how to use social media platforms as both tool and site of inquiry.

**Digital Notebooks: Recording Strategies of 21st Century Science Learners**

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

We will examine how 4th and 5th graders used digital notebooks to record their science learning. While their entries were similar to those found in paper-based notebooks, examples showcasing the possibilities of digital notebooks entries will be shared. We will also discuss opportunities the digital notebook provides to further student learning.

**Three technological tools used to develop, improve, and analyze teaching**

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

In this session we will describe how we utilize three different technologies to provide practice teaching in a virtual environment, then provide qualitative observations using after action review software, and quantitative data collection using an app that provides robust measures of teacher questioning and responding, classroom activity and student engagement. The presenters will demonstrate how the three tools work together to achieve robust feedback and thereby growth in teaching skills. These three tools were used in a research study designed to provide indicators of levels of preservice teacher’s growth with regard to classroom management, student engagement, and questioning and responding. The results of the study and suggestions for using these tools in preservice or inservice programs will be shared.

**Traditional Paper Set**

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<tr>
<th>Time</th>
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<tr>
<td>8:00 a.m.-9:00 a.m.</td>
<td>Preservice Science Teacher Preparation</td>
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<td>Salon A</td>
<td>Elementary Majors’ Willingness to Specialize in Science and Views on Evolution.</td>
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<td>Presider: Nicole Glen</td>
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Ronald Hermann (Towson University)

This exploratory study of students enrolled in a generalist elementary teacher education program indicates that students willing to specialize in science also have a higher understanding of natural selection and acceptance of evolution than their peers who are less willing to specialize in science.
Preservice Science Teachers on Animal Encroachment: Critical Friend Pairs and Socioscientific Arguments

Bahadir Namdar (Department of Primary Education, Recep Tayyip Erdogan University) Vanessa Klein (Biology Education, Department of Biology and Molecular Biology, Montclair State University) Sara Raven (Science Education, Texas A&M University, College Station)

In this study, we investigated how preservice science teachers constructed arguments focused on animal encroachment in various critical friend pair formations. Results indicated that working in critical friend pairs helped students to: adopt new evidence to support their initial claim, understand the flaws in their arguments, engage in more research on the subject, and construct counter arguments.

Science Teachers Use of Exploratory Talk in a Journal Club

Karen Tallman (Lasell College)

This study explored how a journal club helped teachers collaboratively engage in exploratory talk, where they learned to reason and weigh new information from research articles. In addition, the journal club format stimulated intellectual types of dialogues similar to what teachers are encouraged to facilitate in their classrooms.

Traditional Paper Set 8:00 a.m.-9:00 a.m. Salon B

Science Teacher Professional Development Presider: Michael Svec

Exploring Learning Progressions of In-Service Teachers

Kelsy Krise (University of Toledo) Rebecca Schneider (University of Toledo)

Understanding new teachers’ pedagogical content knowledge (PCK) is essential for supporting growth. This study examined PCK for first-, second-, and third-year science teachers across a school year to determine how learning progressed over time. The findings of this study describe a trajectory of learning for new science teachers.

A Case of Design Based Online Teacher Professional Development to Introduce Integration of STEM

Tasneem Anwar (University of Minnesota) Gillian Roehrig (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 and proposed a model for STEM integration specific to context.

Comparing the Classroom Experiences of Two Urban High School Teachers Implementing Scientific Argumentation Activities for the First Time

Brent Gilles (Indiana University) Gayle Buck (Indiana University)
The purpose of this study was to compare the pedagogy and beliefs of two teachers implementing scientific argumentation in their classrooms for the first time. The findings suggest that understanding when to exert control was central to the successes of our teachers. The findings have implications for those designing professional development.

### Preservice Science Teacher Preparation

**Developing New Generation Science Teachers: A Comparison between American and Chinese Approaches**

Ling Liang (La Salle University)

Two preservice science teacher education programs, one in a top-tier Chinese teacher preparation university and the other in a large US public research university, were examined and compared. Differences between the two approaches in science teacher preparation were identified and explained. Directions for future research were also offered.

**Exploring Preservice and Inservice Teachers’ Ideas of Multiculturalism: Explorations across Two Science Methods Courses**

Felicia Mensah (Teachers College, Columbia University) Julie Brown (University of Minnesota, Twin Cities) Gillian Roehrig (University of Minnesota, Twin Cities)

In this study, we use Banks’ (2002) typology on multicultural curriculum reform as one strategy for developing multicultural, culturally relevant preservice elementary and secondary inservice science teachers. We collect teachers’ initial ideas of Bank’s four approaches for integrating multicultural content into the school and university curriculum.

**How Pre-service Elementary Teachers Perceive Their Science Methods Experiences in the USA and New Zealand – an International Comparison**

Victoria Rosin (University of Wisconsin-Eau Claire)

A strong focus on literacy and numeracy in elementary schools has diminished the time devoted to teaching other subject areas. Science, in particular, has suffered in both the USA and New Zealand. This comparative survey study reviews pre-service elementary teachers’ perceptions of science teaching during their practicum placement in the two countries and potential areas for program improvements.
Jamie Mikeska (Educational Testing Service) Geoffrey Phelps (Educational Testing Service) Andrew Croft (Educational Testing Service)

We report on findings from a validation study examining the relationships between elementary science teachers’ performances on two types of science measures practice-based content knowledge for teaching items and subject matter knowledge items and indicators of their professional preparation, teaching experience, and self-efficacy.

A Beginning Teacher’s Struggle to Integrate Science into her Language Arts Curriculum

Deborah Hanson (Hanover College)

This presentation is a case study of beginning elementary teacher who asked for assistance in integrating science with her required language arts curriculum. Lessons learned as this teacher successfully made this integration are shared, along with recommendations for professional development in this area. Insights are provided as to her motivation for this endeavor and the role of her personal beliefs.

Engaging Pre-Service Teachers in a Pedagogy Of Wonder

Andrew Gilbert (George Mason University) Christie Byers (George Mason University)

This presentation represents an effort to both construct a pedagogy of wonder and investigate the impact of approaches steeped in wonder with future elementary teachers. These findings point to positive outcomes in terms of making sense of science content, improving self-confidence and addressing key issues of interest. Findings and implications for science teacher education will be discussed.

Small Group Roundtable 8:00 a.m.-9:15 a.m. Salon F

Preservice Science Teacher Preparation

Varied Approaches for STEM and Education Faculty Collaboration to Train Pre-Service Secondary Science Teachers

Melissa Demetrikopoulos (Institute for Biomedical Philosophy) John Pecore (University of West Florida) Cynthia Trawick (Morehouse College) Brendan Callahan (Kennesaw State University) Thomas Manning (Valdosta State University)

The practice of having secondary STEM teachers complete a STEM major has become more common partly due to support provided through Noyce grants. Due to differences in institutional cultures, a variety of approaches to collaboration between STEM and Education faculty have been developed. This session will provide four very different approaches.
JSTE  9:15 a.m.-10:15 a.m.
Salon G

Journal Editors: Norman Lederman and Judith Lederman

This interactive session will focus primarily on assisting authors in getting their manuscripts accepted for publication in JSTE and secondarily on how to become a member of the Editorial Review Board for the journal. The journal Editors (as well as some of the journal's Associate Editors) will provide detailed information (and statistics) on the critical issues that all authors should address when submitting their work to the journal for publication. In particular, the major reasons why manuscripts are rejected will be discussed as well as concrete suggestions/solutions to help authors avoid the common pitfalls that result in negative editorial decisions. In addition the session will provide a detailed discussion of what reviewers look for when reviewing manuscripts. For those participants seeking to become members of the Editorial Review Board of the journal a detailed discussion of the process will be described. The session is meant to be interactive throughout with plenty of time allotted for all individuals to ask questions and voice any concerns they may have.

Traditional Paper Set  9:15 a.m.-10:15 a.m.
Cedar Rapids

Mixed
Presider: Michael Dias

Earth System Education for Urban Engineering Undergraduate Students

Younkyeong Nam (Pusan National University)

This study shows that urban engineering students’ experience of team-based research about the topic they choose based on their own interest and relevance to their major had positive impact on two important aspects of their learning: learning competency of earth system knowledge and understandings of the Earth as a system.

Fostering Educators’ Design and Implementation of Environmental Education Curricula through Professional Development

Suzanne Nesmith (Baylor University) Erin Dixon (Baylor University)

This study explored the impact of an onsite wetland professional development experience on P-12 science educators’ environmental education attitudes, efficacy, curricular decision-making, and instructional practices. Based on the findings, implications for professional development experiences and attainment of the goals for curriculum development in environmental education are discussed.

Outdoor Inquiry Impacting Classroom Pedagogy: Transferability of Environmental Education Informal Learning and Teaching Strategies

Sarah Radencic Lalk (Mississippi State University) Ryan Walker (Mississippi State University)

Professional development at an Environmental Education camp in the Great Smoky Mountains National Park attended by K12 educators was evaluated to determine aspects of the authentic science and
informal learning experiences modeled at the camp that would be implemented in classrooms of participants.

**Traditional Paper Set**

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| 9:15 a.m. - 10:15 a.m. | Council Bluffs Equity and Diversity  
Presider: Deb Hemler |

**Transitioning to New Alternate Science Content Standards**

Lori Andersen (University of Kansas) Emily Thatcher (Iowa Department of Education)

Participants will learn how a consortium of states is responding to new NGSS-aligned alternate standards, including changes to how students with significant cognitive disabilities are taught. Findings from a teacher survey and student assessments will be shared. A state education agency representative will share educators’ reflections on their work to implement new standards.

**The Beliefs and Attitudes Toward STEM Fields of Female Sixth Grade Students of Color**

Felicia Leammukda (University of Minnesota) Elizabeth Crotty (University of Minnesota) Jeanna Wieselmann (University of Minnesota) Gillian Roehrig (University of Minnesota)

Females of color are underrepresented in STEM fields. This mixed methods study examines the effect of novel STEM curricula on improving attitudes of these students toward STEM. The authors highlight particular characteristics of STEM curricula that appeal to female students of color based on the findings of this research.

**Longitudinal Effects of School Demographics on Student and School Science Achievement**

Kevin Thomas (University of Central Florida) Jonathan Hall (University of Central Florida) Tonjua Freeman (University of Central Florida) Malcolm Butler (University of Central Florida)

Student achievement gaps relative to student demographics and socioeconomic status have been a wide area of study for many years. This study focuses on these student effects on science achievement. Additionally, more current theoretical frameworks are now being explored to reframe the achievement gap. We explore the framework of social capital theory with data for a single school district over three years.

**Informal Science Education**

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| 9:15 a.m. - 10:15 a.m. | Davenport Philippine Traditional Games as Context of Science Curriculum: A Case Study  
Presider: Cathy Wissehr |

Fernan Tupas (Northern Iloilo Polytechnic State College) Severa Amistoso (Northern Iloilo Polytechnic State College) Leonisa Babas (Northern Iloilo Polytechnic State College)
This qualitative research focused on case study which aimed to identify the impact of Philippine traditional games in the context of science curriculum. It also determined science ideas, concepts and practice of Philippine traditional games or commonly called Larong Lahi played in the Municipality of Estancia. Results showed that these games have a great impact in science curriculum and showed that physics ideas and concepts, such as motion, gravitational force, energy, kinetic energy, frictions, and speed were all embedded in playing the Philippines traditional games.

**The Significance of Informal Science Experiences on Science Motivation Development for Students of Color from Middle and High School, Through Undergraduate Education**

Denise Mahfood (Teachers College Columbia University)

This purpose of this paper is to highlight how Black/African American and Latina/o students describe their motivation to learn science and their science learning across their years of schooling from middle and high school through college.

**African American Girls, Storytelling, and Informal STEM Learning Experiences**

Natalie King (Georgia State University)

In this presentation, I share the interpretations and perceptions of African American girls who participated in FOCUS, a community-based informal STEM program. Using narrative inquiry, participants generated detailed accounts of their informal and formal STEM learning experiences, and how they perceive themselves as African American girls in STEM amidst injustices related to their race, gender, and class.

**Graduate Student Forum**

9:15 a.m.-10:15 a.m.

Sioux City

Dissertation Poster Session

**Traditional Paper Set**

9:15 a.m.-10:15 a.m.

Dubuque

Educational Technology

Presider: Vanessa Klein

**Technology Integration in Science Education: A study of how teachers use modern learning technologies in Biology classrooms**

Dionysius Gnanakkan (Illinois Institute of Technology) Norman Lederman (Illinois Institute of Technology) Judith Lederman (Illinois Institute of Technology)

This study investigated the practices of high school biology teachers on their use of modern learning technologies (probes, simulations, modeling tools etc.) and whether using these technologies alleviated misconceptions among students. Findings reported mixed results about reducing misconception among students. Teachers were found to task their students in higher order thinking activities.
“Definitely not for everyone”: Variations in how science teachers integrate technology in a STEM unit

Angelina Constantine (University of Minnesota - STEM Education Center) Paula Rozowa (University of Minnesota - STEM Education Center) Alaina Szostkowski (University of Minnesota - STEM Education Center) Joshua Ellis (Michigan Technological University) Gillian Roehrig (University of Minnesota - STEM Education Center)

This multiple-case study explores the technology integration beliefs and practices of three elementary science teachers across an urban school district with a 1:1 iPad policy. By interviewing these teachers and observing them during the implementation of their co-developed STEM unit, we found that their beliefs about technology integration in STEM were more ambitious than their actual practice.

Themed Paper Set 9:15 a.m.-10:15 a.m. Salon A

Preservice Science Teacher Preparation

Supporting Elementary Preservice Teachers’ Learning to Facilitate Engagement in Science Practices Integrated with Science Content

Anna Maria Arias (Illinois State University) Sarah Fick (Wake Forest University) Amanda Benedict-Chambers (Missouri State University) Amber Bismack (University of Michigan) Elizabeth Davis (University of Michigan) Annemarie Palincsar (University of Michigan)

This themed paper set considers the development of teaching practice and knowledge of preservice teachers during practice-based teacher education programs and method courses. The set focuses on supporting elementary teachers to facilitate students to integrate science practices with science content as called for by new reforms (e.g., NGSS).

Traditional Paper Set 9:15 a.m.-10:15 a.m. Salon B

Science Teacher Professional Development Presider: Jamie Mikeska

Elementary school teachers perceptions of classroom implementation of a three-dimensional art/science/robotics project.

Jeffrey Carver (West Virginia University)

Teachers in three elementary schools in one school district in a Mid-Atlantic State were provided professional development in the utilization of Arts & Bots to meet standards related to Scientific and Engineering Practices as outlined in the Next Generation Science Standards. This presentation will provide a description of the technology as well as present results of the surveys and interviews conducted.
The benefits and challenges of teacher learning through NGSS-aligned curriculum development

Brenda Bergman (Michigan Technological University) Ashley Miller (Michigan Technological University) Jacqueline Huntoon (Michigan Technological University)

We present research findings from NGSS-aligned curriculum development and associated professional development with 49 teachers. We explain the activities implemented and investigate research findings, including: (1) the quality curriculum produced, (2) strengths and weaknesses of the curriculum design and professional development processes, and (3) professional development benefits to teachers.

Examining the Implementation of Academic Language Instructional Supports by an Elementary Science Specialist

Karl Jung (University of Minnesota)

Language plays an important role in the teaching and learning of science and students need to be supported in accessing this language. This study investigates the ways in which an elementary science specialist implemented academic language instructional supports that were planned through instructional coaching meetings.

Traditional Paper Set 9:15 a.m.-10:15 a.m. Salon C

Preservice Science Teacher Preparation Presider: Katherine Mangione

What makes an influential teacher? Preservice perceptions and implications for science teacher education.

Daniel Bergman (Wichita State University)

Prospective science teachers described their influential teachers. The most frequent attributes were passion, rapport, pedagogy, time, high expectations, fun, and helpful. Examples and implications for teacher education and research will be discussed, including attribute synergy, alignment with literature, professional dispositions, and more.

Exploring Interrelationships Among Pre-service Teachers’ Beliefs, Attitude, and Self-efficacy: a pre-post study

Mahsa Kazempour (Penn State University (Berks campus))

The aim of this mixed method study was to explore the interrelationships among elementary pre-service teachers’ beliefs, attitudes, and self-efficacy with regard to science and science teaching before and after enrolling in a science methods course.

Improving Pre-Service Elementary Teacher Attitudes and Program Engagement Through Professional Development Workshops

Nicole Glen (Bridgewater State University) Heather Pacheco-Guffrey (Bridgewater State University)
We will share findings and resources from our successful, replicable workshop series designed to increase positive learning experiences in science and engineering, provide access to and experience with curricular resources, and increase opportunities for social networking among elementary education majors prior to their science methods course.

**Small Group Roundtable**

**College and University Science Education**

Inquiry-based teaching increases self-efficacy beliefs in college freshmen students enrolled in a Chemistry laboratory

Lucia Chacon-Diaz (New Mexico State University) Prentice Baptiste (New Mexico State University) Cecilia Hernandez (New Mexico State University) Antonio Lara (New Mexico State University)

Based on the premise that prospective science teachers should be exposed to an inquiry-based pedagogical approach, and demonstrate confidence in their science content knowledge and teaching, before entering the classroom, a quantitative causal comparative study was implemented in order to compare the impact of college freshmen students' self-efficacy beliefs.

**COFFEE BREAK**

**KEYNOTE**

A Perilous Time to be a Science Teacher

Dr. Diane Ravitch, New York University

Diane Ravitch is a prolific writer and renowned historian of education at New York University. A former U.S. Assistant Secretary of Education, Dr. Ravitch has written more than 500 articles and reviews, including the New York Times bestseller, Reign of Error: The Hoax of the Privatization Movement and the Danger to America's Public Schools.

**LUNCH**

On your own – the Rock River Grill and City Center Lounge are in the hotel. Three food courts with local fare and shopping are less than five minutes away via the Skywalk – just exit the hotel via the Skywalk, turn right, and walk about 100 meters – you’ll find three floors of choices!
Workshop  1:30 p.m.-3:30 p.m.  Salon F

Writing Compelling Proposals for NSF Funding in Science Teacher Education

David Haury (National Science Foundation) Margret Hjalmarson (National Science Foundation) Alan Oliveira (University at Albany-SUNY) Michael Rook (National Science Foundation) Adam Smith (National Science Foundation)

Two NSF program officers and an experienced reviewer will discuss NSF funding programs, current funding priorities, the review process, features of highly competitive proposals, and things to avoid when submitting proposals. Participants will review and discuss excerpts from proposals that were previously submitted and ranked highly competitive.

Graduate Student Forum  1:30 p.m.- 3:30 p.m.  Salon H

The Job Search: Experienced educators will share experiences and offer strategies for the interview, job search and curriculum vitae writing.

Traditional Paper Set  1:30 p.m.-2:30 p.m.  Council Bluffs

Equity and Diversity  Presider: Karen Irving

Science Inquiry and Academic English Language Development

Lisa Gross (Appalachian State University) Shanan Fitts (Appalachian State University)

This presentation focuses on a collaborative project that promotes English Language Learner’s academic language development through science inquiry. This effort includes science curriculum development and lesson implementation by university faculty, classroom teachers, and ESL specialist. Project goals and student learning outcomes are the focus.

Doing science: The journey into conducting scientific experiments with a student who is visually impaired

Rhea Miles (East Carolina University) Alana Zambone (East Carolina University)

A student who is visually impaired learns how to work independently to conduct science investigations to prepare for the scientific workforce and to complete drug addiction research to participate in the regional science fair.

Middle School Science Teachers’ Appraisals and Emotional Responses to Challenging Situations that Can Occur when Facilitating Inquiry-based Instruction: A Multiple Case Study

Daniel Alston (University of North Carolina at Charlotte) Jeff Marshall (Clemson University)

This study examines the appraisals and emotional responses of two middle school science teachers when presented with challenging situations that can occur when facilitating inquiry-based lessons.
Small Group Roundtable 1:30 p.m.-2:30 p.m. DM Exhibit Hall

Preservice Science Teacher Preparation

Developing a Maker Endorsement Program for Pre-Service Science Teachers

Shelly Rodriguez (The University of Texas) Jill Marshall (The University of Texas) Michael DeGraff (The University of Texas)

Preparing teachers with skills that support Making is a gap in many teacher preparation programs. A newly developed Maker endorsement program hopes to prepare science teachers to bring Making into the K-12 setting. The development of the Maker endorsement program, the specific details of the initiative, and lesson learned will be discussed.

Experiential Session 1:30 p.m.-2:30 p.m. Salon A

Science Teacher Professional Development

Developing STEM Identity in Under-represented Minority Women- Increasing Capacity through STEM Identity

Imelda Nava (UCLA) Marco Nava (LAUSD)

This session is based on what was learned from the challenges and assets of first generation minority women in STEM fields through an institute intended to build STEM identities. Elements of this institute will be shared in this space. Facets of STEM identity are explored through engagement in activities related to STEM and society, personal narratives and reflective practice.

Traditional Paper Set 1:30 p.m.-2:30 p.m. Davenport

Informal Science Education

Presider: Stephen Thompson

Teaching Sustainability in Fragmented Curricula: The Role of Explicit Instruction and Experiential Learning

Ryan Walker (Mississippi State University) Renee Clary (Mississippi State University)

Following environmental camp attendance, students (N = 215) self-identified meaningful experiences not explicitly targeted within curricula. Analysis revealed non-traditional instruction impacted students. Our results attest to the importance of implicit instruction and experiential learning, which we suggest be incorporated in traditional classrooms to facilitate students’ sustainability understanding and civic responsibility.

Student Confidence in STEM: Effects of a STEM Partnership of Six Nonprofits

Jeanna Wieselmann (University of Minnesota)
A partnership between six STEM organizations provides fourth- and fifth-grade students with a set of cohesive STEM experiences, but preliminary survey findings indicated a decrease in student confidence in STEM following their experiences. The present study utilized small group interviews to better understand how STEM experiences can affect student confidence.

**Exploring the change of docents’ understandings and practices about science communication through the training workshops in situated learning context**

Young Shin Park (Chosun University) Eunhang Lee (Chosun University)

The purpose of this study was to train preservice docents for expertise in science communication practically. I designed the training course with the experienced docents as mentors so that participants could build practical knowledge in the context of situated learning for revitalization of science museum education.

**Traditional Paper Set**

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<th>1:30 p.m.-2:30 p.m.</th>
<th>Salon B</th>
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**Science Teacher Professional Development**

*Introducing inquiry-based science teaching to teachers with lesson study*

Toshinobu Hatanaka (Toho University)

This research aims to investigate the effect of lesson study, which address structured inquiry activities, for elementary science teachers in the Philippines. As the result, improvement of lessons, which was planed and taught by groups of teachers, is observed. And participants, who observe and attend the lesson discussion meeting, showed positive response for lesson study.

**Naturally Inspired – Modeling Natural Systems to teach Computer Science Fundamentals**

Mike Borowczak (Erebus Labs) Andrea Burrows (University of Wyoming)

Every student needs to know how to code - but who’s going to teach them? Many pre-service and most in-service K-12 teachers lack the computer science (CS) skill set to confidently teach broad concepts to their students. A multi-day, inquiry-based professional development using a multi-agent simulator resulted in measurable CS content gains.

**Learning and Leading through Discipline Literacy in Science and Math Education: Utilizing Mobile Technologies**

Rita Hagevik (The University of North Carolina at Pembroke)

Four faculty members at a major University have been engaged with four rural high needs middle schools in a project whose purpose is to support content area teachers in the integration of literacy into their content instruction utilizing mobile technologies or tablets and educational apps. Using the
professional development model of Japanese Lesson Study, math and science teachers created app-based lessons.

**Traditional Paper Set**  
**Preservice Science Teacher Preparation**  
**Presider: Brent Gilles**

**Collaborating to teach elementary science methods in the field with K-6 classroom teachers: Benefits for in-service and pre-service teachers**

Matthew Vick (UW-Whitewater) Patricia Falk (Mukwonago Area School District)

A science methods course was taught in a local elementary school. The professor led pedagogy lessons. Pre-service teachers planned and led inquiry-based science activities and lessons in K-6 classroom with an in-service teacher. Both in-service and pre-service teachers reported positive professional learning benefits related to inquiry.

**Challenges of Including Clinical Teaching Components in Science Methods Courses**

Mo Basir (University of Central Missouri)

In this study a clinical teaching component has embedded into a science methods course. The study focused on how prospective teachers perceived and reacted to the problems occurred in actual teaching environments. The results suggest while prospective teachers’ classroom management skills have shown some improvement, their abilities in responsive teaching have shown no or little improvement.

**What Should Elementary Science Methods Courses Teach?: Lessons Learned From a Study of Program Graduates**

Julianne Wenner (Boise State University) Sherry Dismuke (Boise State University)

Given the complexities of teaching elementary science, what should be taught in science methods courses? To investigate this, we studied graduates of our educator preparation program (EPP) to discern challenges in teaching science and science instructional practices. Findings indicate that our EPP needs prepare students to teach science within the culture of their schools and improve PCK for science.
allowed students to make assignments relevant to their professional goals, which prompted students to integrate research-based practices into their teaching.

**College and University Science Education**

**Navigating the NGSS: Uncharted Waters**

Lesley Shapiro (Classical High School) Rudolf Kraus (Rhode Island College)

The NGSS represent the future of science education and constitute a broad change from previous practice. Identifying this need, we rewrote our Science Methods in Secondary Schools course to focus on the shift from old standards to the NGSS. This session will be helpful to anyone working with in-service or pre-service teachers and the NGSS.

**Preservice Science Teacher Preparation**

**Integration of a Science Teacher Video Club into a Pedagogy Course**

Frederick Freking (University of Southern California) Anthony Maddox (University of Southern California)
Jenny Ingber (Bank Street College)

This presentation will share how one teacher education program designed and implemented a science teacher video club into an existing pedagogy class.

**Preservice Science Teacher Preparation**

**Incorporating Problem-Based Learning and Lesson Study into a Science Education Course for Pre-Service Teachers**

Michelle Cook (Clemson University)

In this syllabus-sharing presentation, I will share background information on problem-based learning and lesson study and discuss the rationale of incorporating these methods in teacher preparation programs. I will present the syllabus, address the structure of the course, and show examples of the products emerging from the course.

**Preservice Science Teacher Preparation**

**Integrating Technology Through Universal Design for Learning to Reduce Learning Barriers for all Students in an Elementary Science Methods Course**

John Pecore (University of West Florida) Jennifer Mesa (University of West Florida)

The integration of technology to facilitate science learning that incorporates the three dimensions of the Next Generation Science Standards using the Universal Design for Learning framework can reduce learning barriers for students with diverse needs in the science classroom ensuring access to all students.
Preservice Science Teacher Preparation

One shot: A elementary science methods course at a small liberal arts college

Daniel Meyer (Illinois College)

This syllabus sharing paper presents a elementary science methods course within a small liberal arts college’s teacher preparation program. The paper focuses on two themes: the course as the only opportunity to specifically address science pedagogy and the opportunities to tightly connect the course to other program courses.

Traditional Paper Set  1:30 p.m.-2:30 p.m.  Dubuque

STEM Education

Value and Limitations of Engineering Activities in Science Instruction: 4 Teachers’ Experiences

Helen Meyer (University of Cincinnati) Lindsay Owens (University of Cincinnati) Cijy Sunny (University of Cincinnati)

We share the cases of 4 science teachers who developed and implemented engineering units to teach science content. Our conclusions shed light on the common and individual ways in the teachers’ valued integrating engineering and the limitations the teachers found depending on their particular contexts, students, and backgrounds.

The Nature of STEM Integration: Strategies for Implementation in the Early Elementary Classroom

Tamara Moore (Purdue University) Kristina Tank (Iowa State University)

With increasing attention on STEM integration in early elementary classrooms, it is important to understand effective strategies for implementation. This paper presents the nature of STEM integration, strategies for facilitating integrated STEM learning experiences for students, and examples of these strategies from kindergarten classrooms.

Impact of a unique STEM competition on students and teachers

Jennifer Albert (The Citadel)

This paper describes a unique STEM competition and its impact on elementary, middle, and high school students, in addition to college and professional groups. Additionally, this paper describes a related professional development opportunity for teachers/mentors and the competition’s overall impact on them.
**Racial Microaggression among Places of Science Teacher Education Faculties – The Reasons, Actions, and Resolutions**

Mary Atwater (University of Georgia, Department of Mathematics and Science Education)

The paper shares the literature findings on racial microaggression of faculties in higher education, especially those that can impact science teacher education faculty members of African ancestry. Racial microaggressions are brief, everyday intentional or unintentional exchanges between people that denigrate one person from a less powerful racial group.

**Assessing elementary teachers’ conceptions of matter: Best practices that promote increased conceptual understanding**

Kimberly Lott (Utah State University) Colby Tofel-Grehl (Utah State University) Max Longhurst (Utah State University)

This paper discusses elementary teachers’ conceptions before and after a science content course on matter. We found increases in conceptual understanding for many fundamental topics, but some misconceptions still persisted despite targeted professional development.

**Equity and Diversity**

**Elementary School Science Success: A Case Study**

Tonjua Freeman (University of Central Florida) Malcolm Butler (University of Central Florida)

This case study shares findings from an elementary school with a large African American and Hispanic student population that has been successful with students’ performance on state-mandated, standardized science tests. It focuses on the organizational and leadership structures of the school.

**Curriculum, Pedagogy, and Assessment**

**A Gentle Introduction to the Use of Rasch Measurement Models in Science Education Research**

Gavin Fulmer (University of Iowa) William Boone (Miami University Ohio)

Rasch measurement models are increasingly visible and popular in US and international science education research due to its benefits over classical assessment approaches. This session will offer a
gentle introduction to the fundamental ideas of Rasch models, including critical reading Rasch research paper, and some examples of recent applications of Rasch measurement in science education research.

**Traditional Paper Set**

2:45 p.m.-3:45 p.m.  
Salon B

**Science Teacher Professional Development**  
Presider: William Thornburgh

**Incorporating Engineering Design into Elementary Science Instruction: Frequency, Content, and Process**

Jennifer Maeng (University of Virginia) Brooke Whitworth (Northern Arizona University) Shannon Dubois (Valparaiso University) Lindsay Wheeler (University of Virginia)

This randomized controlled trial explored the extent to and ways in which elementary teachers incorporated engineering design (ED) principles into their science instruction following PD. Significantly more treatment teachers than control teachers incorporated ED into instruction. Physical science was most often taught through ED.

**Engineering in Elementary School: Building 21st Century Learners**

Karen Irving (Ohio State University) Kathy Malone (Ohio State University) Vinta Tiarani (Ohio State University) Trudy Giasi (Ohio State University) Rachel Kajfez (Ohio State University) Andrew Heckler (Ohio State University)

The EiE-Ohio Building 21st Century Learners project is a collaboration between LEA City Schools and the Colleges of Education, Arts & Sciences and Engineering to bring STEM integrated engineering units to high needs elementary schools. Our presentation will describe the project and the research findings for the first year of implementation.

**A STEM-based PBL Professional Development for Pre-/In-service teachers in a Urban School district.**

Matthew Benus (Indiana University Northwest) Anita Martin (Indiana University Northwest)

Three urban school district in-service teachers and two pre-service candidates experienced 30 hours of PD and 40 hours of engaging middle school students in a PBL summer solar energy learning experience. Findings center on an innovative PD model that engaged pre-/in-service teachers in leading and teaching a PBL unit that included cutting edge instructional planning and pedagogy in STEM education.

**Preservice Science Teacher Preparation**

Presider: Tasneem Anwar

**Teachers’ Conceptions of the Nature of Engineering after a Semester-Length Triad Teaching Experience with an Engineer**

Jacob Pleasants (Iowa State University) Joanne Olson (Iowa State University) Christopher Spinler (Iowa State University)
We report on a teacher education project that works with student teachers and cooperating teachers to support engineering and science education at the elementary level. One of the goals of the project is to develop teachers’ knowledge of engineering, and this session presents findings from the first year of the project.

**Pre-Service Teachers’ Self-Efficacy of Teaching Engineering in Science Classrooms**

Laura Ochs (University of Virginia) Frackson Mumba (University of Virginia) Jennie Chiu (University of Virginia) Alexis Rutt (University of Virginia)

This study examined pre-service science teachers’ self-efficacy of teaching engineering in science classrooms before and after instruction on engineering design, and how to integrate it in science teaching. Results show statistically significant difference between pre and posttest scores, which suggests that the pre-service teachers’ increased their self-efficacy of teaching engineering design in science classrooms. In particular, the participants gained greater self-efficacy in two factors after the intervention; engineering pedagogical content knowledge self-efficacy, and engineering engagement self-efficacy.

**Engineering Mini-Units for Preservice Elementary Teachers**

Matthew Perkins Coppola (Indiana University-Purdue University Fort Wayne)

In a science methods course preservice teachers are introduced to the engineering design process through engineering mini-units (EMU). These teachers then design and teach a two day EMU as part of their classroom field experience. Preservice teachers reported improvement in self-efficacy, increased Design PCK, and their mentors were more likely to teach an engineering lesson in the future.

**Traditional Paper Set**

2:45 p.m.-3:45 p.m.  
Salon D

**Curriculum, Pedagogy, and Assessment**

Presider: Julie Brown

**Tracing Changes in Middle School Teachers’ Conceptions of Plant Processes as a Result of a Modeling-based Professional Development Experience**

Stephen Thompson (University of South Carolina)

Study traces changes in middle school science teachers’ conceptions of plant functions as a result of participation in a scientific modeling-based professional development initiative. The presentation will highlight participants’ understanding of individual plant processes and their inter-related nature, and describe how related conceptions changed over time.

**The Impact of Educative Curriculum Materials on Middle School Science Teachers’ Practices**

Jennifer Mesa (University of West Florida) Rose Pringle (University of Florida) Natalie King (Georgia State University)
In this study, we investigated how a reform-based curriculum including educative features supported middle school science teachers’ learning and transformed their teaching practices during a comprehensive PD program. Findings suggest that the features facilitated the teachers’ learning while shaping and scaffolding their pedagogical practices.

**Using Hands-on Learning Modules to Address Challenging Concepts in Electricity and Magnetism**

James Rutter (University of Virginia) Nigel Standish (University of Virginia) David Slykhuis (James Madison University)

The focus of this study is on hands-on learning environments, where a student builds a tangible representation of a particular concept, allowing the student to construct their own knowledge around it. This paper explores the use of a hands-on project in a middle school engineering class to teach fundamental concepts of electricity and magnetism.

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**Traditional Paper Set 2:45 p.m.-3:45 p.m. Dubuque**

**STEM Education**

Presider: Helen Meyer

**“Let Me Prove to You How I Can Be Here”: Explorations of Identity and Intersectionality in Female African-American STEM Students**

David Sparks (University of Texas at Arlington)

This qualitative study looked at the lived experiences of five female African-American students in undergraduate and graduate STEM programs and included measurements of stereotype vulnerability, an essay written by the students to a hypothetical female African-American STEM student, and a series of semi-structured interviews where they shared their experiences in the world of STEM.

**Critical Characteristics of Effective Implementation of Professional Development for Argument-Based Science Teaching Approach**

Katie Weiss (University of Iowa) Mark McDermott (University of Iowa)

The aim of this presentation is to discuss initial critical characteristics of the implementation of an argument-based science teaching approach that have been identified throughout the course of the first year of PD. The unique needs and goals of the participating districts have helped inform the PD design to provide for more long-term effective implementation.

**The Impact of a Teacher’s STEM Endorsement on Student Achievement**

Christina Hillesheim (Mississippi State University) Aressa Coley (Mississippi State University) Gabriel Posadas (Mississippi State University) Ryan Walker (Mississippi State University)

Using the Mississippi statewide longitudinal data system, researchers investigated the influence non-endorsed STEM teachers have on their students. Outcomes for student achievement were assessed
using: graduation rates, state mandated standardized test for biology and algebra, and the need for post-secondary remedial coursework.

**Roundtable 2:45 p.m.-3:45 p.m. Cedar Rapids**

**Ethnoscience and Environmental Education**

**Science Education in the Absence of Scientific Community and Science Culture**

Mansour Vesali (Shahid Rajaee Teacher Training University)

Science has a profound role not just in modern world but also in every aspect of every person in every place on the Earth. In this situation science education as a system transmitting the culture of science has a prominent place in educational systems of every country. But, what if we have science education while there is no science culture?

**Traditional Paper Set 2:45 p.m.-3:45 p.m. Salon G**

**College and University Science Education**

**Presider: Dawnne LePretre**

**Strategies to Improve Active Engagement in Academic Courses for Future Teachers**

Sandra Westmoreland (Texas Woman's University)

This presentation will provide a model and framework for other science education faculty and administrators who wish to promote active engagement in their institution’s classrooms. I will present the rationale, recruiting information, workshop plans, and designs for active engagement implementations and measurements for intervention success.

**Supporting the Bridge: How Field Experience Teachers Help Preservice Teachers Transition from Theory to Practice**

Jared Allen (Indiana University) Rebecca Borowski (Indiana University) Meredith Park Rogers (Indiana University)

This study seeks to understand, through the lens of preservice teachers, the role of a field experience instructor. Discussion is provided on how consistent collaboration and communication between the methods and field experience instructors is noticed by the preservice teachers and helped them to better connect theory to practice.

**Physics & Preservice Teachers Partnership Project (P^4): An Interdisciplinary Peer Learning Tool**

Paul Simmonds (Boise State University) Julianne Wenner (Boise State University)

In P^4, physics graduate students teach physics content to teacher candidates, who then use this content to plan/execute a 15-minute elementary school science lesson. Overall, this new peer learning model was a success, with all participants reporting benefits. P^4 can help increase content knowledge
in science methods courses, and help train hard science students to teach and communicate more effectively.

**Coffee Break**  3:30 p.m. – 4:00 p.m.

**Traditional Paper Set**  4:00 p.m.-5:00 p.m.  Council Bluffs

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

**Presider:** Debra Stork

**Experiences of Pre-service Elementary Teachers Learning to Teach the Nature of Science**

Kayla Brauer (Drake University) Jerrid Kruse (Drake University) Neal Patel (Drake University) Mitchell Klocke (Drake University)

This study sought to shed light on preservice elementary teachers’ (PSET) thinking after implementation of two approaches to teach nature of science (NOS). Focus group interviews were conducted with the PSETs after black-box and historical short story lessons. Analysis focused on struggles PSETs faced while teaching, rationale for and strategies used to teach NOS, comparing NOS to science content, views on supporting student learning of NOS as well as those activities that supported their own learning of NOS and how to teach NOS.

**Recognizing science from non-science: Preservice elementary teachers determining the appropriateness of including creationism and/or intelligent design in a K-12 science curriculum**

Ian Binns (UNC Charlotte) Mark Bloom (Dallas Baptist University)

This research explores how elementary preservice teachers justify including or excluding creationism and/or intelligent design into a science curriculum.

**A Three Part Framework for Locating Aspects of NOS in the Enterprise of Science**

Daniel Meyer (Illinois College) Allison Antink-Meyer (Illinois State University)

In this theoretical paper, we present a framework that seeks to assist in the instruction on NOS. It is not intended as an alternative to existing articulations of NOS, but rather as a lens through which to consider them. It can serve as both a heuristic for class discussion and as a guide to instructional planning.

**Small Group Roundtable**  4:00 p.m.-5:00 p.m.  DM Exhibit Hall

**Curriculum, Pedagogy, and Assessment**

**Advancing Culturally Responsive Science Education in Secondary Classrooms through an Induction Course**
In this roundtable session, we will share our experiences designing and implementing an induction course for secondary science teachers that advanced culturally responsive science education through teachers’ critical reflection and curriculum design. We hope to share our successes and gain insight as to how the challenges we met might be overcome.

Traditional Paper Set  4:00 p.m.-5:00 p.m.  Salon B

Science Teacher Professional Development  Presider: Barbara Billington

Quality AND Quantity: The impact of a year-long professional development on elementary teachers’ teaching of science

Jesse Wilcox (Drake University) Jerrid Kruse (Drake University) Benjamin Herman (University of Missouri) Hallie Edgerly (Drake University) Jaclyn Easter (Drake University)

Despite the increasing emphasis on STEM education and the NGSS, many elementary teachers do not feel comfortable with teaching science content. This study presents results from year one of a year-long PD demonstrating strong increases in elementary teachers’ self-efficacy (STEBI-A) and their enacted science teaching practices (LSC-COP).

Factors underlying science teacher implementation of modeling instruction

Kathleen Gray (NC State University College of Education) Margaret Blanchard (NC State University College of Education) N Scott Ragan (NC State University)

Using the framework of self-determination theory, this session features research findings from a model-based teaching professional development program for high school science teachers in a southeastern state. All participants reported statistically significant increases in feelings of competence, and a subset reported statistically significant increases in feelings of autonomy and relatedness.

Teacher Characteristics and School-Based Professional Development in Inclusive STEM-focused High Schools: A Cross-case Analysis

Nancy Spillane (West Virginia University) Sharon Lynch (George Washington University)

Inclusive STEM-focused High Schools (ISHSs) that successfully prepare students from underrepresented groups for STEM majors in college and STEM careers select teachers who are philosophically aligned with school missions, motivated to collaborate, and provide them with strong, targeted teacher professional development leading to teacher empowerment and professionalization.
Traditional Paper Set 4:00 p.m.-5:00 p.m. Salon C

Mixed

Facing Preconceptions in Pre-service Teachers Through Book Club Discussions

Roya Heydari (Columbia University, Teachers College) Felicia Mensah (Columbia University, Teachers College)

This study focuses on the use of book club in a science education course to assess the preconceptions secondary preservice teachers (PSTs). Analysis of the book club provided one theme - fear. This finding highlights the importance of safe spaces in classrooms with implications for teacher educators and their students.

"Because it's what scientists do": Beginning career-changers' beliefs about the practice of argumentation.

Carrie-Anne Sherwood (University of Michigan)

This study employed semi-structured interviews and qualitative case study analyses to examine the beliefs of five career changers about the scientific practice of argumentation before and after a yearlong preservice teacher training program.

A Review of Group Functionality Levels Reached by Triads in an Alternative Student Teaching Placement

Christopher Spinler (Iowa State University) Jacob Pleasants (Iowa State University) Joanne Olson (Iowa State University)

Engineering graduate students were placed in elementary classrooms and assisted student/cooperating teacher pairs in planning and teaching science and engineering lessons. This study reports the degree to which groups experienced success or failure and explores the related underlying factors.

Traditional Paper Set 4:00 p.m.-5:00 p.m. Salon E

Mixed

STEM outreach programs: Impacting science teachers' beliefs and outcome expectancies

Philip Myszkal (University of Toronto) Isha DeCoito (University of Western Ontario)

An integrated and inquiry-based approach is considered the best avenue for inspiring students to pursue STEM studies and careers. Although science and math teachers report high efficacy for teaching said subjects, findings suggest disconnect in terms of teachers’ beliefs about their students’ abilities to achieve success in STEM subjects.
Supporting Integrated STEM in the Elementary Classroom: A Professional Development Approach Centered on an Engineering Design Challenge

Kristina Tank (Iowa State University) Anne Estapa (Iowa State University)

The ways in which teachers conceptualize, interpret, and enact STEM impacts instruction. Therefore, it becomes imperative that we support teachers as they conceptualize and incorporate engineering-based STEM experiences into their classrooms. This study sought to understand how a PD focused on the use of engineering design impacted how teachers conceptualized and enacted STEM in their classroom.

Exploring preservice elementary teachers' technological choices around scientific modeling: A case study

Tina Vo (University of Nebraska-Lincoln)

This research focuses on garnering a more nuanced understanding of how preservice elementary teachers’ knowledge about scientific modeling impacts their technological choices; specifically pertaining to ways they support elementary students’ scientific modeling around hydrological phenomena.

Teacher Educators, The Evolution of a Secondary Program in Response to the Development of Transformative Action Groups. (Canceled)

Kathryn Watkins (University of New Mexico)

Regional Meetings 5:15 p.m. - 6:15 p.m. See Below

Southeast Region -- Salon A
Mid-Atlantic Region -- Salon B
Northeast Region -- Salon C
North Central Region -- Council Bluffs
Southwest Region -- Dubuque
Far West Region -- Salon F
Northwest Region -- Salon G
International Region -- Salon H

WISE Dinner 6:45 p.m. – 8:45 p.m. TBA
SATURDAY, January 14, 2017

Forums  7:00 a.m. – 7:50 a.m.

Environmental Education  Salon A
Graduate Student  Salon B
Inclusive Science Education  Salon C
Policy and Gov. Relations  Council Bluffs
Scientist/Science Educators Collaboration  Cedar Rapids
Seniors as Resources for Science Education  Salon F
Small Colleges and Programs  Salon G
Technology  Salon H
Women in Science Education  Dubuque

Oversight Committee  8:00 a.m. - 9:00 a.m.  Sioux City

CITE  8:00 a.m.-9:00 a.m.  Salon H

Journal Editors: Andrea Burrows and Timothy Slater

Learn how to publish in, and become involved with, the journal Contemporary Issues in Technology and Teacher Education (CITE-Science). Our goal for this session is to interact with the ASTE membership, so we encourage attendees to ask questions. Specifically, we will discuss manuscript topics, preparation, and submission to CITE-Science which covers peer-reviewed innovative technologies regarding pre-service, in-service, or collegiate science teacher education. In addition, for those interested in becoming a member of the editorial review board we’ll share details about the process for applying, qualifications needed, and expectations for your service.

Traditional Paper Set  8:00 a.m.-9:00 a.m.  Council Bluffs

History, Philosophy, and Nature of Science  Presider: Stacy McCormack

Focus and Trends in Nature of Science Research during the Past Twenty Years

Noushin Nouri (University of Arkansas) William McComas (University of Arkansas) Maryam Saberi (Shiraz University) Jennifer Oramous (University of Arkansas)

The aim of this project was to look over the past 20 years in five science education journals and consider what trends might be seen with respect to NOS-related studies. A content analysis was used for analyzing the articles that featured NOS and providing a proposed categorization of the research focus for each article.
Why are Geosciences Excluded from the Common U.S. Biology, Physics, Chemistry Course Progression? Perceptions of Teachers, Future Teachers, and Geoscience Students

Alice (Jill) Black (Missouri State University)

This mixed-methods study investigated the perceptions of in-service teachers, pre-service teachers, and university geoscience students concerning the possible reasons that geoscience courses have not traditionally been included in the U.S. college-bound secondary science course progression. The history behind this progression is also presented, as well as possible responses to the present situation.

Traditional Paper Set 8:00 a.m.-9:00 a.m. Davenport

Science Teacher Professional Development Presider: Bridget Mulvey

Exploring the Experiences of Urban Elementary Teachers in an Intensive Science and Math Professional Development Program

Jaclyn Easter (Drake University) Hallie Edgerly (Drake University) Jerrid Kruse (Drake University) Jesse Wilcox (Drake University)

This study describes a long-term, intensive science professional development program and explores the experiences of practicing elementary teachers as they worked to change their thinking about and enactment of effective science teaching.

Could engineering help improving chemistry teachers’ use of reform-based practices in their classrooms?

Sarah Boesdorfer (Illinois State University)

This study began to explore the hypothesis that learning to include engineering in their classroom would increase the use of learner-centered teaching practices by high school chemistry teachers. The outcomes from a professional development program provide preliminary support for the hypothesis but more research is needed.

Small Group Roundtable 8:00 a.m.-9:00 a.m. DM Exhibit Hall

Equity and Diversity

Toward Inclusion of All Learners Through Science Teacher Education

Sami Kahn (Ohio University) Michele Koomen (Gustavus Adolphus College) Christopher Atchison (University of Cincinnati) Sarah Summy (Western Michigan University) Judith Lederman (Illinois Institute of Technology) Teresa Shume (North Dakota State University) Jenna Porter (California State University - Sacramento) Terri Hebert (Indiana University South Bend) Marcia Fetters (Western Michigan University) Selina Bartels (Illinois Institute of Technology) Jonte’ Taylor (Pennsylvania State University) Catherine
Koehler (Southern Connecticut State University) Kathy Gee (California State University, Sacramento) Lacey Huffling (Georgia Southern University) Jannike Seward (Indiana University, South Bend)

During this small group roundtable session, authors of the forthcoming book, Toward Inclusion of All Learners Through Science Teacher Education will share their research supporting quality science experiences for students with disabilities.

Experiential Session 8:00 a.m.-9:00 a.m. Dubuque

Educational Technology

How Learners’ Eyes Track Over Visual Science Inscriptions: A Pilot Study [Canceled]
Kevin Finson (Bradley University) Jon Pedersen (University of South Carolina) Roger Bruning (University of Nebraska – Lincoln) Michael Dodd (University of Nebraska – Lincoln)

Themed Paper Set 8:00 a.m.-9:00 a.m. Salon A

Preservice Science Teacher Preparation

Lessons from the First 100: How to Build a Successful STEM Teacher Preparation Program
David Sparks (University of Texas at Arlington) Ann Cavallo (University of Texas at Arlington) Greg Hale (University of Texas at Arlington) Karen Allmond (University of Texas at Arlington) Karen Matsler (University of Texas at Arlington)

Since 2008, UTeach Arlington has grown to become the second largest UTeach STEM teacher preparation program site in Texas, second only to UTeach Austin. UTeach Arlington recently graduated its first 100 science and mathematics teachers since its first class in 2014. This session will share its successes and challenges to assist universities in developing effective STEM teacher preparation programs.

Traditional Paper Set 8:00 a.m.-9:00 a.m. Salon B

Mixed Presider: Karen Irving

Perceptions of In-service Teachers Toward Teaching STEM in Thailand
Wachira Srikoom (The institute for the Promotion of Teaching Science and Technology (IPST)) Deborah Hanuscun (University of Missouri) Chatree Faikhamta (Kasetsart University)

We surveyed 154 in-service teachers in Thailand to examine their ideas about teaching STEM, which has been gaining increased attention in educational policies. Results showed 85.5% of teachers had not heard of STEM education. Despite this, they expressed both an interest in teaching STEM and concerns about teaching Engineering.
“I wanted the experts to come in and teach me”: How Seven Secondary Science Teachers Conceptualize Culturally Responsive Science Education

Alaina Szostkowski (University of Minnesota) Devarati Bhattacharya (University of Nebraska-Lincoln) Gillian Roehrig (University of Minnesota)

Inquiry approaches promise engagement for all science students, yet Indigenous ways of knowing often stay undermined. Reformers call for teachers to support underrepresented groups through culturally responsive teaching. This paper explores how seven secondary science teachers conceptualized culture to inform their instruction.

Scientific Reasoning Abilities of In-Service Science Teachers in a Biology Modeling Workshop

Andria Stammen (The Ohio State University) Trudy Giasi (The Ohio State University) Courtney Irwin (The Ohio State University) Kristin Henkaline (The Ohio State University) Peter Lund (The Ohio State University) Karen Irving (The Ohio State University) Zakee Sabree (The Ohio State University) Kathy Malone (The Ohio State University)

The Modeling Biology Instruction: Leaders in Science and Engineering (MoBILiSE) Project is a collaboration between the 17 LEAs, and the Colleges of Education, Evolution, Ecology and Organismal Biology, and Engineering Education departments. Our presentation will describe the project and its effects on secondary teachers’ scientific reasoning skills.

Examining the Critical Practice of Anticipating in Secondary Pre-Service Science Teachers’ Lesson Planning

Danielle Ross (Northern Arizona University)

This study will show that PSTs receiving intensive instruction on ambitious planning practices for task-based discussions, like anticipating and the other Five Practices, can effectively develop deep and thorough anticipating skills. Supporting the findings of Grossman and her colleagues, iterative cycles of decomposition, representation, and approximation are effective as a design model for teacher preparation. Furthermore, this study illustrates the need to support PSTs in developing their capacity for effectively anticipating during lesson planning. Teacher educators must provide more opportunities for the PSTs to plan, teach, and reflect on lessons of various types and at varying levels of authenticity.
Scaffolding preservice teachers’ noticing of elementary students’ scientific thinking

Susan Hawkins (Indiana University)

This study explores how preservice elementary teachers’ abilities to professionally notice students’ scientific thinking progressed as they participated in a content-specific moderated, video-based, professional learning community. It also explored the impact on instructional decision-making and pedagogical content knowledge for teaching science.

Developing Student Teacher Noticing Skills through Science Video Club

Donna Ross (San Diego State University) Nina Drammissi (Lakeside School District)

As part of a science and math teacher education program redevelopment, the authors incorporated a Video Club for science student teachers. The focus of Video Club was to support student teachers’ abilities in professional noticing, including eliciting, analyzing, and responding to the scientific ideas of the secondary students.

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<thead>
<tr>
<th>Traditional Paper Set</th>
<th>8:00 a.m.-9:00 a.m.</th>
<th>Cedar Rapids</th>
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<tr>
<td>STEM Education</td>
<td>Presider: Celestin Ntemngwa</td>
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Cultivating Innovative Problem Solvers in Pursuit of STEM Professions: Pre-College STE(A)M Academy, Diabetes and Medicine

Yvonne Franco (University of Tampa) Richard Pollenz (University of South Florida)

STEM disciplines are currently in need of innovative thinkers to solve world challenges. This study presents data from an intensive STE(A)M Academy, using the arts to prepare juniors/seniors to creatively investigate and communicate solutions to challenges. A mixed-methods approach assessed attainment of program objectives and student learning.

Status of Science and Engineering Practices in K-12 Science Curriculum Materials

Vivien Chabalengula (University of Virginia) Sonia Bendjemil (University of Virginia) Frackson Mumba (University of Virginia) Jennifer Chiu (University of Virginia)

We investigated the coverage status of science and engineering practices in K-12 engineering programs. Nine programs that are widely used in the United States at elementary, middle school, and high school levels were analyzed via a document content analysis method using the K-12 science education framework, as an analysis framework. Results revealed that developing and using model, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, and obtaining, evaluating, and communicating information had medium/high coverage; whereas asking questions and defining problems; using mathematics and computational thinking; and engaging in argument from evidence had low coverage.
Capitalizing on Strengths: What pre-service STEM Education teachers, engineering majors, and middle school English language learners have to teach each other (Canceled)

Anne Gatling (Merrimack College) Cynthia Carlson (Merrimack College)

Small Group Roundtable 8:00 a.m.-9:00 a.m. Salon F

Preservice Science Teacher Preparation

Where oh where is engineering? The examination of edTPA portfolios for the Next Generation Science Standards-Science and Engineering Practices (Canceled)

Erica Brownstein (The Ohio State University) Larry Horvath (San Francisco State University)

Traditional Paper Set 8:00 a.m.-9:00 a.m. Salon G

College and University Science Education Presider: Lisa Gross

Awareness of Students’ Existing Science Conceptions: A Case Study

Yohanis De La Fuente (Texas Christian University)

A case study of how a 4th grade science teacher considers her students’ previous experiences, prior knowledge and existing conceptions for instruction. Interviews, observations, and collection of documents were conducted to investigate her impressions and practices concerning her students’ existing science conceptions before formal instruction.

Graduate Teaching Assistants Learn like Pre-Service Teachers--a novel idea

Seema Rivera (Clarkson Univeristy Cap Region Campus) Catherine Snyder (Clarkson University) John DeJoy (Clarkson University)

Many undergraduate students will experience being taught by Graduate Teaching Assistants (GTAs). This study investigates if science and math GTAs’ participation in a pedagogy program, modeled after a Masters in Arts Secondary Teaching (MAT) program, can help to increase teaching self-efficacy and help to cultivate pedagogical skills.

Does the Reform in the Science Programme of the Colleges of Education Reflect in Junior Secondary School Classrooms? (MOVED from Thrusdday a.m. due to travel issues)

Cecilia Boakye (University of Cape Coast) Joseph Gharthey Ampiah (University of Cape Coast)

This study explored the influence of the science curriculum of the colleges of education in Ghana on the instructional practices of selected newly qualified science teachers at the Junior Secondary School level (JHS; age 12-15 years). We explored whether the 2007 reform in the training of science teachers in the colleges of education reflected in the instruction of 5 newly qualified teachers (NQTs) at the JHS level as it was intended.
Preservice Science Teachers’ Examination of the Complexities of Teaching through Case Writing (Canceled)
Aris Reynold Cajigal (Mariano Marcos State University – College of Teacher Education) Aleli Martin (Mariano Marcos State University – College of Teacher Education) Elma Santos (Mariano Marcos State University – College of Teacher Education) Filomena Barbara Gallardo (Mariano Marcos State University – College of Teacher Education)

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<tr>
<td>Equity Committee Meeting</td>
<td>9:15 a.m.-10:15 a.m.</td>
<td>Sioux City</td>
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<td>Workshop</td>
<td>9:15 a.m-11:15 a.m</td>
<td>Salon H</td>
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Preparing Secondary Science Teacher Candidates for the edTPA: Digging Deeper into Assessing Student Learning

In this workshop, participants will explore the requirements for teacher candidates’ successful completion of Task 3: Assessing Student Learning for the edTPA, a performance-based assessment required for teacher certification in NY and many other states. Participants will then evaluate a sample Assessment Commentary using the edTPA Task 3 Rubrics.

Traditional Paper Set 9:15 a.m-10:15 a.m Salon A

Preservice Science Teacher Preparation

Pre-Service Teachers’ Models of the Process of Teaching and Learning
Patricia Friedrichsen (University of Missouri) Laura Zangori (University of Missouri) Eric Wulff (University of Missouri) A. Womack (University of Missouri)

We will be sharing a modeling activity for use in elementary and secondary methods courses in which pre-service teachers draw initial and final models of the process of teaching and learning science. Findings from our exploratory study indicate pre-service teachers used the models as sense-making tools to reflect on their progress in the course.

Exploring Elementary Preservice Teachers Conceptions of the Nature and Purpose of Models and Modeling
Laura Zangori (University of Missouri) Deborah Hanuscin (University of Missouri)

We developed a Perspectives on Modeling questionnaire to examine conceptions elementary preservice teachers’ (PSTs) hold about the nature and purpose of scientific models and modeling. Our findings suggest that PST’s ideas about this NGSS scientific practice are tightly connected to their ideas about the practices of scientists.
Experiences and Reflections of Elementary Pre-Service Teachers in a Science, Technology, Society (STS) Focused Methods Course

Aidin Amirshokoohi (DeSales University)

Implementation of Science, Technology, and Society (STS) instruction requires that science teachers’ beliefs be compatible with the goals of the STS curriculum and they possess a positive attitude toward STS issues and instruction. This case study will focus on five elementary pre-service teachers who experienced an STS-based methods course.

Changing Secondary Students’ Views of NOS with SSI

Dawnne LePretre (Illinois Institute of Technology) Norman Lederman (Illinois Institute of Technology) Judith Lederman (Illinois Institute of Technology)

The focus of this research was to study any changes in secondary students’ understandings of nature of science when instruction used a socio-scientific instructional context. Nature of science was addressed in an explicit, reflective manner and significant improvement in students’ understanding were noted with respect to tentativeness, creativity, empirically based, and observation/inference.

Secondary Science Teacher Scholars’ Nature of Science Views and Instruction in the Philippines: Curriculum constraints

Bridget Mulvey (Kent State University) Mila Rosa Librea (Kent State University)

We explored NOS views and instruction of secondary science teacher scholars from the Philippines, with U.S. teaching experience and nature of science (NOS) training. The national curriculum acted as a filter, with curriculum-aligned ideas being accepted more readily. Those with more training taught NOS beyond curriculum-aligned ideas.

The Teacher’s Perspective on the Value of Science Inquiry and Science Fair in the Secondary Classroom

Christina McDaniel (Mississippi State University)

This qualitative study explores the concept of science inquiry through the frame of successful teachers who implement teaching strategies that highlight science inquiry, such as science and engineering fair projects. Using the modern expectancy-value model, teachers who mentored International Science and Engineering Fair finalists, were interviewed and five distinct themes emerged.
Using Reflective Practice to Facilitate Conversations and Transform Instructional Practice for Middle School Science Teachers

Robbie Higdon (James Madison University)

This multiple case study sought to examine the use of reflective dialogue and its impact on stimulating cognitive dissonance to advance conceptual understanding about the use of inquiry-based methods. Study participants revealed held conceptions about their instructional practice that were influencing their decision-making process for the use of effective inquiry-based practices.

A Shift Towards Project-based Learning with ELLs during a Year-Long Professional Development Program

Rory Glass (State UNiversity of New York at Albany) Alan Oliveira (State University of New York at Albany)

The growing population of English Language Learners (ELLs) in the U.S. and the difficulties that they have had in school historically are of great concern to many educators. Our research suggests that professional development, utilizing a collaborative process of structured reflection can influence the classroom practices of science teachers.

Going Global: Infusing Global Collaboration in the STEM Classroom

Kate York (Texas Tech University) Laura Schisler (Texas Tech University)

This case study looked at the outcomes of providing preservice STEM teachers collaborative experiences with preservice/in-service STEM teachers enrolled in university programs in Belarus and South Korea. Participants detailed their personal benefits and challenges, along with the value and likelihood of incorporating global collaboration with students in their future STEM classrooms.

Changes in Elementary Teachers’ Planning for Engineering with Professional Development Support

Mitch Klocke (Drake University) Renald Daemicke (Drake University) Megan Wagner (Drake University) Jerrid Kruse (Drake University) Jesse Wilcox (Drake University)

With adoption of the NGSS, elementary teachers are faced with new challenges to include engineering. Our study demonstrates how teachers’ initial attempts result in activity-mania. Yet, after support in making connections between effective science and engineering teaching, teachers made strong progress toward effective engineering lesson design.
Focused on becoming a secondary science teacher

Stephanie Philipp (University of Louisville)

Prospective middle and secondary science teachers explored the teaching profession through readings, discussions, and fieldwork in public schools for 15 weeks. A case study analysis of how the prospective teachers’ perceptions about science teaching changed is presented. Implications for science teacher preparation will be discussed.

An Examination of the History of Science (HOS) Typology in Practice in Secondary Preservice Methods Instruction

William McComas (University of Arkansas) Noushin Nouri (University of Arkansas)

History of Science in science instruction helps students understand how science works. This study applies the HOS teaching typology to consider rationales, practices, syllabi and opinions of 24 individuals who teach a HOS/NOS class for preservice secondary science teachers to validate the HOS typology in actual methods class settings.

Traditional Paper Set

<table>
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<tr>
<th>Mixed</th>
<th>9:15 a.m.-10:15 a.m.</th>
<th>Salon B</th>
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<tbody>
<tr>
<td>Preservice Science Teachers’ Beliefs and Attitudes on Classroom Management</td>
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<td>Celestin Ntemngwa (University of Houston Downtown)</td>
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<td>The purpose of this study was to find out the attitudes and beliefs of preservice elementary and middle (grades 6-12) school science teachers (PREMTs) toward classroom management. Data was collected using the Attitudes and Beliefs on Classroom Control (ABCC) Inventory and analyzed using descriptive statistics. The results will be presented.</td>
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Recognizing student understanding from assessment work: A case of four secondary chemistry pre-service teachers.

James Nyachwaya (North Dakota State University)

This study explored four secondary pre-service chemistry students’ understanding of the particulate nature of matter, PNM, the extent to which the pre-service chemistry students were able to analyze and evaluate student drawings from chemistry education research literature, which were based on PNM, and how they would go about addressing any student misunderstandings, errors or misconceptions they saw.

Teachers and Technology - Present Practice and Future Directions

Tasha Richardson (OISE/University of Toronto) Isha DeCoito (Western University)
This presentation looks specifically at the factors that influence, challenge, and constrain, current middle school teachers’ decisions to use technology in their classrooms through the lens of the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2005).

**Traditional Paper Set**  
9:15 a.m.-10:15 a.m.  
**Salon C**

**Preservice Science Teacher Preparation**  
**Presider: Su Gao**

**Model Nature of Science Lesson (NOS) Planning in Preservice Science Education Methods Settings: Challenges, Practices and Potential**

Stephen Burgin (University of Arkansas) William McComas (University of Arkansas)

In this presentation, we will share a NOS lesson planning assignment that we implemented with preservice secondary science teachers. The challenges and potential of this assignment will be discussed in hopes of providing practical advice to encourage preservice science teacher educators to engage their students in planning for lesson which target integrated and complex aspects of NOS.

**Inquiry Or Lecture: Does Course Pedagogy Influence The Science Teaching Self-Efficacy Of Preservice Elementary Education Majors?** *(Canceled)*

Kyle Gray (University of Northern Iowa)

**Influences on Development of Inquiry-based Practices in Pre-service Teachers**

Nikeetha Dsouza (Clemson University) Heidi Cian (Clemson University) Renee Lyons (Clemson University) Michelle Cook (Clemson University)

This study captures the process of development of inquiry-based practices in pre-service teachers (PSTs) during their fieldwork in a single-semester methods course. Utilizing a case-study approach framed within situated cognitive learning theory, we identify elements that influence the development of the PSTs’ inquiry-based practices.

**Traditional Paper Set**  
9:15 a.m.-10:15 a.m.  
**Salon G**

**College and University Science Education**  
**Presider: Emily Dare**

**The development of a conceptual diagnostic survey to gauge students' knowledge in the geosciences**

Sarah Guffey (University of Wyoming) Stephanie Slater (Center for Astronomy & Physics Education Research (CAPER)) Timothy Slater (University of Wyoming) Andrea Burrows (University of Wyoming) Sharon Schleigh (East Carolina University)

The Exam of Geology Standards EGGS is a new pre- and post-test multiple-choice instrument designed to measure college students’ understanding of geology. Currently undergoing validation, EGGS’s purposefully targets the geology concepts specified by: AAAS 2061 Benchmarks, NRC NSES, Earth Science Literacy Principles, and NGSS.
The Impact of Teacher Licensure Pathway on Student Achievement

Gabriel Posadas (Mississippi State University) Katie Huston (Mississippi State University) Aressa Coley (Mississippi State University) Ryan Walker (Mississippi State University) Renee Clary (Mississippi State University)

This presentation will examine how teacher licensure pathways have an effect on student achievement in biology and algebra. Results from the study have implications for future research on pedagogical and content knowledge as related to student achievement.

A case study approach to understanding ecology misconceptions through the use of collaborative group work

Angelique Troelstrup (Middle Tennessee State University) Grant Gardner (Middle Tennessee State University) Jennifer Parrish (Middle Tennessee State University) Katherine Mangione (Middle Tennessee State University)

This study sought to investigate the impact of collaborative group work via concept mapping activities on biology majors’ conceptual knowledge in ecology. Three case studies revealed that different group characteristics influenced student understanding. Results indicated collaborative group work may be beneficial in developing in-depth ecological knowledge.

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<td>NTLI Committee Meeting</td>
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<td>Cedar Rapids</td>
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<tr>
<td>Traditional Paper Set</td>
<td>10:30 a.m.-11:30 a.m.</td>
<td>Davenport</td>
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Science Teacher Professional Development  
Presider: Melanie Weitz

Pedagogical Content Knowledge for Science Professional Development Leaders

Paul Numedahl (BSCS) Connie Hvidsten (BSCS) Jody Bintz (BSCS) Kathy Roth (California State Polytechnic University, Pomona)

Much has been studied about the pedagogical content knowledge (PCK) of classroom teachers, but little is known about PCK for those who provide professional development for teachers. In this study, we examine the kinds of knowledge and abilities held by PD Leaders in a program that is showing positive effects on both teacher and student learning.

Effects of an Intensive Multi-Year Professional Development Model to Enhance Elementary Science Teaching on Student Academic Achievement in Science and Reading Comprehension in Grades 1-2

Nancy Romance (Florida Atlantic University) Michael Vitale (East Carolina University) Cathy Miller (Florida Atlantic University)

Ontological engagements: How might we (un)know the beginning science teacher?

Maria Wallace (Louisiana State University)
The dominant ontological foundations driving research on science teacher induction have produced the beginning science teacher to exist as knowable entity. Yet, beginning science teachers are continually expected to become anew. The purpose of this ongoing ethnographic study is consider ways of (un)knowing the beginning science teacher.

**Small Group Roundtable**  
10:30 a.m.-11:30 a.m.  
DM Exhibit Hall

**Equity and Diversity**

**Making sense of Multicultural Education and Culturally Relevant Pedagogy**

Line Saint-Hilaire (Queens College/CUNY)

The author presents her concerns and questions about ambiguities emerging from her literature review of multicultural education and culturally relevant pedagogy studies. She hopes to extend the conversation about what scholars mean when they use the terms multicultural, multiethnic and culturally relevant. Specifically, she worries about a mismatch between the terms used and the research reported.

**Themed Paper Set**  
10:30 a.m.-11:30 a.m.  
Salon A

**Preservice Science Teacher Preparation**

**Preservice Science Teachers’ Concerns and Approaches for Teaching Socio-Scientific Issues Summary of Previous Literature**

Lisa Borgerding (Kent State University) Murat Dagistan (Kent State University)

This qualitative study explores preservice secondary science teachers’ ideas, concerns, and approaches for teaching socioscientific issues (SSI) as they move through a semester-long science methods class that specifically addresses teaching about controversial and socioscientific issues.

**Traditional Paper Set**  
10:30 a.m.-11:30 a.m.  
Salon B

**Science Teacher Professional Development**  
Presider: Elizabeth Ring

**Professional development: What attracts biology teachers and what they valued**

Molly Weinburgh (Texas Christian University) Cecilia Silva (Texas Christian University) Kathy Smith (Tarleton State University)

We examined biology teachers’ reasons for attending and perceived value of long-term PD. Data from reflections, focus groups, and feedback forms resulted in three themes for selecting the PD and four themes for the value provided to the teachers. Discussion and suggestions for professional development for science teachers are given.

**Who Helps Science Teachers? District-Based Science Support and NGSS**
Jennifer Mayo (Einstein Fellowship)

Science teachers face radical instructional shifts in response to NGSS. Individuals in district-based roles are in the position to provide teachers support as they navigate these changes. This study defined distinct science teacher and district science administrator roles and explored ways NGSS was incorporated into their professional practice.

‘Seeing the Big Picture’: Professional Learning and the Occasional Teacher

Wayne Melville (Lakehead University) Matt Roy (Lakehead University) Ian Hardy (University of Queensland) (Canceled)

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<th>Traditional Paper Set</th>
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<th>Salon C</th>
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<tr>
<td>Preservice Science Teacher Preparation</td>
<td>Presider: Lindsay Wheeler</td>
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Learning to Teach Science through Problem-Based Learning: Prospective Elementary Teachers’ Experiences

Shannon Dubois (Valparaiso University)

Little is known about how prospective teachers develop their understanding about problem-based learning (PBL). To contribute to the knowledge in this area, this research examined prospective elementary teachers’ experiences with PBL in a science methods class. Implications for science teacher educators pertain to using PBL as an instructional approach.

A Community-Based Service-Learning Project in Energy for Preservice Elementary Teachers – Benefits and Challenges

Carole Lee (University of Maine at Farmington) Patricia Williams (University of Maine at Farmington)

This study describes a community-based service-learning project utilized in a science methods class. An authentic science teaching experience was provided to preservice elementary teachers regarding energy and its application to real life situations. The project had positive impacts on the preservice elementary teachers’ learning and teaching of science to elementary students.

Associating Career Choice with Science: An Interest Driven Learning Project for Preservice Elementary Teachers

Nathan Dolenc (University of Louisiana at Lafayette) Aimee Barber (University of Louisiana at Lafayette) William Kazanis (University of Texas San Antonio)

It may not always seem obvious that we use scientific processes in our daily lives, especially to those in non-science, technology, engineering, and mathematical (STEM) careers. This paper discusses an interest driven learning project for preservice elementary teachers that involved the development of science lessons from career choice information gathered from a class of second graders.
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<tr>
<td><strong>Experiential Session</strong></td>
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<td>Salon G</td>
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<tr>
<td><strong>College and University Science Education</strong></td>
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<tr>
<td><strong>The Art of Designing Science “KNOW”tations: The Artful Making and Representation of Ideas</strong></td>
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<td>Merrie Koester (University of South Carolina Center for Science Education)</td>
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<td>Guiding student performances toward specific learning destinations and integrating opportunities for formative assessment are complex tasks fraught with difficulty. Many students know much more than they can tell you or write down. We will explore how the ‘Know’ employs principles of graphic design to make emerging science ‘knowing’ visible during each stage of inquiry.</td>
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<td><strong>Business/Awards Luncheon</strong></td>
<td>11:45 a.m.-1:30 p.m.</td>
<td>Salon D, E, F &amp; G</td>
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<td>Annual business meeting, ASTE Award presentations, Presidential Address, passing of the gavel, and 2018 ASTE Baltimore Conference preview.</td>
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<td><strong>ASTE Executive Committee</strong></td>
<td>2:00 p.m.-3:45 p.m.</td>
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<td><strong>ASTE Board of Directors</strong></td>
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### Outstanding Science Educator of the Year (Award I)

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<th>Name</th>
<th>Institution</th>
<th>Other Notes</th>
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<td>Gerald Krockover</td>
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<td>Vincent Lunetta</td>
<td>Univ. of Iowa</td>
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<td>Anton Lawson</td>
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<td>Charles R. Coble</td>
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<td>John Penick</td>
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<td>Lawrence F. Lowery</td>
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<td>William C. Kyle, Jr.</td>
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<td>Barry Fraser</td>
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<td>William F. McComas</td>
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<td>Ronald Bonnstetter</td>
<td>Univ. of Nebraska (10+ yrs.)</td>
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<td>Michael Clough</td>
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<td>Penny J. Gilmer</td>
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<td>James A. Shymansky</td>
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<td>Deborah Tippins</td>
<td>Univ. of Georgia (10+ yrs.)</td>
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<td>Julie A. Luft</td>
<td>Arizona State Univ. (10+ yrs.)</td>
<td>Randy L. Bell, Univ. of Virginia (&lt;10 yrs.)</td>
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<td>Julie Gess-Newsome</td>
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<td>Rebecca Schneider</td>
<td>University of Toledo (10+ yrs)</td>
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<td>Lynn Bryan</td>
<td>Purdue University (10+ yrs); Carla Johnson, University of Cincinnati (&lt;10 yrs)</td>
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<td>Alec Bodzin</td>
<td>Lehigh University (10+ yrs)</td>
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<td>Gail Jones</td>
<td>North Carolina State Univ. (10+ yrs); Deborah Hanuscin, Univ. of Missouri (&lt;10 yrs)</td>
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<td>Rose Pringle</td>
<td>University of Florida (10+ yrs); Erin Peters-Burton, George Mason University (&lt;10 years)</td>
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<td>2017</td>
<td>Felicia Moore Mensah</td>
<td>Columbia University, (10+ yrs); G. Nathan Carnes, 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
2017  Kent Crippen, University of Florida

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)**

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<td>1990</td>
<td>A Reflective Approach to Science Methods Courses for Preservice Elementary Teachers</td>
<td>Dorothy Rosenthal (California State Univ.- Long Beach)</td>
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<td>1991</td>
<td>Enhancing Science and Mathematics Teaching</td>
<td>Kenneth Tobin, Nancy Davis, Kenneth Shaw, and Elizabeth Jakubowski (Florida State Univ.)</td>
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<td>1992</td>
<td>The Learning Cycle as a Model for the Design of Science Teacher Preservice and Inservice Education</td>
<td>Peter Rubba (Pennsylvania State Univ.)</td>
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<td>1993</td>
<td>Reconstructing Science Teacher Education Within Communities of Learners</td>
<td>Deborah Tippins (Univ. of Georgia), Sharon Nichols and Kenneth Tobin (Florida State Univ.)</td>
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<td>1995</td>
<td>Science for Early Adolescence Teachers (Science FEAT): A Program for Research and Learning</td>
<td>Samuel Spiegel, Angelo Collins, and Penny J. Gilmer (Florida State Univ.)</td>
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<td>1996</td>
<td>An Innovative Model for Collaboration Reform in Elementary School Science Teaching</td>
<td>M. Gail Shroyer, Emmett Wright, and Linda Ramey-Gassert (Kansas State Univ.)</td>
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<td>1997</td>
<td>Reconceptualizing the Elementary Science Methods Course Using Reflective Orientation</td>
<td>Sandra Abell and Lynn Bryan (Purdue Univ.)</td>
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<td>1998</td>
<td>What Science Education Standards Say: Implications for Teacher Education</td>
<td>Penny Hammrich (Temple Univ.)</td>
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<td>Professional Development Programs for Elementary Science Teachers: An Analysis of Teacher Self-Efficacy Beliefs and the Professional Development Model</td>
<td>Tracy J. Posnanski (Univ. of Wisconsin-Milwaukee)</td>
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<td>2001</td>
<td>Empowering Teachers as Researchers and Inquirers</td>
<td>Anne M. (Amy) Cox-Petersen (California State Univ.- Fullerton)</td>
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<td>2002</td>
<td>Being There and Not Being “There:” The Experience of Teaching an Elementary Science Education Course on the Internet</td>
<td>Janice Koch and Michael Barriere (Hofstra Univ.)</td>
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<td>2003</td>
<td>Using a Card-Sorting Task to Elicit and Clarify Science Teaching Orientations</td>
<td>Patricia Friedrichsen (Univ. of Missouri- Columbia) and Thomas Dana (Pennsylvania Univ.)</td>
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<td>An Inquiry-Based Laboratory Lesson to Construct an Understanding of Earth’s Seasons</td>
<td>Paul Ashcraft and Susan Courson (Clarion Univ.)</td>
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<td>2007</td>
<td>Using Historical Non-Fiction and Literature Circles to Develop Elementary Teachers’ Nature of Science Understanding</td>
<td>Sharon E. Nichols (Univ. of Alabama) and William Straits (California State Univ.- Long Beach)</td>
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<td>2008</td>
<td>More Than a Conversation: Using Cogenerative Dialogues in the Professional Development of High School Chemistry Teachers</td>
<td>Sonya N. Martin (Drexel Univ.) Kathryn Scantlebury (Univ. of Delaware).</td>
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<td>2009</td>
<td>Flexibly adaptive professional development in support of teaching science with geospatial technology.</td>
<td>Nancy M. Trautman (Cornell Laboratory of Ornithology) &amp; James G. Makinster (Hobart and William Smith Colleges)</td>
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<td>2010</td>
<td>Learning to Teach Science Through Collaboration: Coteaching and Cogenerative Dialogue in Elementary Science Methods Courses</td>
<td>Christina Siry (Univ. of Luxembourg), Nicole Lowell, and Elizabeth Zawatski (Manhattanville College)</td>
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2011 What about those left behind? A template for developing quality science lessons for English language learners. Susan Gomez-Zwiep & Bill Straits. (California State University of Long Beach)
2012 Descriptive Inquiry in The Throes of Learning to Teach: Can Prospective Teachers Learn to Teach and Study their Teaching Closely?– Michele Koomen and Jamie Mitchell (Gustavus Aldophus College)
2013 No Award Given
2014 Connecting to our community: Utilizing photovoice as a pedagogical tool to connect college students to science. Kristin Cook, Bellarmine University and Cassie Quigley, Clemson University
2015 If You Can’t Say Something Nice: A Design-Based Research Approach Investigating the Social Interactions of New Science and Math Teachers Using a Video Annotation Tool. Joshua Ellis, Tasneem Anwar, Justin McFadden, & Gillian Roehrig from the University of Minnesota STEM Education Center
2016 The Use of Journal Clubs in Science Teacher Education. Dr. Karen A. Tallman, Springfield College and Dr. Allan Feldman, University of South Florida
2017 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

Implications of Research for Educational Practice (Award V)

1981 Wait-time and Learning in Science- Kevin Tobin (Western Australia Institute of Technology) and William Capie (Univ. of Georgia)
1982 No Award Given
1983 The Disadvantaged Majority: Science Education for Women- Jane Butler Kahle (Purdue Univ.)
1984 Training Science Teachers to Use Better Teaching Strategies- Russell H. Yeany and Michael J. Padilla (Univ. of Georgia)
1985 Using Research to Improve Science Teaching Practice- Kenneth Tobin (Western Australian Institute of Technology)
1986 Active Technology for Higher Cognitive Level Learning in Science- Kenneth Tobin, William Capie, and Antonio Bettencourt (Univ. of Georgia)
1987 Training Teachers to Teach Effectively in the Laboratory- Pinchas Tamir (Hebrew Univ.)
1988 What Can Be Learned From Investigations of Exemplary Teaching Practice- Kenneth Tobin (Florida State Univ.)
1989 Visual/Spatial Thinking: An Essential Element of Elementary Science- Alan J. McCormack (San Diego State Univ.)
1990 Helping Students Learn How to Learn: A View from a Teacher-Researcher- Joe Novak (Cornell Univ.)
1992 Teacher Development in Microcomputer Usage in K-12 Science- James D. Ellis (BSCS)
1993 Understanding and Assessing Hands-On Science- Lawrence Flick (Washington State Univ.)
1994 Teaching Evolution: Designing Successful Instruction- Lawrence Scharmann (Kansas State Univ.)
1995 Using Visits to Interactive Science and Technology Centers, Museums, Aquaria and Zoos to Promote Learning in Science. Leonie Rennie and Terrence McClafferty (Curtain Univ. of Technology)
1996 General Biology: Creating a Positive Learning Environment for Elementary Education Majors- Larry Scharmann and Ann Stanheim-Smith (Kansas State Univ.)
1997 Empowering Science Teachers: A Model for Professional Development- Ann Howe (Univ. of North Carolina- Raleigh) and Harriet Stubbs (North Carolina State Univ.)
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<td>A Dynamical Systems Based Model of Conceptual Change</td>
<td>Andrew Hurford (Haskell Indian Nations Univ.)</td>
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<td>Teachers and Technology: A Case Study From an Implementation Project</td>
<td>Myra Halpin (North Carolina School of Science and Mathematics) and Ann Howe (North Carolina State Univ.)</td>
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<td>Visual/Spatial Thinking: A Forgotten Fundamental for School Science Programs</td>
<td>Alan J. McCormack and Cheryl L. Mason (San Diego State Univ.)</td>
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<td>2002</td>
<td>What Knowledge is of Most Worth for Lateral Entry Secondary Science Teachers?</td>
<td>William R. Veal (Univ. of North Carolina- Chapel Hill)</td>
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<td>Teacher Student Co-Construction in Middle School Life Science</td>
<td>Maria Nunez-Oviedo (Univ. of Massachusetts- Amherst), Mary Ann Rea-Ramirez (Hampshire College), John Clement and Mary Jane Else (Univ. of Massachusetts- Amherst)</td>
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<td>Culturalized Science Instruction: Exploring Its Influence upon Black and White Students’ Achievement</td>
<td>Eileen Parsons (North Carolina State Univ.)</td>
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<td>Narrative of Community: Visualizing Culturally Relevant Science Pedagogy Through the Identities of Black Middle School Teachers</td>
<td>M. Jenice Goldston and Sharon E. Nichols (Univ. of Alabama)</td>
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<td>A Case Study of Fifth Grade Teachers’ Changes in Methodology During a Two-Year Timeframe</td>
<td>Anita Martin and Brian Hand (Univ. of)</td>
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<td>2009</td>
<td>Pathways to success in science: A phenomenological study examining the life experiences of African-American women in higher education</td>
<td>Claudette L. Giscombe</td>
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<td>Exploring Multiple Outcomes: Using cogenerative dialogues and coteaching in a middle school science classroom</td>
<td>Nicole K. Grimes, The Graduate Center, The City University of New York</td>
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<td>Synergistic Teaching of Science to English Language Learners: Comparative Analysis of the Strategies</td>
<td>Daniel J. Bergman, Wichita State University</td>
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<td>2012</td>
<td>A mixed methods study of mid-career science teachers: The growth of professional empowerment</td>
<td>Amy Moreland and Mary Hobbs (University of Texas at Austin).</td>
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<td>2013</td>
<td>Teachers’ NOS Practices Two to Five Years after Having Completed an Intensive Science Education Program</td>
<td>Benjamin Herman, University of South Florida, Michael Clough, and Joanne Olson, both of Iowa State University</td>
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<td>2014</td>
<td>Educational turbulence: The influence of macro and micro policy on science education reform.</td>
<td>Carla Johnson, Purdue University</td>
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<td>2015</td>
<td>Using our Heads and HARTSS (Humanities, ARTs, and Social Sciences): Developing Perspective-Taking Skills for Socioscientific Reasoning.</td>
<td>Sami Kahn &amp; Dana Zeidler, University of South Florida</td>
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<td>Prevalence and predictors of out-of-field in the first five years.</td>
<td>Ryan Nixon, Brigham Young University</td>
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