2023 ASTE International Conference

Salt Lake City, UT
January 11-14, 2023

Science Education Elevated!
At a Glance

**January 11**

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<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>8:00am—6:00pm</td>
<td>Field Trip</td>
<td>In-Person</td>
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<tr>
<td>9:00am—3:00pm</td>
<td>Full Board of Directors Meeting #1</td>
<td>In-Person</td>
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<td>Executive Committee Meeting</td>
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<td>Registration</td>
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**January 12**

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<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>7:00am—8:30am</td>
<td>Fun Run/Walk</td>
<td>In-Person</td>
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<tr>
<td>7:00am—8:30am</td>
<td>Continental Breakfast</td>
<td>In-Person</td>
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<td>8:00am—8:15am</td>
<td>Presidential Welcome</td>
<td>In-Person</td>
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<tr>
<td>8:30am—9:15am</td>
<td>Poster Session 1</td>
<td>In-Person</td>
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<td>9:00am—3:00pm</td>
<td>Collaboration Space</td>
<td>In-Person</td>
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<tr>
<td>9:15am—9:30am</td>
<td>Coffee Break</td>
<td>In-Person</td>
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<tr>
<td>9:30am—10:15am</td>
<td>Poster Session 2</td>
<td>In-Person</td>
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<tr>
<td>10:30am—11:30am</td>
<td>Concurrent Session 1</td>
<td>In-Person</td>
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<tr>
<td>11:30am—12:30pm</td>
<td>Lunch on your own</td>
<td>In-Person</td>
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<tr>
<td>11:30am—12:30pm</td>
<td>Graduate Student Luncheon</td>
<td>In-Person</td>
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<tr>
<td>12:45pm—1:45pm</td>
<td>Concurrent Session 2</td>
<td>In-Person</td>
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<tr>
<td>2:00pm—2:45pm</td>
<td>Work in Progress Showcase 1</td>
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<tr>
<td>2:30pm—3:15pm</td>
<td>Mentor-Mentee Nexus</td>
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<tr>
<td>2:45pm—3:00pm</td>
<td>Coffee Break</td>
<td>In-Person</td>
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<tr>
<td>3:00pm—3:45pm</td>
<td>Work in Progress Showcase 2</td>
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<tr>
<td>4:00pm—5:00pm</td>
<td>Equity Committee Meeting 1</td>
<td>In-Person</td>
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<tr>
<td>5:00pm—6:00pm</td>
<td>Regional Meetings</td>
<td>In-Person &amp; Online</td>
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<tr>
<td>5:30pm—6:00pm</td>
<td>President’s Virtual Welcome</td>
<td>Online</td>
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<tr>
<td>6:00pm—8:00pm</td>
<td>Welcome Reception</td>
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**January 13**

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<th>Event</th>
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<tbody>
<tr>
<td>7:00am—8:30am</td>
<td>Breakfast</td>
<td>In-Person</td>
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<tr>
<td>7:15am—8:15am</td>
<td>Forum Meetings</td>
<td>In-Person &amp; Online</td>
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<tr>
<td>8:30am—9:30am</td>
<td>Concurrent Session 3</td>
<td>In-Person</td>
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<tr>
<td>8:30am—9:30am</td>
<td>Virtual Concurrent Session 1</td>
<td>Online</td>
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<tr>
<td>9:00am—3:00pm</td>
<td>Collaboration Space</td>
<td>In-Person</td>
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<tr>
<td>9:45am—10:45am</td>
<td>Concurrent Session 4</td>
<td>In-Person</td>
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<td>Time</td>
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<tr>
<td>9:45am—10:45am</td>
<td>Virtual Concurrent Session 2</td>
<td>Online</td>
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<tr>
<td>10:45am—11:00am</td>
<td>Coffee Break</td>
<td>In-Person</td>
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<tr>
<td>10:45am—11:00am</td>
<td>Virtual Network Time</td>
<td>Online</td>
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<td>11:00am—12:30pm</td>
<td>Keynote</td>
<td>In-Person &amp; Online</td>
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<td>12:30pm—2:00pm</td>
<td>Lunch on your own</td>
<td>In-Person</td>
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<td>1:00pm—2:00pm</td>
<td>Virtual Poster Session</td>
<td>Online</td>
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<tr>
<td>12:30pm—2:00pm</td>
<td>Graduate Student Workshop</td>
<td>In-Person</td>
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<td>Concurrent Session 5</td>
<td>In-Person</td>
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<tr>
<td>2:00pm—3:00pm</td>
<td>Virtual Concurrent Session 3</td>
<td>Online</td>
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<td>3:00pm—3:15pm</td>
<td>Coffee Break</td>
<td>In-Person</td>
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<tr>
<td>3:15pm—4:15pm</td>
<td>Concurrent Session 6</td>
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<td>3:15pm—4:15pm</td>
<td>Virtual Concurrent Session 4</td>
<td>In-Person</td>
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<tr>
<td>4:30pm—5:30pm</td>
<td>Committee Meetings</td>
<td>In-Person &amp; Online</td>
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<tr>
<td>6:00pm—8:00pm</td>
<td>WISE Dinner</td>
<td>In-Person</td>
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<td>6:00pm—8:00pm</td>
<td>JSTE Editor Reception (by Invitation Only)</td>
<td>In-Person</td>
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<tr>
<td>8:00pm—10:00pm</td>
<td>Graduate Student Social</td>
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**January 14**

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<tr>
<td>7:00am—8:30am</td>
<td>Breakfast</td>
<td>In-Person</td>
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<tr>
<td>7:15am—8:15am</td>
<td>Birds of a Feather</td>
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<tr>
<td>7:15am—8:15am</td>
<td>Equity Committee Meeting 2</td>
<td>In-Person</td>
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<tr>
<td>7:15am—8:15am</td>
<td>Oversight Committee Meeting</td>
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<td>8:30am—9:30am</td>
<td>Concurrent Session 7</td>
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<td>9:30am—10:15am</td>
<td>Coffee Break</td>
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<tr>
<td>9:30am—10:15am</td>
<td>Fireside Chats</td>
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<td>9:30am—11:30am</td>
<td>Collaboration Space</td>
<td>In-Person</td>
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<td>10:30am—11:30am</td>
<td>Concurrent Session 8</td>
<td>In-Person</td>
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<tr>
<td>12:00pm—1:30pm</td>
<td>Awards Lunch</td>
<td>In-Person &amp; Online</td>
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<tr>
<td>2:30pm—4:30pm</td>
<td>Executive Committee</td>
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<td>5:00pm—8:00pm</td>
<td>Board of Directors Meeting</td>
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<tr>
<td>8:00pm—8:30pm</td>
<td>Executive Committee</td>
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**January 15**

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<tr>
<td>8:00am—1:15pm</td>
<td>Field Trip</td>
<td>In-Person</td>
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Welcome to the 2023 ASTE International Conference

Austin, Charleston (WV), Des Moines, Hartford, Nashville, and Sacramento—Salt Lake City proudly joins her sister Capitol cities in hosting the 2023 ASTE Annual International Conference, and the Conference Committee warmly welcomes you to Utah!

Thank you for submitting so many superior proposals, which clearly indicate healthy growth and increasing prestige for ASTE. As our members and associates continue to produce innovative research, we are proud that our organization values and maintains the friendly, nurturing environment for which ASTE is renowned.

The theme for the 2023 conference is Science Education Elevated! Scientific knowledge and thinking are essential for democracy and the future STEM workforce (National Academies of Sciences, Engineering, and Medicine, 2021). Recent attacks on democracy, threats from nuclear weapons, climate change, racial and economic injustices, and a global pandemic create an urgent need to address these national and international challenges. Thus, science education must be elevated to a higher priority. The 2023 ASTE conference meets this challenge by elevating science education through cutting-edge research and innovative practices.

In keeping with the conference theme, our committee is delighted to offer several special events, workshops, and sessions that focus on biodiversity and sustainability. The following highlighted events provide a few enticing examples, and we are deeply grateful to our gracious sponsors whose generous support allows us to provide you with some amazing opportunities.

Our committee is delighted and honored to welcome our keynote speaker, Dr. Lawrence Krissek, an internationally renowned geologist and Professor Emeritus at The Ohio State University. His keynote address, A Geoscience Perspective on Antarctic Climate Change: Ice Shelves, The Underappreciated Brakes on the Antarctic Ice Sheets, is certain to be a thought-provoking highlight of the conference. Dr. Krissek, who has spent many years studying Utah’s extraordinary geology and directing geology field camps in the state, will lead a preconference field experience that focuses on The Geoscience Perspective on Climate Change in Utah: Evidence from Lakes and Glaciers. During the conference, he will offer a climate change workshop related to his research in Antarctica, Training Teachers to Think Like a Geologist: An Example Using Seafloor Sediments to Reconstruct Antarctic Climate History.

In addition to participating in the superior conference sessions, workshops, and special events, we invite you will take the opportunity to explore Utah’s many natural wonders and scenic beauty. Numerous hiking trails and ski slopes beckon from close proximity to Salt Lake.

We are excited to host this conference in Utah and hope your experiences challenge you to share, ponder, inspire, nurture, and reconnect with colleagues while welcoming newcomers. Enjoy the conference!
THE GOAL OF THIS PROJECT IS TO DEVELOP DIVERSE RANGELAND-BASED GRAZING SYSTEMS, WHICH ARE DESIGNED TO OPTIMIZE RUMINANT PRODUCTION, REDUCE ENVIRONMENTAL IMPACTS, ENHANCE BIODIVERSITY, AND IMPROVE COMMUNITY HEALTH AND WELL-BEING.

THE EDUCATION TEAM WORKS WITH TEACHER PARTNERS TO INTEGRATE GARDEN-BASED LEARNING AND SMART FOODSCAPES INTO STEAM TEACHING AND LEARNING, WHICH ALLOWS TEACHERS AND STUDENTS TO ENGAGE WITH RANGELAND FLORA AND FAUNA. GARDENS PROVIDE OPPORTUNITIES FOR TEACHERS TO SUPPORT STUDENTS’ DEVELOPMENT OF SCIENTIFIC WAYS OF THINKING AND ENCOURAGE ENVIRONMENTAL STEWARDSHIP AND SUSTAINABILITY.

THROUGH APPROACHES THAT REDUCE THE ENVIRONMENTAL FOOTPRINT OF BEEF PRODUCTION, WE AIM TO:

- WORK WITH EDUCATION PROFESSIONALS TO INTEGRATE THE PRINCIPLES UNDERLYING SMART FOODSCAPES AND SUSTAINABLE SYSTEMS INTO SCHOOL CURRICULA.
- PROVIDE K-12 STEAM CURRICULAR MODULES AND ENHANCE UNDERSTANDING OF RANCHING AS A VALUABLE AND ENVIRONMENTALLY RESPONSIBLE AGRICULTURAL ENTERPRISE.
- EDUCATE TEACHERS AND CHILDREN, WITH THEIR FAMILIES, ABOUT SUSTAINABLE SYSTEMS.

COLLABORATORS

UTAH STATE UNIVERSITY
UNIVERSITY OF FLORIDA
COLORADO STATE UNIVERSITY
LINCOLN UNIVERSITY, NEW ZEALAND
UNIVERSITY OF NORTH CAROLINA, PEMBROKE

CHECK US OUT!

USU.EDU/SMART-FOODSCAPES
USDA-NIFA-SAS #2021-69012-35952
GROW & LEARN WITH GENTLE, SOLITARY BEES

School & Community Garden Programs – and Discounts

Our programs help raise awareness of the importance of solitary bees in food production, ecosystem services, and the need to conserve solitary, wild bees. All our educational materials are FREE, and qualifying gardens receive 15% off all products!

Science-Based Bee Knowledgeable Library

Whether it’s guidance on raising solitary bees, resources to teach your community about these fantastic pollinators, or classroom activities to implement in a school or library program - that you’ll be able to find it here!

Our Goal Is Your Success

We work with beekeepers, researchers, and nonprofits to stay on top of current challenges facing native bees and create best practices for solving those challenges. Our BeeMail Newsletter, Blog, and Online Help Center keep you in the loop and help you raise solitary bees successfully.

Pre-Program & Program Sessions

Wednesday, January 11, 2023

Pre-Conference Field Trip: The Geoscience Perspective on Climate Change in Utah: Evidence From Lakes and Glacier

Larry Krissek, Tamara Peffer, Steve Kerlin.

8:00am - 6:00pm
Cost $35

Includes: transportation, field experience, museum admission, workshop, materials, and lunch
Does not include: snacks, water

Overview: Utah’s geology and geography provide tremendous scenic beauty, but also carry records of major climatic changes over timescales of thousands to millions of years. This field experience will visit several localities in the Salt Lake City area where evidence of these climatic changes can be observed, with an emphasis on the climate records produced by glaciers and large internally drained lakes (i.e., lakes without an outflowing river, such as the present Great Salt Lake). The focus of this field experience on the geological record of past climate links closely with the topic of the conference keynote address by Dr. Lawrence Krissek and with his workshop on “thinking like a geologist.” The water workshop at the museum, led by Tamara Peffer and Dr. Steve Kerlin, will explore and compare potential impacts and interactions between natural salts and human-applied treatment on stream life and other biota.

The field experience, sponsored by Utah State University Smart Foodscapes (https://www.usu.edu/smart-foodscapes/) (USDA-NIFA # 2021-69012-35952), is divided into a morning portion and an afternoon portion. One of the two major stops in the morning portion and the stop for the afternoon portion of the field experience are inside ADA-compliant buildings; the other morning stop is outdoors, and requires <100 m of walking on a flat paved sidewalk. Restrooms are available throughout the field experience and workshop. Dress warmly and bring water and or snacks. Lunch will be provided at the museum.

The morning portion of the field experience will have two major stops, with the potential for several additional brief stops if time and weather allow. The first stop will be at the Utah Geological Survey’s Utah Core Research Center (https://geology.utah.gov/map-pub/survey-notes/core-center-news/why-a-building-full-of-rocks-is-so-important-to-utah/) where we will examine rock cores drilled from the Eocene (~55-43 million years ago) Green River Formation in northeastern Utah (https://geology.utah.gov/map-pub/survey-notes/new-core-new-insights/). The Green River Formation was deposited in the ancient Lake Uinta, which has been interpreted as having many of the same characteristics as the modern Great Salt Lake. In both cases, the lakes had internal drainage, meaning that they lacked a major outflowing river; as a result, the volume and the chemistry of water in the lake was controlled by the relative amounts of precipitation and evaporation, making the lake and its sediments an excellent recorder of climatic conditions in the lake basin. We will learn how to recognize and interpret this story of past climates from the cores examined.

The second major morning stop will be at the G.K. Gilbert Geologic View Park (https://geology.utah.gov/map-pub/survey-notes/geosights/g-k-gilbert-geologic-view-park/) in Sandy, UT, at the mouth of Little Cottonwood Canyon. At this park a short walk on a flat paved sidewalk allows views of a variety of geologic features: 1) bedrock in the canyon that ranges from 1.7 billion to 31 million years old; 2) a classic U-shaped valley carved by glaciers within the last 100,000 years; 3) the highest elevation shoreline formed by Lake Bonneville, an expanded version of the Great Salt Lake, approximately 18,000 years ago; and 4) evidence of multiple movements on the Wasatch Fault during the last 10,000 years.
If time and weather allow, the morning portion of the field experience will conclude with stops at the Temple Granite Quarry Historical Monument in Little Cottonwood Canyon (including an optional 0.4 mile walk on a paved path) and at two other locations between Little Cottonwood and Big Cottonwood Canyons to see Lake Bonneville shorelines and sediments.

The afternoon portion of the field experience and the water workshop will consist of a visit to the Natural History Museum of Utah (https://nhmu.utah.edu/). Admission, lunch, and water workshop will be provided by sponsors, Pennsylvania Department of Education (https://www.education.pa.gov/Pages/default.aspx) and Stroud Water Research Center (https://stroudcenter.org/). During the water workshop, led by Tamara Peffer and Steve Kerlin, participants will analyze the chemical composition of the water samples. Using additional tools such as WikiWatershed, we will explore and compare potential impacts and interactions between natural salts and human-applied treatment on stream life and other biota. From this point, we work to frame our observations and potential inquiry and action using the Environmental Literacy Model.

After the workshop, we have two curated experiences in the museum led by Larry Krissek. Our group discussions will focus on the exhibits of the Great Salt Lake and its immediate predecessors (e.g., Lake Bonneville) and of the Green River Formation and participate in the water workshop. Exhibits of sediment cores taken from the Great Salt Lake illustrate climatically driven variations in lake extent and lake chemistry similar to those seen during the morning in the Green River Formation cores. In addition to its sedimentary record of past climates, the Green River Formation exhibit at the NHMU also shows excellent examples of exquisitely preserved fauna (e.g., fish, insects) and flora, which themselves carry information about past climates.

After our group visits to the Great Salt Lake and Green River Formation exhibits, participants will have time to explore the remainder of the NHMU on their own. Vans will leave for the conference hotel at approximately 5:30 p.m. However, the museum stays open until 9 p.m. on Wednesdays, so those wishing to stay longer can do so and make their own way back to the conference hotel.

Full Board of Directors Meeting
9:00am - 3:00pm in Orion

Executive Committee Meeting
4:30pm - 5:30pm in Orion

Registration
5:00pm - 9:00pm in Arches
**Thursday, January 12, 2023**

**Fun Run/Walk**
6:30am - 8:30am

Why not kick off the 2023 conference on the “right foot?” I can’t think of a better way to start the day than with a little exercise in a friendly atmosphere with terrific company! We will be holding the 5K fun walk/run on Thursday, January 12th at 6:30 am in the Lobby of the Sheraton Salt Lake City Hotel (conference hotel). The “race” is free! So all you need do is complete the waiver and email it to epters1@gmu.edu. If you can’t decide now, we will have waivers in the hotel lobby on the morning of January 12th. Recent Honors: Top Ski Resorts: Snowbird and Alta (Forbes) #1 US Hiking City: Salt Lake City (National Geographic) #1 Mountain Town: Park City (Travel + Leisure) #1 Board Gamers: Salt Lake City (BestPlaces) #2 Friendliest US City: Salt Lake City (Travel + Leisure) Utah hosts the Utah Jazz, Utah Grizzlies, REAL Salt Lake, 6 National Parks, and 7 National Monuments. And for patrons of the arts, Salt Lake offers nationally recognized professional companies: Ballet West, Salt Lake Symphony, Utah Opera Company, Pioneer Theater Company, and the Utah Festival Opera and Musical Theatre Company. We look forward to hosting you at higher elevations!

*Format: General*

**Breakfast**
7:00am - 8:30am in Capitol Reef

*Format: General*

**Registration**
8:00am - 2:00pm in Arches

*Format: General*

**Presidential Welcome & Land Recognition Ceremony**
8:00am - 8:15am in Capitol Reef

*Format: General*

**Poster Session #1**
8:30am - 9:15am in Canyons South Lobby

*Format: General*

**College and University Science Education**

**Educating About Extinction in the Anthropocene**

**Yael Wyner,** City College of NY - CUNY

**Rob DeSalle,** American Museum of Natural History

8:30am - 9:15am in Canyons South Lobby - Session Poster

We surveyed undergraduate biology students about the role of natural selection and genetic drift in three extinction cases. Many students mistakenly attributed the threatened status of the panda (59%, 31%), the extinction of a hypothetical plant (34%, 32%), and the dinosaur extinction (50%, 22%) to natural selection and genetic drift

*Format: Individual Poster Presentation*
**Beyond Standards: Investigating the Habits of Mind of Noyce Scholars**

Seema Rivera, Clarkson University  
Preethi Titu, Kennesaw State University; Isaac Kizaa, Clarkson University  
8:30am - 9:15am in Canyons South Lobby - Session Poster

Knowing that the values teachers hold toward teaching in general and issues of equity and diversity in particular, this study investigated Noyce scholar’s Habits of Mind (HoM) by using reflection as a way to critically think about their experiences which offered us insights into the values they hold on equity and diversity in teaching and learning.

Format: Individual Poster Presentation

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**Science Explanation Contest - ExplanaJam**

Brian Foley, California State University Northridge  
8:30am - 9:15am in Canyons South Lobby - Session Poster

An online contest challenges students to show their skills at explaining science phenomena. The ExplanaJam competition provides a way to engage students in demonstrating their explanation skills on a topic of their choice and provides motivation and examples to help students construct better explanations.

Format: Individual Poster Presentation

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**Integrating Science Pedagogy Into an Educational Equity and Inclusion Class for Elementary Science Teacher Candidates**

Frederick Freking, USC Rossier School of Education  
John Pascarella, USC Rossier School of Education; Shanta Smith, Rossier School of Education  
8:30am - 9:15am in Canyons South Lobby - Session Poster

Elementary pre-service teacher candidates have an exceptional amount of content that they must learn to meet the needs of their students. This poster presentation will share the process and course development of a collaboration between elementary science education faculty and education diversity, equity and inclusion faculty.

Format: Individual Poster Presentation

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**Using Online Simulations Within Secondary Science Method Courses to Support Preservice Teachers in Learning How to Facilitate Argumentation-Focused Discussions**

Jamie N. Mikeska, ETS  
Heather Howell, ETS; Pamela S. Lottero-Perdue, Towson University; Calli Shekell, ETS  
8:30am - 9:15am in Canyons South Lobby - Session Poster

In this study, we examined secondary science preservice teachers’ perceptions of the clarity and authenticity of three different types of online simulations used to help them learn how to facilitate argumentation-focused discussions. We also examined whether and why they would recommend using these simulations in future teacher education courses.

Format: Individual Poster Presentation
Pre-Service STEM Teacher Identity Development Gaps: Case Study in Indonesia

Anjar Putro Utomo, University of Minnesota
Gillian Roehrig, University of Minnesota

8:30am - 9:15am in Canyons South Lobby - Session Poster

Any gaps related to developed pre-service STEM teacher identity become crucial to be found for integrated STEM education development in Indonesia. Thus, a case study is employed, and the finding is that the risk-taker becomes the only difference among Indonesian pre-service science teachers in three majors (Science, Physics, and Biology).

Format: Individual Poster Presentation

Using Curriculum Writing as a Professional Learning Tool to Develop Teacher Agency and Pedagogical Content Knowledge for STEM Educators: Initial Development

Robert B Marsteller, Delaware State University
Tina Mitchell, Delaware State University

8:30am - 9:15am in Canyons South Lobby - Session Poster

Describes the initial stages of an effort to design a professional learning model for STEM educators to develop teacher agency and pedagogical content knowledge.

Format: Individual Poster Presentation

Culturally Responsive Science Teaching in International Schools

Jennifer Heisler, Kent State University

8:30am - 9:15am in Canyons South Lobby - Session Poster

This study investigated culturally responsive teaching (CRT) through the Culturally Responsive Instruction Observation Protocol (CRIOP) framework with international school teachers. Initial findings support the idea that culturally responsive science teaching happens through elements (i.e., relationships, Discourse) found in the CRIOP model.

Format: Individual Poster Presentation

Exploring Preservice Teacher Agency Through Community Driven Science

Megan Beckam, University of Nevada, Reno

8:30am - 9:15am in Canyons South Lobby - Session Poster

This study explored how secondary science preservice teachers experienced a community driven science project within the context of a university course specifically looking at how their experiences fostered agency with and in science. Results suggest engagement with community driven science can foster agency in multiple ways.

Format: Individual Poster Presentation
A Longitudinal Qualitative Analysis of Secondary Students’ Understanding of Climate Change

Tina Cartwright, Marshall University
Deb Hemler, Fairmont State University; Paula A Magee, Indiana University Indianapolis

8:30am - 9:15am in Canyons South Lobby - Session Poster

This study presents the changes in middle to high school students’ understanding of weather, climate and climate change over a 4 year period. Analysis of the interview data will be discussed. Content areas where students struggled will be highlighted and recommendations for areas to focus for instruction will be shared.

Format: Individual Poster Presentation

THE EFFECT of ONE-to-ONE CHROMEBOOKS on TEACHER-STUDENT DISCOURSE in MIDDLE SCHOOL SCIENCE CLASSROOMS

Jami L. Daniel, Drake University
Jerrid Kruse, Drake University

8:30am - 9:15am in Canyons South Lobby - Session Poster

With the expansion of 1:1 technology programs across the country, interactions between teachers and students are significantly altered. Using a quasi-experimental design, this study analyzes the patterns in teacher-student discourse in 2 middle school science classrooms when 1:1 devices are utilized compared to when devices are not utilized.

Format: Individual Poster Presentation

3D Into 5E for Space Sciences Lessons Using NASA Education Resources for Upper Elementary and Middle School Classrooms

Soon C Lee, Kennesaw State University

8:30am - 9:15am in Canyons South Lobby - Session Poster

This project provided upper level elementary and middle school teachers with a conceptual model (i.e., 3D into 5E), lesson templates, and sample lessons that illustrated how to incorporate the NASA’s educational materials and activities into “5E” inquiry-based instructional sequences that are well aligned with NGSS 3D learning.

Format: Individual Poster Presentation

A Critical Analysis of Representation in U.S. Life Science Textbooks

Gina M Zaccagnini, Purdue University
Austin R Jenkins, Purdue University

8:30am - 9:15am in Canyons South Lobby - Session Poster

This poster outlines a critical analysis of representation in U.S. life science textbooks. Results reveal a lack of diversity across race, gender, nature of work, and range of ability. Given the impact of representation on student interest and engagement, more inclusive curriculum must be used. Implications for scholars and teachers are provided.

Format: Individual Poster Presentation
What Makes a K-12 STEM Outreach Partnership Attractive to College Students and What Keeps Them Coming Back for More

Kerry O Cresawn, James Madison University

8:30am - 9:15am in Canyons South Lobby - Session Poster

Understanding factors that motivate college students to participate in K-12 STEM outreach is critical for recruitment and retention. In this study, we found that relationships and the focus on interest and excitement over teaching were key factors in motivating students to persist in a K-12 STEM partnership over three semesters despite challenges.

Format: Individual Poster Presentation

Confidence and Change in Elementary Pre-Service Teacher Science Content Knowledge

Demetrice Smith-Mutegi, Old Dominion University
Erika Wise, Marian University, Indianapolis

9:30am - 10:15am in Canyons South Lobby - Session Poster

As future generalists in the classroom, pre-service elementary teachers (PSETs) are trained to prepare to teach a wide range of courses, subjects, and topics. This study aimed to describe PSETs’ confidence in their science performance and assess the impact of an inquiry-based science methods course on their scientific content knowledge (SCK).

Format: Individual Poster Presentation

Engaging Preservice Elementary Teachers in the Science Practices Through an Online Physics Course

Rylie S Speirs, Brigham Young University
Adam Bennion, Brigham Young University

9:30am - 10:15am in Canyons South Lobby - Session Poster

This study addresses how online courses can engage preservice elementary teachers in science practices. We compare data from a physics class that took place in person in 2019, and online in 2020. Our preliminary findings suggest that scaffolding may enable preservice teachers to engage in science practices at a level similar to in-person courses.

Format: Individual Poster Presentation
Designing Research Experiences for Pre-Service Teachers

Lara Smetana, Loyola University Chicago
Betsy Leong.

9:30am - 10:15am in Canyons South Lobby - Session Poster

This poster describes the development of a pre-RET program and shares lessons learned and findings from the first cohort.

Format: Individual Poster Presentation

Review of Lesson Plan Creation and Implementation of Integrated STEM Concepts

Mike Borowczak, University of Wyoming
Andrea C Burrows, University of Central Florida; Melanie Kinskey, Sam Houston State University

9:30am - 10:15am in Canyons South Lobby - Session Poster

We answer, “what is STEM integration” and what parts of created lesson plans show integrated STEM and computer science. Findings show lesson plan submission metrics including organization, integration, and questions show as “struggling” [45%, 46%, 41%], and objectives, activities, assessment, and catch show as "excellent" [43%, 48%, 43%, 48%].

Format: Individual Poster Presentation

The Influence of Science Perceptions and Ideology on University Biology Students’ COVID-19 Actions and Vaccine Acceptance

Benjamin Herman, Texas A&M University
Michael Clough, Texas A&M University; Asha Rao, Texas A&M University; Sara Poor, Texas A&M University; Ben Janney, Texas A&M University; Aaron Kidd, Texas A&M University; Alex Sobotka, Texas A&M University; Alister Olson, Texas A&M University

9:30am - 10:15am in Canyons South Lobby - Session Poster

This session will address research and pedagogical recommendations based on how 967 university biology students’ perceptions about COVID-19 science (e.g., prevention knowledge and NOS) and sociocultural membership (e.g., political affiliation) associates with their COVID-19 vaccine acceptance and mitigating actions.

Format: Individual Poster Presentation

Elevating Discussions About Equity in STEM Education

Katie Laux, Upper Iowa University

9:30am - 10:15am in Canyons South Lobby - Session Poster

The purpose of this study was to explore how engaging in dialogic collaborative action research (D-CAR) supports a professional learning community (PLC) focused on discussing equity in STEM classrooms.

Format: Individual Poster Presentation
Pre-Service Teachers’ Perspectives of Teaching Science Equitably

Joi D. Merritt, James Madison University
Angela W. Webb, James Madison University

9:30am - 10:15am in Canyons South Lobby - Session Poster

This study explores changes to TCs’ beliefs about equitable science teaching from the beginning to the end of their modified elementary and secondary science methods courses. Shifts in TCs’ beliefs about equitable science instruction, as evidenced by changes in the Draw a Science Teacher Test scores (Thomas et al., 2001), are discussed.

Format: Individual Poster Presentation

Exploring the Use of a Haptically-Enabled Science Simulation About Force and Motion

James Minogue, NC State University
Emily Brunsen, NC State University; Robert Monahan, NC State University; Tabitha Peck, Davidson College; David Borland, RENCI

9:30am - 10:15am in Canyons South Lobby - Session Poster

This poster session will share findings from the testing of a haptically-enabled simulation designed to help preservice teachers re-learn core concepts regarding force and motion.

Format: Individual Poster Presentation

Narrative Analysis of a Teacher Leader’s Experiences With Integrated Science Curricular Reform

Kevin Fleming, George Washington University
Jonathon Grooms, George Washington University; Alan R Berkowitz, Cary Institute of Ecosystem Studies

9:30am - 10:15am in Canyons South Lobby - Session Poster

A narrative analysis explored a teacher leader’s experiences implementing an integrated science curriculum as part of NGSS reform efforts. Findings reveal in their experiences a range from eager, yet skeptical to intrigued and motivated to push onward navigating factors with the duality of classroom and district-level responsibilities.

Format: Individual Poster Presentation

Teaching and Persisting in High-Needs Schools: Motivating Preservice Secondary STEM Teachers to “Make It Their Mission”

Kerry O Cresawn, James Madison University
Angela W Webb, James Madison University

9:30am - 10:15am in Canyons South Lobby - Session Poster

NSF-funded Noyce Scholarship Programs require scholars commit to teach two years per year of funding in a school located in a high-needs district. But how do we support scholars to teach in the actual high-needs school? This study explores perceptions, interest, and motivations to teach in high-needs schools of one university’s Noyce scholars.

Format: Individual Poster Presentation
Leveraging Virtual Exchange: Outcomes of a Science Lesson Teaching and Learning Experience Between Pre-Service Teachers and K-12 Students

M. Kate York, The University of Texas at Dallas
Katie Donaldson, The University of Texas at Dallas; Viviana Miglino, Colegio Bayard; Anabel Bronnimann, Colegio Bayard; Belén Albarracín, Colegio Bayard

9:30am - 10:15am in Canyons South Lobby - Session Poster

Virtual exchange (VE) experiences provide numerous benefits for K-12 students, in-service teachers, and pre-service teachers alike. This qualitative study explores the perceptions of and learning outcomes associated with pre-service science teachers in the U.S and 6th and 7th form (grade) students in Argentina engaged in a VE science lesson.

Format: Individual Poster Presentation

Shared Practices in Cultivating Learners to Become Scientifically Literate Citizens

Mandi Collins, University of Nevada, Reno

9:30am - 10:15am in Canyons South Lobby - Session Poster

The role of scientific literacy has been emphasized by current socioscientific issues. This study informs topics of professional learning that support cultivating learners’ scientific literacy based on study results exploring middle school ELA, science, and social studies teachers’ shared practices in cultivating learners’ scientific literacy.

Format: Individual Poster Presentation

Indiana Schools’ Implementation of Virtual Instruction During the Pandemic – a Preliminary Analysis

Lu Wang, Indiana University Kokomo
Carter Adkins, Indiana University Kokomo

9:30am - 10:15am in Canyons South Lobby - Session Poster

The pandemic has influenced almost every aspect of our lives, including education. Based on the analyses of two public datasets, this proposal presents findings of how public schools in Indiana implemented virtual instruction during the 2020-2021 school year. Results will inform the science teacher education with regard to technology literacy.

Format: Individual Paper Presentation

STEM Like a Girl: Perceptions of Middle School Girls When Participating in STEM Immersion Projects

Melisa Fowler, The University of Alabama
Elizabeth Wilson, The University of Alabama; Taylor Lamon, Woodland Forrest Elementary School

9:30am - 10:15am in Canyons South Lobby - Session Poster

The aim of this study was to examine how immersing girls in STEM through afterschool programs and a summer experience, such as Space Camp, was perceived by the participating middle school girls. We gathered information to inform future iterations of STEM immersion projects as we develop a cohesive and replicable model.

Format: Individual Poster Presentation
An Analysis of K-12 Climate Change Science Standards in the U.S.

Breanna Beaver, Kent State University
Jennifer Heisler, Kent State University; Shannon Navy, Kent State University

9:30am - 10:15am in Canyons South Lobby - Session Poster

Climate change education is vital for the future of our planet. However, the extent to which climate change is included in the U.S. science curriculum is unknown. This study analyzed the K-12 U.S. science standards to explore the extent to which science standards cover climate change.

Professional Learning Community-Professional Development Program for Postsecondary STEM Faculty Developing Inclusive Course-Based Undergraduate Research Experiences

Rommel J. Miranda, Towson University
Laura Gough, Towson University; Matthew Hemm, Towson University; Trudymae Agboka, Towson University; Kelly Elkins, Towson University; Jacqueline Doyle, Towson University

9:30am - 10:15am in Canyons South Lobby - Session Poster

This HHMI-funded Inclusive Excellence PLC-PD Program presentation focuses on: 1) providing professional development for postsecondary STEM faculty to promote effective inclusive teaching practices, and 2) reforming laboratory courses to incorporate authentic research experiences via course-based undergraduate research experiences.

Science Teachers’ Knowledge and Perceptions of Local School Communities: Outcomes From a Cross-National Survey

Xavier Fazio, Brock University

9:30am - 10:15am in Canyons South Lobby - Session Poster

This paper presentation reports on validation of a science teacher and local communities survey assessing teachers’ knowledge and perceptions of local school communities. Outcomes from a cross-national survey highlight its potential use in future research and show opportunities afforded by an approach to science curriculum and teacher development.

Exploring a Model for Rural Elementary Science Teacher Preparation

Stephen L Thompson, University of South Carolina

10:30am - 11:30am in Alta - Session A

Presenters will share design structures and outcomes related to a summer institute that served as a foundational elementary science teacher preparation program experience. The institute engaged teacher residents, coaching teachers, and supervisors in shared learning and teaching experiences with elementary students utilizing a virtual format.
Highlighting Global Science Education for Rural Elementary Science Preservice Teaching Using Children's Literature

James McDonald, Central Michigan University
Sumreen Asim, Indiana University Southeast

10:30am - 11:30am in Alta - Session B

Science educators confront practical and philosophical issues in attempting to integrate a global perspective into their practice. This pilot study describes two rural science teacher educators who integrated a global science education lens into elementary methods courses using picture-books.

Design-Based Research as Professional Development: Outcomes of Teacher Participation in the Development of the Science Practices Innovation Notebook (SPIN)

Erin E. Peters-Burton, George Mason University
Hong T.H. Tran, University of Georgia; Brittany H. Miller, George Mason University

10:30am - 11:30am in Brighton - Session A

The purpose of this paper is to present the results of a collaborative PD model, Design-Based Research, which involved teachers, educational psychologists, science educators, technology educators and software developers to design a web-based tool to support high school student engagement with data practices during science investigations.

An Analysis of Teacher Content and Pedagogical Content Knowledge in a Place-Based STEM Professional Learning Program

Regina E. Toolin, University of Vermont
Simon Jorgenson, University of Vermont; Stephanie Ratmeyer, University of Vermont

10:30am - 11:30am in Brighton - Session B

A convergent parallel mixed methods design was utilized to examine changes in K-12 teacher content and pedagogical content knowledge (PCK) over the course of their 2-year participation in the VSTEM Teacher Leadership Institute.
Reimagining Possibilities for Elementary Science Field Experiences & Practica

Debi Hanuscin, Western Washington University

Jesse Wilcox, University of Northern Iowa; Jamie Mikeska, ETS; Pamela Lottero-Perdue, Towson University; Jerrid Kruse, Drake University; Sarah Voss, Drake University; Isaiah Kent-Schneider, Drake University; Josie Melton, Western Washington University; Tina Vo, UNLV; Dana-Atwood Blaine, University of Northern Iowa; Helen Douglass, The University of Tulsa; Dan Moran, Fab Lab Tulsa; Selina Bartels, Valparaiso University; Ben Boche, Valparaiso University; John Pecore, University of West Florida; Minkyoung Kim, University of West Florida; Corey Nagle, University of West Florida; Tadlee Welty, University of West Florida; Melissa Demetriopoulos, University of West Florida; Matthew Perkins Coppola, Purdue University Fort Wayne; Jim McDonald, Central Michigan University; Kelly Feille, University of Oklahoma; Stephanie Hathcock, Oklahoma State University

10:30am - 11:30am in Deer Valley - Session A

The structure of elementary field experiences has remained relatively unchanged over the years. This session will demonstrate, through 13 posters, various innovations to the elementary field experiences. We conclude with a sense-making session. Attendees will have the opportunity to indicate they would like to be included in future collaborations.

Format: Exploratory Session

Professional Development for Science Teacher Educators (Workshops)

Start With Story: Driving Inquiry Through Film in the Science Classroom

David J Olson, Retro Report

10:30am - 11:30am in Little Cottonwood - Session A

How do you engage students to connect the past and present? How do you teach students to dissect essential questions and create links between science and public policy? Start with stories. Turn that attention into meaningful learning with strategies from Retro Report’s free library of films and lessons.

Format: Workshops

Educational Technology

Climate Change on the Outer Banks: Embedding Low-Cost Mobile Technology in Socioscientific Issues Instruction

Mark H Newton, East Carolina University

Len Annetta, East Carolina University; Denise M Bressler.

10:30am - 11:30am in Powder Mountain - Session A

A qualitative study that utilized Epistemic Network Analysis (ENA) comparing differences in how differing mixed reality technologies were associated with how pre-service teachers engaged with various aspects of climate change on the Outer Banks of North Carolina.

Format: Individual Paper Presentation  Presider: Lindsay Lightner
Geology and Geography as Contexts for Consequential Learning With Rural Youth by Integrating Science and Technology.

Colby Tofel-Grehl, Utah State University
Tyler Hansen, Utah State University

10:30am - 11:30am in Powder Mountain - Session B

This paper examines the ways technology supports students' explorations of science within a rural Hawaiian context. Findings indicate that technology offers unique affordances for supporting youth positive beliefs about science despite longstanding local conflict with science. Students engaged in consequential science learning thru modeling.

Teaching With GIS: Building Teachers' Geospatial Skills and Knowledge for Integrated Instruction

Danielle J Malone, Washington State University
Judith Morrison, Washington State University; Jonah Firestone, Washington State University; Lindsay Lightner, Washington State University; Sarah Newcomer, Washington State University; Stassia Feltes, Washington State University

10:30am - 11:30am in Powder Mountain - Session C

This research investigates how teachers acquire geospatial skills and knowledge through professional development initiatives. This investigation is the first step in determining the professional development needs of K-12 teachers to support their integration of geographic information systems (GIS), specifically ArcGIS, in classroom instruction.

Supporting Pre-Service Science Teachers to Use an Analytic Framework to Measure the Alignment Between Their Teaching and the Goals of the NGSS

Jarod Kawasaki, California State University, Dominguez Hills

10:30am - 11:30am in Snowbird - Session A

I describe an approach to supporting pre-service teachers to measure the alignment between their teaching and the goals of the NGSS. During a secondary science methods course, teacher candidates used an analytic framework to examine video recordings of their teaching to support self-examination, reflection, and teacher learning around the NGSS.

Help or Hindrance: Investigating the Influence of the edTPA on Teacher Candidates PCK Development

Matt Reynolds, North Carolina State University
Soonhye Park, North Carolina State University

10:30am - 11:30am in Snowbird - Session B

This longitudinal qualitative study examined the potential influence of the edTPA, the most widely implemented preservice teacher performance assessment in the U.S., on preservice science teachers' pedagogical content knowledge (PCK) development. Identified potential benefits vs. consequences of the edTPA process on PCK development are discussed.
Investigating Teachers, Administrators, and Families Perspectives on STEM Education in North Dakota With a Focus on Indigenous Communities

Ryan Summers, University of North Dakota
Josh Wayt, North Dakota EPSCoR State Office; Raymond Burns, North Dakota EPSCoR State Office; Jean Ostrom-Blonigen, North Dakota EPSCoR State Office; Kelly A. Rusch, Civil Construction, and Environmental Engineering, North Dakota State University & North Dakota EPSCoR State Office

10:30am - 11:30am in Solitude - Session B

Qualitative data collected from K-12 teachers, administrators and families were used to explore intersections between STEM education and traditional ways of knowing. All respondents were associated with tribal communities (n=27) and a majority identified as Native American. Connections between Indigenous STEM, research, and practice are discussed.

Format: Individual Paper Presentation  Presider: Omah Williams-Duncan

Comparison of Rural and Urban High School Science and Engineering Integration in Two School Districts

Elizabeth F Hasseler, University of Nebraska-Lincoln
Elizabeth B Lewis, University of Nebraska-Lincoln

10:30am - 11:30am in Solitude - Session C

A comparative case study was conducted in an urban and rural district, focusing on how science and engineering were integrated into the high school programs. This led to the recommendation for districts to provide collaboration and mentorship opportunities that support teachers integrating engineering into their classrooms.

Format: Individual Paper Presentation  Presider: Omah Williams-Duncan

Integrating Language and Science for Multilingual Learners: Lessons Learned From a Professional Development Collaboration

David T Crowther, University of Nevada, Reno
Rita MacDonald, University of Wisconsin, Madison

10:30am - 11:30am in Sundance - Session A

This session will report on lessons learned from a two-year study focusing on the collaboration with a university and school partnership in a rural PK-4th elementary school on teacher experiences in integrating language and NGSS-based three-dimensional science to better engage all students, but especially Multilingual Learners in learning science.

Format: Individual Paper Presentation
Examining Racial and Linguistic Ideologies and Formative Assessment Practices Among Preservice Teachers of STEM and Other Subjects

Quentin C Sedlacek, Southern Methodist University
Catherine Lemmi, California State University, Chico; Kimberly Feldman, University of Maryland, Baltimore County

10:30am - 11:30am in Sundance - Session B
Research on language diversity in science education is blossoming, but research on dialect diversity in science education remains rare. Using survey data and preserviceteachers’ responses to a formative assessment activity, we show that asset-based views of African American English are correlated with stronger PCK for teaching science literacy.

Format: Individual Paper Presentation

Experimenting With Hybrid Language Practices in the Secondary Science Classroom: One Science Teacher’s Foray Into Multilingual Learning Opportunities

Alexis Rutt, University of Mary Washington
Chris Chang-Bacon, University of Virginia

10:30am - 11:30am in Sundance - Session C
The study chronicles a science teacher’s integration of hybrid language practices into her classroom by capitalizing on students’ bilingualism during a modeling activity. Findings indicate tension between some students’ enthusiasm and others’ reluctance to participate multilingually. Implications for teacher educators and researchers are discussed.

Format: Individual Paper Presentation

The Buzz About Bees

Kathy Cabe Trundle,
Rita Hagevik, Kaitlin U. Campbell, Laura Wheeler, Michelle Parslow, Katherine N. Vela, Larry Krissek, Shannon Rhodes, A'lura Hamilton

10:30am - 11:30am in Wasatch
This workshop focuses on the biodiversity of native bees and the role you can play as Pollinator Protectors. The workshop includes the 3-H Social and Emotional Learning Cycle (Hearts-on, Hands-on, and Heads-on), indigenous storytelling, and how to invite and protect native bees in your landscaping. You will work with an entomologist to construct a native bee home to install at your home or on your campus.

Format: General

Peer Recognition in High School Physics

Marta R. Stoeckel, University of Minnesota
Gillian Roehrig, University of Minnesota

10:30am - 11:30am in Wildcat - Session A
This study explores the dynamics of recognition in small groups in a high school physics classroom. We used video of small groups during a variety of small group activities to identify and analyze events where students gave or received peer recognition. We also interviewed students to understand how they perceived peer recognition in small groups.


Mila Rosa L Carden, University of North Texas
Laura Corr, Arizona State University; Amanda H Norton, Yuma Elementary School District One; Peter Rillero, Arizona State University; Theresa Lowe, Yuma Elementary School District One

10:30am - 11:30am in Wildcat - Session B

We describe development and work with a consolidated classroom observation protocol called RAVID for inservice grades 3 to 8 science lessons in rural schools in a border community. Initial findings suggest conductivity to strong interrater reliability, high internal reliability, and low pretest scores for inservice teachers.


Characteristics of High School Students’ Problem Solving in a Model Eliciting Activity (MEA) of Finding a Locations of Fine-Dust-Free School

Younkyeong Nam, Pusan National University
Eunji Lee, Pusan National University

10:30am - 11:30am in Wildcat - Session C

This study is to investigate high school students’ problem-solving characteristics through a Model Eliciting Activity (MEA). The students solved the problem by combining the given data in various ways, but in common they chose the data directly related to fine-dust emission first as a method of excluding the place of high fine-dust concentration.


Lunch on Your Own

11:30am - 12:30pm

Format: General

Graduate Student Luncheon

11:30am - 12:30pm in Zion

Format: General

Preservice Science Teacher Preparation-ELEMENTARY

Investigating the Impact a Unique Pre-Service Science Methods Program Had on the Participants' First Years of Teaching

Kalani J Eggington, Utah Valley University

12:45pm - 1:45pm in Alta - Session A

A unique, 7-week collaborative science methods program will be presented, along with the impact the program had on the participants' first years of teaching. Findings will inform science methods instructors on how to further enhance their teaching to promote long-term effects among their pre-service students.

Format: Individual Paper Presentation  Presider: Bridget Mulvey
The Everyday Science Framework: Help Teachers Build Effective Scientific Thinking Within and Beyond the Classroom

Bryan Nichols, Florida Atlantic University
12:45pm - 1:45pm in Alta - Session B
This presentation will describe the everyday science framework, a network of concepts, skills, and attitudes that helps teachers and students consider how scientific thinking applies to their life beyond the classroom. The ESF is simple to grasp but pedagogically rich enough to build towards a sophisticated understanding.

Research Experiences for Undergraduates in Practitioner Inquiry: Exploring the Experiences of Preservice Elementary Teachers

Jesse Wilcox, University of Northern Iowa
Sarah Voss, Drake University; Shelby Miller, Seymour Community Schools
12:45pm - 1:45pm in Alta - Session C
This study explores the impact of a research experience for preservice elementary teachers that engaged in practitioner inquiry. Compared to a control group, participants had greater gains in their science teaching knowledge. Additionally, interviews revealed participants formed a community of practice that helped them connect theory to practice.

Syllabus Sharing: Core/Differentiated Instruction for Social Studies and Science in Early and Middle Childhood

Mila Rosa L Carden, University of North Texas
12:45pm - 1:45pm in Big Cottonwood - Session A
The syllabus contributes to a potential research agenda that will explore the impact of combined science and social studies methods course on preservice teachers’ NOS conceptions. The learning outcomes provide evidence that the course context can improve participants’ NOS conceptions particularly sociocultural NOS.

Elevating the Personal Side of Elementary Science Professional Development

SARA LOUISE HAGENAH, Boise State University
Julianne Wenner, Clemson University
12:45pm - 1:45pm in Big Cottonwood - Session B
Professional development experiences are need to be high quality, engaging and meaningful for teachers. Recognizing and responding to the need for increased support for learning and well-being in PD settings is an absolute necessity. In this position paper, we explore the question of what it means to elevate the personal side of PD.
A Preliminary Study of the Impact of a Science Program on Student Achievement in Early Grades

Kadir Demir, Georgia State University

Peter Paprzyczi, University of Southern Mississippi; Charlene M Czerniak, University of Toledo; Joan Kaderavek, University of Toledo; Susanna Hapgood, University of Toledo; Scott Molitor.

12:45pm - 1:45pm in Big Cottonwood - Session C

This study examined the impact of the NURTURES program on Grade 1-3 student learning in science and mathematics after the first year of the program implementation in participating schools in Ohio and Georgia.

Format: Small Group Roundtables  Presider: Regina Toolin

The Implications of Technology-Mediated Lesson Study in the Professional Learning of Rural Science Teachers

Tracy M Poulsen, Brigham Young University

Rebecca Sansom, Brigham Young University; Heather Leary, Brigham Young University; Josh Stowers, Brigham Young University; Max Longhurst, Utah State University

12:45pm - 1:45pm in Brighton - Session A

Rural science teachers struggle with isolation and lack of professional learning opportunities. Teachers participated in technology-mediated lesson study, designing, and implementing secondary science lessons aligned to NGSS standards. Participation in the project resulted in increased capacity and strengthened social networks.

Format: Themed Paper Set  Presider: Jessica Stephenson Reaves

Science Teacher Educators Working for Care-Full Change: Dimensions, Provocations, and Movements

Maria F.G. Wallace, University of Southern Mississippi

Caitlin G. McC. Fine, Metropolitan State University of Denver; Christie Byers, George Mason University; Kristen Schaffer, Mount Royal University; Jonathan L. Hall, California State University, San Bernardino; Colin Hennessy Elliott, Drexel University, University of Colorado Boulder

12:45pm - 1:45pm in Deer Valley - Session A

Presenters share innovative projects within science teacher education that center the development of care (in all its forms) for a more just world. Attendees are invited to explore provocative problems-of-practice to generate movements that better center the children and communities they serve.

Format: Themed Paper Set  Presider: Dan Alston

Using a Self-Efficacy Framework for Teacher Education for STEM

Amanda M Gunning, Mercy College

Meghan E Marrero, Mercy College

12:45pm - 1:45pm in Little Cottonwood - Session A

This workshop focuses on using a self-efficacy framework to design experiences for K-12 teacher development for STEM, including how we have applied it to pre-service teacher education, professional development, and related research. Participants will reflect upon their own teacher education programs and how self-efficacy can be employed.

Format: Workshops
Training Teachers to Think Like a Geologist: An Example Using Seafloor Sediments to Reconstruct Antarctic Climate History
Larry Krissek, 12:45pm - 1:45pm in Millcreek
This workshop will focus on identifying and developing three essential skills needed to “think like a geologist”: making scientifically valid observations, thinking over a range of timescales, and applying Walther’s Law. Participants will use these skills to interpret past climates as recorded in a seafloor sediment core from Antarctica.

STEM Identity Development in a Research Experience for Undergraduates
Gillian Roehrig, University of Minnesota 12:45pm - 1:45pm in Parleys - Session A
This study reports on STEM identity development with a REU (Research Experiences for Undergraduates) program. Dimensions of competence, performance, and recognition developed over the course of the REU program, particularly during research group meetings. Recognition was critical to all REUs, but most important to students of color.

Eastern Success Scholars: First-Year Interventions to Promote STEM Identification in Low-Income, High-Achieving College Students in a STEM Learning Community
Laura S Rodriguez, Eastern Connecticut State University 12:45pm - 1:45pm in Parleys - Session B
Results of first-year interventions designed to promote STEM identities in high ability, low-income biology and math majors will be discussed. Interventions include awarding of a yearly scholarship, cohort placement in a STEM-themed first-year experience seminar, faculty and peer mentoring, community meetings, STEM seminars, and career workshops.

Engineering Integration and Constraints Three Years Later: Sustainability Among Elementary Science Teachers
Allison M Esparza, Texas A&M University 12:45pm - 1:45pm in Powder Mountain - Session A
This study investigates the sustainability of professional development in upper elementary science. Participants completed an intensive 16-week program and were surveyed three years after completion to determine the extent of implementation and current constraints.
**Direct From the Source: Teacher’s Definitions of Teacher Leadership**

Amanda L Gonczi, Michigan Technological University  
Brett Criswell, West Chester University of Pennsylvania; Christine Lotter, University of South Carolina; Rachel Funk, University of Nebraska-Lincoln; Kelsey Quaisley, University of Nebraska-Lincoln  

12:45pm - 1:45pm in Powder Mountain - Session B  
A total of 81 teachers were interviewed across 4 different Noyce Track 3 projects sites to discern how teacher leaders define the construct of teacher leadership. Patterns indicate context and dispositions have been overlooked in previous definitions. Some teachers also identified a layer of positionality in their definition.

Format: Individual Paper Presentation  
Presider: Mike Borowczak

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**Analysis of Science Teacher Educators’ Purposes for Preparing Pre-Service Elementary Teachers Amidst Policy Reforms**

Iliana E. De La Cruz, Texas A&M University  
Joanne K. Olson, Texas A&M University  

12:45pm - 1:45pm in Powder Mountain - Session C  
It is crucial science teacher educators offer coherent, transcendent, purposes and motivations for elementary teachers to persist teaching authentic science amidst the wave of standards-based reform. This study aims to describe what purposes teacher educators have for preparing elementary pre-service teachers to teach science.

Format: Individual Paper Presentation  
Presider: Mike Borowczak

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**Task Interviews as a Research and Student Assessment Strategy: Examples From Computational Thinking and Science in K-2**

Kristina M Tank, Iowa State University  
Tamara J. Moore, Purdue University; Anne Ottenbreit-Leftwich, Indiana University  

12:45pm - 1:45pm in Sidewinder - Session A  
This hands-on workshop will provide examples of task interviews with K-2 students using computational thinking strategies. Participants will learn how task interviews can be used for assessing student standards-based learning and eliciting knowledge to answer research questions.

Format: Workshops

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**Emancipating STEM Education Through Abolitionist Teaching: A Research-Practice Partnership to Support Virtual Microteaching Experiences**

Vanessa N Louis, Georgia State University  
Natalie S King, Georgia State University  

12:45pm - 1:45pm in Snowbird - Session A  
In this paper, we share an approach to address systemic racism by highlighting a research-practice partnership [RPP] effort between a university and STEM program to understand the extent to which centering abolitionist teaching and emancipatory practices in a science methods course supported teacher candidates’ virtual microteaching experiences.

Format: Individual Paper Presentation  
Presider: Stacey Britton
A Qualitative Look at How a Community of Practice Used TeachLive to Prepare Preservice Secondary Science Teachers to Use Language in a Science Classroom

Kristina Otero, University of Central Florida
Su Gao, University of Central Florida; Vassiliki Zygiouis-Coe, University of Central Florida; Joyce Nutta, University of Central Florida; Haiyan Bai, University of Central Florida

12:45pm - 1:45pm in Snowbird - Session B

Presented here are the findings from exploring the feedback regarding language offered to the PSTs from a collaborative team of science, literacy, and TESOL education faculty through TeachLive™ coaching sessions in an innovated undergraduate course of science education supported by an NSF funded project.


Females in Higher Education: A Comparison of Perspectives and Mainstream Definitions of STEM

Mary D. Curtis, Independent Researcher
Carol C. Waters, University of Houston-Clear Lake; David Sparks, University of Texas Permian Basin

12:45pm - 1:45pm in Solitude - Session A

This presentation will highlight a qualitative study that employed intersectionality to provide a lens that could address inequality within STEM (Collins & Bilge, 2020). Researchers explored female perceptions of STEM disciplines in higher education. The presentation will discuss one emergent theme, the STEM Array, and its subthemes.

Format: Individual Paper Presentation  Presider: Rebekah Hammack

Transcending Disciplines: Engaging College Students in Interdisciplinary Research, Integrated STEM, and Partnerships

Andrea C Burrows, University of Central Florida
Trina JKilty, University of Wyoming

12:45pm - 1:45pm in Solitude - Session B

Interdisciplinary teams of undergraduate college students designed and built integrated STEM projects and shared lessons with K-12 students. Interviews and field observations were analyzed. The projects encouraged scientific inquiry, but presented challenges fully integrating STEM disciplines and transitions among multiple disciplines.

Format: Individual Paper Presentation  Presider: Rebekah Hammack

Building Consensus in Summer Camp Group Work

Trina JKilty, University of Wyoming
Clay Carper, University of Wyoming; Andey Robins, University of Wyoming; Mike Borowczak, University of Wyoming

12:45pm - 1:45pm in Solitude - Session C

An innovative approach to lessons about cryptography at an informal summer camp for children ages 10-15. Campers enciphered and deciphered code, solved mysteries, and played games in small groups. The authors analyzed campers’ attitudes by observation and pre/post questionnaires. Gamification of computer science concepts in groups engages learners.

Format: Individual Paper Presentation  Presider: Rebekah Hammack
Theoretical and Practical Teaching Strategies for K-12 Science Education in the Digital Age

Joshua Ellis, Florida International University
Sumreen Asim, Indiana University Southeast; Colleen Megowan-Romanowicz, Arizona State University; Erin Peters-Burton, George Mason University; Kate Popejoy, ASTE; Andria Schworz, University of Wyoming

12:45pm - 1:45pm in Sundance - Session A
The integration of technology into science is a way to enhance and support learning, but learning how to implement and support productive uses of educational technology in science classrooms is often overlooked. This presentation will feature digital-age strategies for science educators from chapter authors of a forthcoming book.

Science Teacher Educator Learning Through Educative Curriculum Materials

Carrie-Anne Sherwood, Southern Connecticut State University
Melanie Kinskey, Sam Houston State University; Sarah Voss, Drake University

12:45pm - 1:45pm in Wasatch - Session A
In our roundtable presentation, we will share with attendees how we used narrative vignettes in a PLC as a tool to reflect upon and learn about our practice as science teacher educators while engaging with educative curriculum materials.

Eliciting Preservice Elementary Teachers’ CKT Through Scenario-Based Tasks

Jaclyn K. Murray, Augusta University
Jamie N. Mikeska, Educational Testing Service; Nicole Glen.

12:45pm - 1:45pm in Wasatch - Session B
The presentation focuses on sharing ways to uncover preservice teachers’ content knowledge for teaching (CKT) matter with scenario-based tasks in a set of Educative Curriculum Materials (ECM) for science teacher educators. Participants will explore the CKT tasks, review responses, and consider instructional moves to advance CKT skills.

Educative Curriculum Materials to Support Teacher Educators in Developing Preservice Elementary Teachers’ CKT

Amanda Obery, Central Washington University
Jeni Davis, Salisbury University; Josie Melton, Western Washington University

12:45pm - 1:45pm in Wasatch - Session C
This presentation focuses on the design and use of Educative Curriculum Materials (ECM; Content Knowledge for Teaching Packets) for science teacher educators. Participants will explore the ECM and engage in a discussion around how the ECM can be used to support teacher educators’ (TE) content learning and teaching.
A Professional Learning Community (PLC) for Science Teacher Educators to Support Changes in Curriculum, Pedagogy, & Assessment

Deborah L Hanuscin, Western Washington University
Sarah Fick, Washington State University; Sumreen Asim, Indiana University Southeast; Heather Lavender, Emily Borda, Western Washington University

12:45pm - 1:45pm in Wasatch - Session D
Learn how a year-long PLC supported 13 elementary science teacher educators’ collaborative learning. We’ll unpack norms, structures, and activities that led to changes in curriculum, pedagogy, and assessment in our content and methods courses as we implemented curriculum materials related to developing content knowledge for teaching about matter.

Informal/Out-of-School Science Education

Bridging Science Fiction and Science Fact: Science Fiction Convention Attendees’ Life Experiences and Views Related to Science Fiction and Science

Gina M Childers, Texas Tech University
Rebecca Hite, Texas Tech University; Christi Whitworth, Texas Tech University; Samantha Noble, Texas Tech University; Kania Greer, Georgia Southern University; Joshua Cruz, Texas Tech University

12:45pm - 1:45pm in Wildcat - Session A
Sci-Fi conventions provide science learning spaces via “track” sessions. This study focused on track attendees’ life experiences related to science fiction and science. Attendees shared that interest in science fiction and science originated in childhood and are linked. The findings suggest that science fiction could foster science interest.

South African Students’ STEM Attitudes and Self Efficacy: Exploring STEM Non-Formal Learning Contexts

Joseph A. Isaac, Texas Tech University
Gina Childers, Texas Tech University

12:45pm - 1:45pm in Wildcat - Session C
Using a non-formal education camp model in South Africa known as the Taylor Education Framework (TEF), this study sought to explore STEM self-efficacy and attitudes of students. Results indicate there was an increase in self-efficacy and attitudes suggesting non-formal STEM learning opportunities may be advantageous for students in South Africa.

Aquaponics in Teacher Preparation: An Investigation Into the Effects of Aquaponics Engagement on Elementary Preservice Teacher Science Teaching Efficacy Beliefs

Michelle L Schpakow, Monmouth University

2:00pm - 2:45pm in Canyons South Lobby - Session Poster
This individual paper presentation discusses an in-progress study exploring the effect of engagement with an aquaponics system on elementary preservice teachers’ science teaching efficacy beliefs as measured by the STEBI-B instrument. Findings from the first year of the study, plans for continued study, and potential implications will be shared.
Black Representation in the Science Curriculum (BRISC) Project
Catherine Quinlan, Howard University
2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster
This workshop is part of a larger NSF funded project to situate the lived experiences and narratives of Black heritage, particularly the African American Gullah Geechee in the science curriculum. This workshop is the first culmination of a series of lessons that use the 5E model and inquiry to explore science concepts using data and products.
Format: Individual Poster Presentation

Why NOT Become a Teacher? Undergraduate Students’ Perceptions of the Teaching Profession
Jacob Pleasants, University of Oklahoma
Amelia Cook, University of Oklahoma; Rachelle Johnson, University of Oklahoma; David Powel, University of Oklahoma
2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster
To explore why so few students are choosing to be science teachers, we conducted a survey of undergraduate students’ perceptions of the teaching profession. We found that many expressed some interest in teaching, but also that they are being discouraged in significant ways. Come and discuss with us the implications for teacher recruitment.
Format: Individual Poster Presentation

Exploring North Dakota Secondary Science Teachers’ Perceptions of Using and Developing Authentic Learning Strategies and Experiences With Science Professional Development
Tarah MDahl, North Dakota State University
James Nyachwaya, North Dakota State University
2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster
This study explored secondary science teachers’ perceptions of authentic learning, their perceptions of how science teachers stay current with the latest science technologies to be able to offer authentic learning opportunities, and their experiences with science professional development in their school district.
Format: Individual Poster Presentation

Modification of a Creativity Assessment in Science Contexts
Lisa M Martin-Hansen, California State University, Long Beach
2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster
Our team is working to create an assessment of creativity in science contexts to gather evidence about students' abilities to think creativity before and after a college course in scientific reasoning and spatial thinking. The work in process focuses upon the modification and pilot of this US version adapted from a Chinese and UK/English instrument.
Format: Individual Poster Presentation
Recognizing, Deepening, and Extending Play-Based Engagements With Science and Engineering Practices in Early Learning Environments

Katahdin Cook Whitt, Maine Mathematics and Science Alliance
Lisa Kenyon, Maine Mathematics and Science Alliance; Rachel Larimore, Samara Early Learning; Alison Miller, Bowdoin College

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster
Young children naturally engage in science and engineering practices through play in sophisticated and robust ways. This poster will explore a series of professional learning modules designed to help early years educators to recognize science and engineering practices in play and then deepen and extend children’s engagement with science.

Format: Individual Poster Presentation

Speaking and Writing About Science: A Promising Science and Literacy Instructional Model Replication Study

Julie K. Jackson, Texas State University

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster
Components of this replication study include (1) innovative vocabulary strategies (2) structured speaking and writing (3) purposeful planning. Vocabulary instruction involves opportunities to process and apply academic language. Purposeful planning provides training and tools for how to integrate language easily and effectively during instruction.

Format: Individual Poster Presentation

Integrating STEM for Education in Suriname: A Baseline Teacher Preparedness Study

Philip C Short, Austin Peay State University
John R McConnell, Austin Peay State University; Dirk Wongsopawiro, Anton de Kom Universiteit

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster
Efforts to enhance science education and integrate STEM disciplines in a diverse country have been initiated. Delivery of a new national curriculum across multicultural communities has presented challenges. Developing a baseline for teacher self-efficacy and local needs to effectively integrate STEM into the curriculum is the focus of this study.

Format: Individual Poster Presentation

Assessment Preparation: Analyzing Teachers Use of Self-Regulated Learning Prompts

Jayme Del Mario

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster
This research proposal presents science teachers with strategic rounds of professional development and coaching cycles on self-regulated learning (SRL) questioning during assessment preparation to analyze if this intervention will have an effect on the results of a pre and post SRL questionnaire on questioning.

Format: Individual Poster Presentation
**STEAM Education: Transforming Teacher Beliefs**
*Iraklis Dimoulas, Fordham University*

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster

Teachers hesitate to integrate STEAM into their classrooms due to factors such as a lack of experience and confidence, supporting students and conducting effective assessments, and classroom support. This presentation details the findings of a study evaluating the impact of factors that contribute to teacher beliefs regarding STEAM integration.

Format: Individual Poster Presentation

**Modeling Students’ Science Achievement With Teacher Explanation and Instructional Activities Based on TIMSS Study 2019**
*Risa Haridza*

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster

This paper investigated the variability of students’ science achievement influenced by students' perceptions and teacher instruction from TIMSS 2019. The sample included 7652 students in grade 8 and 409 teachers across the United States. This study uses multilevel modeling to understand the variables significantly affecting science achievement.

Format: Individual Poster Presentation

**Investigating Factors Associated With Nonscience Major Students’ Perceptions of Credibility Regarding Publicly Contentious Science Ideas**
*Benjamin A Janney, Texas A&M University*

*Benjamin C Herman, Texas A&M University; Tamara Powers, Texas A&M University*

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster

This session will: a) summarize research aimed at understanding the factors associated with peoples' acceptance of well-established, yet publicly contentious science ideas; b) present an analysis of students’ perceptions of credibility and reasoning regarding five science ideas; c) put forward implications for educators in general science courses.

Format: Individual Poster Presentation

**Authentic Community Engagement in Science**
*Amanda Obery, Central Washington University*

*Matt Queen, Montana State University Billings*

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster

Exploring the intersections of CTE and STEM education may foster interest in critical rural healthcare careers beginning in elementary school. The instrumental case study builds interest in biomedical careers with rural and American Indian communities, through co-created STEM curriculum with community members and teachers.

Format: Individual Poster Presentation
**An Evaluation of Pre-Service Elementary Teachers’ Use of the Touch-Talk-Text Model: Interdisciplinary Science and Literacy**

*Danielle R Scharen, North Carolina State University*

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster

This session presents elementary preservice teachers’ reflections and results after using the Touch-Talk-Text interdisciplinary framework to integrate science and literacy in their K-2 classrooms, allowing ALL students to access science through sensory, language, and discourse connections.

**Prevalence of High-Resolution Analyses of the Teacher’s Role in Recent Science Education Publications.**

*Aaron E. Kidd, Texas A&M University*

*Michael Clough, Texas A&M University; Joanne Olson, Texas A&M University*

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster

Research has established the teacher as the most significant classroom variable on student learning. This study examined articles from three high-impact journals. 111 articles were identified as intervention studies necessitating a high-resolution analysis of the teacher’s role, but few studies did so. Implications for research will be addressed.

**The Important Role That the Science Fair Can and Should Play in Science Teacher Presentation**

*Stephen R Burgin, University of Arkansas*

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster

On this poster we will share ways in which we engaged our preservice secondary science teachers in completing their own authentic scientific investigation and how during their field experience they mentored junior high students as they participated in a regional science fair. We will also discuss ongoing data collection and analysis plans.

**Reforming an Introductory Undergraduate Biology Course Through Collaborative Action Research**

*Aidin Amirshokoohi, DeSales University*

*Mahsa Kazempour, Penn State University- Berks Campus; Lara Goudsouzian, DeSales University*

2:00pm - 2:45pm in Canyons South Lobby - Session WiP Poster

This presentation will focus on the collaborative action research to reform and modify an introductory undergraduate biology course. The findings will focus on the instructor’s conceptions, features of pre and post instruction, perceived barriers or concerns with implementation of changes, instructor’s reflection and further modifications.

**Mentor-Mentee Nexus**

2:30pm - 3:15pm in Zion

*Format: General*
**Coffee Break**
2:45pm - 3:00pm in Canyons Lobby

**Format:** General

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**Equity & Diversity**

**Nurturing a Cultivating Genius Framework in K-8 Classrooms**

*Chelsea M Sexton, University of Georgia*

*Emily Adah Miller, University of Georgia*

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

In this multiple case study, we explore the adventures of three K-8 teachers navigating highs and lows of Gholdy Muhammad’s Cultivating Genius framework. Thematically analyzing both teachers’ and students’ understandings of identity, skills, intellect, criticality, and joy with the experiences that build them can nurture future classroom enactment.

**Format:** Individual Poster Presentation

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**Preservice Science Teacher Preparation-ELEMENTARY**

**Scientific Principles Identification (SPI) Implementation Research Study**

*Omah M. Williams-Duncan, University of Houston - Clear Lake*

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

This study implements (and aims to refine) a Scientific Principles Inventory (SPI) framework. During science methods classes, the researcher implements the framework to assist pre-service teachers with lesson planning. Participants learn to identify and align science content in trade texts with Next Generation Science Standards.

**Format:** Individual Poster Presentation

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**Curriculum, Pedagogy, and Assessment**

**Three Dimensional Teacher Questioning Practices in Science Classrooms**

*Elizabeth A McMillan, University of Texas at San Antonio*

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

Strong teacher questions allow students to share their experiences and thinking and to deepen understanding. This work seeks to understand how questioning during classroom discourse in science classrooms may include focus and attention not only to content but also to practices and cross cutting concepts.

**Format:** Individual Poster Presentation

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**Informal/Out-of-School Science Education**

**Moving Forward on Developing an Inclusive and Accessible Informal STEM Learning Experience for Deaf and Hard-of-Hearing Students**

*Scott D Cohen, Georgia State University*

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

STEM HANDS is a short-term science camp designed for deaf and hard of hearing (dhh) students that provide an inclusive and accessible STEM learning experience. Data was generated by dhh students to capture their transformational experience and communicative use from various STEM learning activities.

**Format:** Individual Poster Presentation
**Perceptions of Bee Conservation on a University Campus**

*James Locklear, The University of North Carolina at Pembroke*

3:00pm - 3:45pm in Canyons South Lobby - Session **WiP Poster**

This study assessed students, professors, staff, and the surrounding community's attitudes and knowledge about bees and pollinator conservation through participation in a bee survey and community interviews. STEM and non-STEM majors and community members were compared. It was found that there was a lack of understanding of bee conservation overall.

**Student Learning P-12**

**How Very Young Children Learn About STEM: Validating the STEM Play Cycle**

*Sue Dale Tunnicliffe, University College London*

Christine D. Tippett, University of Ottawa; Roxana Yanez Gonzalez, University of Ottawa

3:00pm - 3:45pm in Canyons South Lobby - Session **WiP Poster**

We examine how young children begin to acquire STEM knowledge and behaviours. One preliminary theory is the STEM Play Cycle, which we use as an analytical lens for data previously collected with children aged 1½ to 2½ years. Feedback will contribute to a theoretical framework, grounded in evidence, for very young children's learning about STEM.

**STEM Education**

**Development and Revision of an Observation Protocol for Early Childhood STEM**

*Todd M Milford, University of Victoria*

Christine D Tippett, University of Ottawa; Roxana Yanez Gonzalez, University of Ottawa

3:00pm - 3:45pm in Canyons South Lobby - Session **WiP Poster**

We developed an observation protocol (OP) to capture actions and behaviors of students and educators in early childhood STEM education. The OP was conceptualized to support initial explorations in a pre-Kindergarten classroom where educators wanted to focus on incorporating STEM. We seek feedback on our current efforts to revise and extend the OP.

**Science Teacher Professional Development-MIDDLE/SECONDARY**

**Thanks for Noticing! a Comparative Case Study of Discourse and Noticing in Elementary, Middle and High School Teachers**

*Andrew L Jones, Utah State University/Canyons School District*

3:00pm - 3:45pm in Canyons South Lobby - Session **WiP Poster**

This study will attempt to look at the relationship between classroom discourse and teacher noticing, specifically as it differs by grade level (elementary, middle, and high school). The study will compare three classroom science teachers at different grade levels and explore the differences in their noticing of classroom discourse.
**A Mixed Methods Study of Science Teacher Educators’ Inclusive Perspectives and Practices**

Christine D Tippett, University of Ottawa
Karen Goodnough, Memorial University of Newfoundland and Labrador; Saiqa Azam, Memorial University of Newfoundland and Labrador; Todd M Milford, University of Victoria

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

We explored science teacher educators’ (STEs) inclusive beliefs and behaviors via surveys and interviews. QUAN results (N = 39) show a range of influential theories and frameworks; QUAL results (N = 8) provide an in-depth look at how some theories/frameworks are applied in teaching. We seek suggestions for the mixing of datasets and/or analyses.

**Preservice and New teacher Induction and Persistence**

**Disequilibrium in Secondary Science Teacher Identity Through a Dialogical Identity Framework: A Comparative Case Study of Different Career Stages**

Betsy Leong, Loyola University Chicago
Michelle LaBorn, Loyola University Chicago; Ryan Johnson, Loyola University Chicago

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

The development of a science teacher identity is a complex process. Using Dialogic Self Theory, the purpose of this study is to understand how moments of disequilibrium impact the identities of a preservice, novice, and veteran secondary science teacher at different stages career development.

**Science Teacher Professional Development-MIDDLE/SECONDARY**

**Autonomous Professional Learning Through Practitioner Inquiry in the Science Classroom: A Study of Growth Plan System Experiences**

Daina K Gaputis, USF
Allan Feldman, David Rosengrant, Jennifer Jacobs, Cheryl Ellerbrock

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

This Work in Progress session will discuss a study investigating how fellows in a science education fellowship program conceptualize their professional learning experience, including how their prior lived experiences have played a part in the development and implementation of their autonomous growth plan systems.

**College and University Science Education**

**Refutation Model of Classroom Discourse to Facilitate Pre-Service Teachers’ Discussions About Evolution**

Rachel A Sparks,
Janet F Stomberg, Veterinary Information Network; Rebekka Darner, Illinois State University

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

Evolutionary theory is essential knowledge for future science teachers, including preservice elementary teachers (PSETs). In this study, we examine the efficacy of an instructional intervention in which refutation discourse facilitated PSETs’ analysis of diagnostic question clusters intended to identify non-normative conceptions about evolution.
Formative Assessment of Modeling Practice Throughout a Physical Science Course for Prospective Elementary Teachers

Jaclyn K Murray, Augusta University
Christi L Pace, Augusta University

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

Our poster shares a formative assessment task to evaluate students’ understanding of a phenomenon via scientific modeling. Prospective teachers make observations, generate inferences, ask questions, investigate to gather data, and engage in collective sensemaking to create a model-based explanation to describe how or why a phenomenon occurs.

Format: Individual Poster Presentation

High Leverage Practices in Environmental Service Learning Courses

Byung-Yeol Park Park, University of Connecticut
Rebecca Campbell, University of Connecticut; Todd Campbell, University of Connecticut; Hannah Cooke, University of Connecticut; Chester Arnold, University of Connecticut

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

Science teaching and learning for sustainability requires instructional approaches that focus on changes in learners’ actions and behavior. Consequently, we developed and examined the implementation of high leverage practices (HLPs) used specifically with this aim in mind to support students’ engagement in environmentally-related service learning.

Format: Individual Poster Presentation

Teach Like an Ancestor

Amelia Cook, University of Oklahoma

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

This project will bring Indigenous Science perspectives into a climate change education experience for undergraduate science students (both Native and Non-Native). How do experiences that use land as pedagogy develop students’ capacity to bridge Indigenous and scientific worldviews? Does this impact student ideas about the nature of science?

Format: Individual Poster Presentation

Engaging in Science Play for All

Rachelle J Johnson, The University of Oklahoma

3:00pm - 3:45pm in Canyons South Lobby - Session WiP Poster

Research shows that play provides important learning experiences that develop skills and dispositions valued in science. However, play is largely absent from schools. What views do science teachers have about play, and what sorts of experiences might help them to value and implement playful experiences in their classrooms?

Format: Individual Poster Presentation

Equity Committee Meeting #1

4:00pm - 5:00pm in Millcreek

Format: General
A Celebration John Staver’s Legacy and Significant Contributions to Science

**Education**
4:00pm - 5:00pm in Wildcat
*Format: General*

**President's Virtual Welcome**
4:30pm - 5:00pm in Zoom Room
*Format: General*

**Mid-Atlantic Region Meeting**
5:00pm - 6:00pm in Brighton and Zoom Room
*Format: General*

**Far West Region Meeting**
5:00pm - 6:00pm in City Creek and Zoom Room
*Format: General*

**Southwest Region Meeting**
5:00pm - 6:00pm in Deer Valley and Zoom Room
*Format: General*

**International Region Meeting**
5:00pm - 6:00pm in Little Cottonwood and Zoom Room
*Format: General*

**Northwest Region Meeting**
5:00pm - 6:00pm in Millcreek and Zoom Room
*Format: General*

**Northeast Region Meeting**
5:00pm - 6:00pm in Powder Mountain and Zoom Room
*Format: General*

**North Central Region Meeting**
5:00pm - 6:00pm in Snowbird and Zoom Room
*Format: General*

**Southeast Region Meeting**
5:00pm - 6:00pm in Solitude and Zoom Room
*Format: General*

**Welcome Reception**
6:00pm - 8:00pm in Zion
*Format: General*
Friday, January 13, 2023

**Breakfast**
7:00am - 8:30am in Capitol Reef
Format: General

**Environmental Education Forum**
7:15am - 8:15am in City Creek and Zoom Room
Format: General

**Technology Forum**
7:15am - 8:15am in Millcreek and Zoom Room
Format: General

**Inclusive Education Forum**
7:15am - 8:15am in Powder Mountain and Zoom Room
Format: General

**Science Teacher Residencies Forum**
7:15am - 8:15am in Sidewinder and Zoom Room
Format: General

**Methods in Elementary Education Forum**
7:15am - 8:15am in Solitude and Zoom Room
Format: General

**Women in Science Education Forum**
7:15am - 8:15am in Wasatch and Zoom Room
Format: General

**Policy and Government Relations Forum**
7:15am - 8:15am in Wildcat and Zoom Room
Format: General

**Registration**
8:00am - 11:00am in Arches
Format: General

Preservice Science Teacher Preparation-ELEMENTARY

**Local Ecosystem Observation Cycle: Supporting Preservice Elementary Teachers**

**Engagement in Equitable Sensemaking**

Jessica R Stephenson Reaves, Kennesaw State University
Anna Arias, Kennesaw State University

8:30am - 9:30am in Alta - Session A

Future teachers need opportunities to engage in equitable sensemaking of science phenomena to learn how to support 3D science learning. We describe an innovative cycle of observing, wondering, and making sense of science phenomena within local ecosystems using prior experiences to change thinking about investigating within their local ecosystems.

Format: Individual Paper Presentation    Presider: Jennifer Bateman
Employing Justice-Oriented Curricula and Pedagogy to Support Elementary Teacher Candidates’ Future Science Teaching

Daniel M Alston, UNC Charlotte
Lenora Crabtree, UNC Charlotte

8:30am - 9:30am in Alta - Session B

Limited emphasis on issues relevant to marginalized communities in science classrooms necessitates teacher educators employ critical, culturally relevant pedagogies. We will explore how justice-oriented curricula supported teacher candidates preparing to teach science to elementary students.

Format: Individual Paper Presentation  Presider: Jennifer Bateman

Preservice Elementary Teachers’ Reasoning About Complexity and Stakeholders in a COVID-19 SSI: A Socioecological Approach

Bridget K Mulvey, Kent State University
Lisa A. Borgerding, Kent State University; Laurie Robinson, Kent State University; Jeff Papa, Kent State University

8:30am - 9:30am in Alta - Session C

This study of 48 elementary preservice teachers’ reasoning in a COVID-19 SSI on how schools should operate indicated that participants attributed complexity to different perspectives, protocol implementation logistics, new science, non-uniform risks/impacts, with minimal consideration of distal stakeholders/systems.

Format: Individual Paper Presentation  Presider: Jennifer Bateman

Women Deciphering the Hidden Curriculum of Academia Through the Lens of Cultural Capital: A Roundtable

Meredith W Kier, William & Mary
Seema Rivera, Clarkson University; Shelly R Rodriguez, University of Texas at Austin; Julianne A Wenner, Clemson University

8:30am - 9:30am in Big Cottonwood - Session A

For many graduate students and early academics in the United States, the social and cultural norms of higher education are rife with unwritten rules. We will discuss the outcomes of a supportive peer-mentorship network of four academic women for over a decade and the parallels with Yosso’s (2005) Community Cultural Wealth Framework.

Format: Small Group Roundtables  Presider: Angela Webb

Community and Care Humanizes STEM Learning Experiences for Black and Latina Girls

Laura R Peña-Telfer, Georgia State University

8:30am - 9:30am in Big Cottonwood - Session B

Using community-based participatory action research (Holkup et al., 2004) situated within a politicized and authentic care (Walker, 1983; Collins, 1991; Valenzuela, 1999) and community cultural wealth (Yosso, 2005) conceptual framework, Black and Latina girls and community co-researchers reimagine STEM teaching and learning.

Format: Small Group Roundtables  Presider: Angela Webb
**Diversifying the STEM Teaching Workforce: Partners and Processes**

*Jose M Rios*, University of Washington Tacoma  
*Kathryn A. Baldwin*, Eastern Washington University

8:30am - 9:30am in Big Cottonwood - Session C  
As part of a state-wide collaborative effort to improve STEM teacher preparation, faculty at an institution of higher education engaged in a Diversity Campaign. At this roundtable, we will summarize the process to date, including journey mapping and a design clinic leading to the development of an action plan for a teacher preparation program.

**Data Analysis and Mathematical Thinking: A Comparison of Cases in Preservice Elementary Science Education**

*Adam Bennion*, Brigham Young University  
*Betsy Davis*, University of Michigan

8:30am - 9:30am in Brighton - Session A  
Analyzing data and thinking mathematically are critical skills needed to engage children in science. We present a longitudinal case study of preservice elementary teachers and their experiences with these practices. Results indicate that aspects of a preservice teachers' knowledge are connected (e.g., KCT can be constrained (or bolstered) by CCK).

**Supporting Elementary Teachers in Growing Their Design Capacity to Implement and Adapt NGSS-Designed Materials Through Meaningful and Sustained Science Professional Learning**

*Katahdin A Cook Whitt*, Maine Mathematics and Science Alliance  
*Lisa Kenyon*, Maine Mathematics and Science Alliance; *F. Leonard Kenyon*, Maine Mathematics and Science Alliance; *Adrienne Hanson*, Maine Mathematics and Science Alliance; *Rhonda Tate*, Maine Mathematics and Science Alliance

8:30am - 9:30am in Brighton - Session B  
Elementary teachers must be equipped with knowledge, skills, and resources to teach science in meaningful and equitable ways. While high-quality instructional materials are an important piece of the puzzle, curriculum-based professional learning opportunities are necessary to support teachers in implementing and adapting materials to their context.

**Impact of Discipline-Specific Science Knowledge and Teaching Efficacy on Instructional Practices of In-Service Elementary Teachers**

*Doug Ball*, Utah State University  
*Colby Tofel-Grehl*, Utah State University

8:30am - 9:30am in Brighton - Session C  
This study examines how in-service elementary teachers' life and physical science subject matter knowledge and science teaching efficacy relate to their discipline-specific instructional practices. Findings stem from interviews of teachers who were selected according to preliminary subject matter knowledge and teaching efficacy survey scores.
Developing Confidence and Knowledge in Teaching Marine Science & Climate Change: a Mixed-Methods Study

Lauren Madden, TCNJ
Louise Ammentorp, The College of New Jersey; Nathan Magee, The College of New Jersey; Graceanne Taylor, Save Barnegat Bay; Sophie Greenberg, The College of New Jersey

8:30am - 9:30am in City Creek - Session A
We report on growth in teachers’ understanding of and confidence in teaching marine science and climate change in NGSS-aligned lessons after a three-workshop professional development series. Data sources include a survey pre- and post-PD and focus group discussion with a subset of participants.

Format: Individual Paper Presentation  Presider: Matt Reynolds

Indonesian Preservice Teachers’ Awareness, Uncertainty Beliefs, Values, and Behaviors Related to Climate Change

Hartono Hartono, Sriwijaya University
Sofendi Sofendi, Sriwijaya University; Ryan Knowles, Utah State University; Kathy Cabe Trundle, Utah State University; Sary Silvhiay, Sriwijaya University; Rita Hagevik, UNC-Pembroke; Laura Wheeler, Utah State University; Rita Inderawati, Sriwijaya University

8:30am - 9:30am in City Creek - Session B
By examining preservice teachers’ attitudes about climate change, we found that elementary and language arts education majors were more likely to hold an anthropocentric view of the environment, which correlates with climate denial. These findings have implications for curricula, outreach, and educational materials.

Format: Individual Paper Presentation  Presider: Matt Reynolds

Examining Relationships Between Youth Climate Change Activism, Democratic Values, and Civic Engagement: Using the 2016 IEA International Civic and Citizenship Education Study Data to Understand Climate Change in Secondary Education

Candace L Penrod, Utah State University
Clayton Chamberlain, Utah State University; Iree Wheeler, Utah State University; Ryan T Knowles, Utah State University

8:30am - 9:30am in City Creek - Session C
Using factor analysis and structural equation modeling with the 2016 IEA International Civic and Citizenship Education Study data, we create climate change scales to determine relationships between open classroom climate, climate change activism, democratic values, and civic participation for secondary students in five countries.

Format: Individual Paper Presentation  Presider: Matt Reynolds
**Closing the Chasm: Science Classroom to Career**  
*Jeff Weld, University of Northern Iowa/Governors STEM Council*

TBD TBD, TBD  
8:30am - 9:30am in Deer Valley - Session A  
This session explores the emergent, urgent imperative to link science classroom learning to workplace applications. Teacher-preparers and professional developers have a number of tools at their disposal, yet the need for an empirically supported and potent model that is readily adaptable is an elusive, fruitful vein of discussion.

*Format: Exploratory Session*

**Teaching Human Ecology Concepts With Models and Simulations**  
*Denise Stewardson, Utah State University*

8:30am - 9:30am in Little Cottonwood - Session A  
Engage in multi-disciplinary activities that use models and simulations to teach ecological concepts, including how human activities can change the physical landscape, ecosystems and climate. Participants will analyze how these experiential strategies can support pre-service teachers in motivating all learners.

*Format: Workshops*

**Where Am I in the Water Cycle? Sharing New Water Cycle Representations**  
*Ryan S. Nixon, Brigham Young University*

Sophie K. Hill, Brigham Young University  
8:30am - 9:30am in Millcreek - Session A  
Current representations of the water cycle commonly omit human influence, sending the message that humans are not involved and limiting students’ learning. In this workshop we will engage participants as learners in a science lesson using newly created representations of the water cycle. We then introduce a suite of new water cycle representations.

*Format: Workshops*

**Preservice Elementary Teachers’ Content Knowledge Understanding During a STEM Internship Experience**  
*Nicole J Glen, Bridgewater State University*

8:30am - 9:30am in Parleys - Session A  
This presentation will explain the content knowledge understandings of preservice elementary teachers in a college science course developed to support their physical science learning and taught in the context of the Department of Defense STARBASE curriculum, leading to an internship experience with English learners at our local air force base.

*Format: Individual Paper Presentation  Presider: Katie Laux*
"I Thought That They Were Very Cut and Dry": Preservice Elementary Science Teachers Learning With/About Models and Modeling

Ayca Karasahinoglu Fackler, University of Georgia

8:30am - 9:30am in Parleys - Session B

Many teachers lack knowledge to build models to support their students' learning. How can we provide prospective teachers with learning opportunities so that they can revise their naïve perceptions on modeling practices? This study revealed preservice elementary science teachers' understanding of modeling practices through reflective practices.

Using Virtual Reality With Pre-Service Elementary Science Teachers to Promote Valid Conceptions of the Reason for the Seasons

Darby Drageset, University of Florida
Kent Crippen, University of Florida; Jeungtae Eom, University of Florida; Richard Bex, University of Florida

8:30am - 9:30am in Powder Mountain - Session A

Join us to learn about our investigation into using virtual reality technologies (VR) to address science learning issues for preservice teachers to improve teacher preparation for teaching science. Our research has implications for the implementation of VR as a tool to elicit conceptual change in preservice teacher science learning.

Examining Elementary Science Teachers’ Attention to and Use of Formative Feedback Within Online Simulated Teaching Experiences

Jamie N. Mikeska, ETS
Pamela S. Lottero-Perdue, Towson University; Devon Kinsey, ETS

8:30am - 9:30am in Powder Mountain - Session B

This study used an online simulated classroom to examine in-service teachers' attention to and use of two different types of written formative feedback designed to support them in developing their ability to engage in one core teaching practice: facilitating discussions that engage students in scientific argumentation.

Using TeachLivE to Develop Preservice Secondary Science Teachers’ Integration of Science, Literacy, and English Learner Support Through Questioning

Kelsey Beeghly, University of Central Florida
Su Gao, University of Central Florida; Vassiliki Zygouris-Coe, University of Central Florida; Joyce Nutta, University of Central Florida; Haiyan Bai, University of Central Florida

8:30am - 9:30am in Powder Mountain - Session C

In this study, TeachLivE was used as a technology innovation to develop preservice secondary science teachers' questioning skills. Data included verbal transcripts of seven PSTs' TeachLivE lessons. Findings show that TeachLivE was a useful context for PSTs to rehearse their questioning while integrating science, literacy, and language strategies.
**University/College Instructors: Use the NSTA Website in Lieu of a Textbook**

*Flavio Mendez*, (National Science Teaching Association

*Donna Governor*, University of North Georgia,

8:30am - 9:30am in Sidewinder

Are you an instructor of preservice teachers of science? Learn about NSTA’s digital resources, virtual experiences, and website tools to help your students become the BEST teachers they can be. More than a simple membership, learn about what’s on the NSTA website that can you help teach your course successfully.

Preservice teachers using the NSTA website in lieu of a textbook create a library of resources, grow their network of professional colleagues, and enhance their content and pedagogical knowledge of science by actively engaging with NSTA digital resources and the online tools in the NSTA website. Instructors using the NSTA website in lieu of a textbook with preservice teachers receive a class landing page to manage their course, a private forum for asynchronous discussions, and gain access to an instructor’s dashboard to monitor and assess their students’ engagement within the website. All instructors using the NSTA website in lieu of a textbook receive a free NSTA digital professional membership and their students become members of the Association at a cost that is competitive and gives the students the ability to add to their website’s library the entire suite of NSTA’s Interactive E-Books+ Professional, professional learning units, and other fee-based resources, like NSTA Daily Do lesson plans, and Journal articles to use in class.

**Takeaway:** Preservice teachers using NSTA in lieu of Textbook create a library of resources, grow their network of professional colleagues, and enhance their content and pedagogical knowledge of science by actively engaging with NSTA digital resources and the online tools in the NSTA website.

**Format:** General

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**Biliteracy and Science Integrated Teacher Preparation: Proposing a Model to Support the Teaching of Secondary Science to Emergent Bilinguals**

*Edward GLyon*, Sonoma State University

*Lyn Scott*, Cal State East Bay; *Rhianna Casesa*, Sonoma State University; *Caroline Spurgin*, Sonoma State University

8:30am - 9:30am in Snowbird - Session A

We propose a teacher preparation model in which preservice secondary science teachers experience, deconstruct, and then approximate teaching practices that leverage emergent bilinguals' translanguaging to support science learning integrated with biliteracy development. We provide examples of how this model looks in a teacher preparation program.

**Format:** Individual Paper Presentation  **Presider:** Mark Enfield

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**Preservice Teachers’ Understandings About Computational Thinking Through Energy Topic STEAM Program**

*Young Shin Park*, Chosun University

*Kiyoung Lee*, Kangwon National University; *Hyeong Soo Kim*, Korea University; *Hyonyong Lee*, Kyoungbook National University; *James Green*, Chosun University; *Jyeon Lee*, Chosun University

8:30am - 9:30am in Snowbird - Session B

Preservice teachers participated STEAM program with Computational thinking (CT) practices with the goal of making preservice teachers understand CT practices. The researchers developed 16 CT practices which were included in engineering-based STEAM program with the use of wave power energy theme.

**Format:** Individual Paper Presentation  **Presider:** Mark Enfield
Elementary Pre-Service Science Teachers' Analysis of an Outdoor Play Space for Teaching Science Concepts

Sherri I. Brown, University of Louisville
Meg Gravil, Eastern Kentucky University

8:30am - 9:30am in Solitude - Session A

This study examines elementary pre-service science teachers’ (n=20) perspectives of an informal outdoor Play Zone area for affordances in learning science concepts. From their observations and reflections on using Play Zone elements, we explore cross-curricular, authentic, science learning experiences from an outdoor nature-based play area.

Format: Individual Paper Presentation  Presider: Brent Gilles

Effecting STEM Interest in Upper-Elementary Youth

Elaine M Westbrook, Montana State University Billings

8:30am - 9:30am in Solitude - Session B

In order to increase elementary students’ interest in STEM, teachers need to incorporate empirical pedagogical approaches when planning curricula. One approach is utilizing a place-conscious framework alongside experiential instructional methods. This study reports the findings of increasing STEM interest with the curricula.

Format: Individual Paper Presentation  Presider: Brent Gilles

A Case Study of How Fifth Grade Students Develop Their Creativity Skills During STEM Integrated Unit

Muhammad Guntur Purwanto, University of Minnesota
Gillian Roehrig, University of Minnesota; Elizabeth Stretch, University of Minnesota; Elizabeth Crotty, The University of Wisconsin–Eau Claire; Jeanna Wieselmann, Simmons School of Education & Human Development

8:30am - 9:30am in Solitude - Session C

STEM Integrated learning is becoming more needed in elementary schools as a response to building students’ 21st-century skills, such as creativity, problem-solving, communication, and collaboration. This multiple case study scrutinized how fifth-grade students develop their creativity skills during a STEM integrated unit.

Format: Individual Paper Presentation  Presider: Brent Gilles

High School Teachers’ Implementations of Science-Based Geospatial Reasoning Projects: Practices, Challenges, and Possibilities

Lindsay K. Lightner, Washington State University
Judith A. Morrison, Washington State University; Danielle J. Malone, Washington State University; Jonah B. Firestone, Washington State University

8:30am - 9:30am in Wasatch - Session A

This study explores high school STEM teachers’ integration of geospatial thinking and reasoning in their classes using geographic information systems software during project-based learning. Findings point to teachers’ successes and challenges in teaching the software, developing students’ geospatial skills, and fulfilling project learning goals.

Format: Small Group Roundtables  Presider: Angela Webb
Environmental Justice, Activism, and STEM Pedagogies: A Freedom Seminar

Holly M Plank, University of Pittsburgh

Hillary M Henry, University of Pittsburgh; Cassie F Quigley, University of Pittsburgh; Danielle Andrews-Brown, University of Pittsburgh

8:30am - 9:30am in Wasatch - Session B

This “Freedom Seminar” elevates science education by supporting students to collectively begin or continue to think about the relationships between freedom, activism, STEM pedagogies, and Environmental Justice, and how they might help us build theorized practices and sites of liberatory action towards an environment that is safe and just for all.

Format: Syllabus Sharing  Presider: Angela Webb

Mentoring as a Critical Induction Support

Lara Smetana, Loyola University Chicago

8:30am - 9:30am in Wasatch - Session C

Mentoring is increasingly recognized as a key component of teacher induction efforts. We describe our efforts to develop, implement, and iterate upon mentoring as a form of induction support for secondary science teachers. The roundtable encourages sharing of ideas and consideration of collaborations amongst ASTE members engaged in similar efforts.

Format: Small Group Roundtables  Presider: Angela Webb

Place-Based Education: Integrating Multiple Principles, Practices and Traditions Into an Undergraduate Place-Based Certificate Program

Regina E. Toolin, University of Vermont

Simon Jorgenson, University of Vermont

8:30am - 9:30am in Wasatch - Session D

This presentation will discuss how multiple traditions of place-based education serve as the foundation for a new undergraduate certificate at the University of Vermont based on the principles, practices and traditions of place-based education.

Format: Small Group Roundtables  Presider: Angela Webb

Exploring Interactions Between Internal and External Factors That Shape Middle School Science Teachers Curriculum Enactments

Laura A Zangori, University of Missouri

Suzy Otto, University of Missouri; Sepideh Fallahhosseini, University of Missouri; Laura B Cole, Colorado State University

8:30am - 9:30am in Wildcat - Session A

Teachers’ abilities to enact co-developed curricular materials as part of a research initiative vary widely across classroom and student contexts. This multi-case study investigates internal and external factors that may have supported or inhibited implementation of a new energy literacy curriculum in six middle school classrooms.

Why Do Effective Science Teachers Persist?: A Mixed Methods Approach Exploring Post-Induction Effective Science Teachers’ Experiences

Molly Ramker, University of Northern Iowa
Jesse Wilcox, University of Northern Iowa; William Lange, University of Northern Iowa; Dori Clausen, University of Northern Iowa

8:30am - 9:30am in Wildcat - Session B

This study investigated the experiences of effective science teachers who persist. Our study found that for teachers to persist, they have to view teaching as more than a job and have the support and the freedom to engage in deliberate practice in order to continually improve.


Evolving Perspectives on Argument-Driven Inquiry Among Secondary Science Teachers

Brendan E. Callahan, Kennesaw State University
Michael Dias, Kennesaw State University; Kathryn Freeman, Cherokee County School District; Jonathan Gustin, Cherokee County School District; Erin Jacobs, Cherokee County School District; Angela Mentzel, Cherokee County School District

8:30am - 9:30am in Wildcat - Session C

Argument Driven Inquiry (ADI) focuses on oral and written argumentation skills to develop students’ knowledge of science and scientific inquiry through planning, implementing, and communicating results of investigations. We will discuss the evolving teachers’ perspectives as they navigate a county-wide implementation process of ADI.


The Effects of Epistemic Beliefs on Students’ Emotions and Attitudes Towards Genetically Modified Foods

David A. Lee, Liberty University
Jillian L. Wendt, University of the District of Columbia; Michelle J. Barthlow, Liberty University

8:30am - 9:30am in Zoom Room - Session A

This study examines the effects of epistemic beliefs on epistemic emotions and attitudes towards genetically modified foods (GMFs). A significant relationship was found between negative epistemic emotions and negative attitudes towards GMFs. Students that experienced less frustration, anxiety, and boredom had more positive attitudes towards GMFs.

Format: Individual Paper Presentation

Using Repeated Microteaching Experiences an Online Elementary Science Methods Course

Franklin S. Allaire, University of Houston-Downtown

8:30am - 9:30am in Zoom Room - Session B

This presentation describes how repeated microteaching rehearsals were adapted for an online science methods course at an urban university and includes challenges, lessons learned, and key considerations. Over 90% of respondents agreed/strongly agreed that both their teaching and understanding of science content improved because of the experience.

Format: Individual Paper Presentation
**Action Research on the Development and Application of a Collaborative Elementary Teacher Training Program to Improve Teacher Professionalism in Digital Science Text Literacy Education**

*Juyeon Lee*, Seoul National University  
*Sonya Nichole Martin*, Seoul National University; *Eunbyul Cho*, Seoul National University; *Hye-Eun Chu*, Macquarie University; *Kieun Eom*, Seoul National University

8:30am - 9:30am in Zoom Room - Session C  
Assessments show literacy rates of students are declining, especially in science. Some research argues increased screentime, and less time reading books may contribute to this trend. We challenged this idea by developing a teacher training and student education program to increase students' digital science text literacy by using electronic devices.

**Collaboration Space**

9:00am - 3:00pm in Big Cottonwood  
Format: General

**Intentionally Teaching Towards Scientific Literacy and Global Competencies in an Embedded Rural Practicum**

*Selina LBartels*, Valparaiso University

9:45am - 10:45am in Alta - Session A  
This study looked at elementary Preservice Teachers'(PST) ability to teach towards Scientific Literacy in an embedded rural practicum experience. PSTs were modeled intentional teaching towards scientific literacy on campus, micro taught and then delivered three science lessons in the field.

**“This Began My Journey of Confidence in Teaching Engineering on an Elementary Level!”: Three Cases to Examine the Development of Preservice Teacher Self-Efficacy for Teaching Engineering in the Elementary Classroom**

*Kristie Gutierrez*, Old Dominion University  
*Minjung Lee*, Old Dominion University; *Jennifer Kidd*, Old Dominion University; *Pilar Pazos*, Old Dominion University; *Krishna Kaipa*, Old Dominion University; *Stacie Ringleb*, Old Dominion University; *Orlando Ayala*, Old Dominion University

9:45am - 10:45am in Alta - Session B  
Due to a nationwide emergence of K-6 engineering and computer science standards, there is a need to better understand how teacher educators can develop preservice teachers' teaching self-efficacy in these areas. Ed+gineering provided novel opportunities for PSTs to experience teaching and learning this content by building COVID-companion robots.
Examining Shifts in Elementary Preservice Science Teachers’ Reform-Minded Identity Development

Jenna Gist, Purdue University
Brenda M. Capobianco, Purdue University

9:45am - 10:45am in Alta - Session C
This study examines how elementary preservice teachers develop reform-minded identities in relation to the most recent national science standards. Results reveal distinct shifts in preservice teachers’ identities and provide suggestions for teacher educators to aid in their development of positive identities for reform-based science teaching.

A Parallel Process to Build Teacher Understanding and Transference Between Professional Development and Classroom Instruction

Martha C Inouye, University of Wyoming
Ana Houseal, University of Wyoming

9:45am - 10:45am in Brighton - Session A
Many science teachers have limited experience and therefore schema regarding phenomenon-based, three-dimensional learning. We demonstrate how engaging teachers in parallel forms of learning as to how we want their students to engage equips teachers with the personal experiences and empathy required to embrace similar structures for their students.

Why Science Teacher Educators Need to Study Newly Hired Science Teachers: An Understanding of Dimensionality

Julie A Luft, University of Georgia

9:45am - 10:45am in Brighton - Session B
As science teacher educators, it is important to pay attention to our newly hired science teachers. By following and studying newly hired teachers, we can have a dimensional understanding of teachers. This can result in better teacher education programming. This session explores the idea of a dimensional understanding of science teachers.

Beyond the University: The Challenges and Potential of External Support for Early-Career Science Teachers in the Field

Candyce Johnson, Teachers College, Columbia University
Lorna Otero, Teachers College, Columbia University; Emelia Pelliccio, Teachers College, Columbia University

9:45am - 10:45am in Brighton - Session C
This case study airs at shared experiences from the perspective of science teachers’ mentors collaborating in an external support program for a participating school that aimed to provide scaffolding for curriculum building, lessons, and techniques. Throughout the program, we encountered challenges and identified additional research questions.
**Secondary Science Teachers' Views and Approaches for Teaching for Climate Justice**

Lisa A Borgerding, Kent State University  
Jennifer Heisler, Kent State University; Breanna Beaver, Kent State University; Adepeju Prince, Kent State University

9:45am - 10:45am in City Creek - Session A

Given the perils of climate change and the promise of climate justice education for motivating action, this mixed methods study sought to investigate Ohio secondary science teachers’ climate justice teaching practices.

**“The Way I Ended Up Doing It Is a Good Way... Whether I Did It Right or Not”: How Teacher Candidates Used Nature Journals in Science Methods Courses During the Pandemic**

Jennifer Kreps Frisch, University of Minnesota Duluth

9:45am - 10:45am in City Creek - Session B

This presentation will examine how pre-service elementary teachers used both paper and digital nature journals in 2020-21, when science methods courses met online asynchronously due to the ongoing COVID-19 pandemic. Candidates’ self-analyses and journals were analyzed for themes related to skills, content, and affect.

**Seeing the Equity in Science Classroom Teaching & Learning Through Video Analyses**

Heather J Johnson, Vanderbilt University  
Jessica Riccio, Columbia University; Anna M Arias, Kennesaw State University; Brett A Criswell, West Chester University; Joshua A Ellis, Florida International University; Lawrence Escalada, University of Northern Iowa; Michelle Forsythe, Texas State University; Andrew Robinson, West Chester University

9:45am - 10:45am in Deer Valley - Session A

The exploratory session examines noticing for equity through video-analyses in science teachers’ education. Participants will have opportunities to engage in interactive break-out stations on supporting and studying equity in teacher education as well as discuss the use of video analyses in preparation of equity-focused science teachers.

**The Potential of Wonder in Science Teacher Education: Conceptualizing the Philosophical, Pedagogical and Research Possibilities.**

Andrew Gilbert, George Mason University  
Christie C. Byers, George Mason University; Adam Johnston, Weber State University; Stephanie Dean, George Mason University; Nate Wood, North Dakota State University; Melissa Cournia, North Dakota State; Cassandra Gilbert, North Dakota State; Tara Nelson, University of Wisconsin – LaCrosse

9:45am - 10:45am in Parleys - Session A

This themed paper set will highlight the potential of wonder to impact across a range of educational contexts. This includes the philosophical/theoretical positioning of wonder, research with in-service and pre-service teachers, outdoor/environmental education and the possibilities to engage graduate students into the research process.
Socio-Environmental Science Investigation to Promote Geospatial Thinking: Integrating ArcGIS Digital Technologies for Learning

Kate Popejoy, Popejoy STEM LLC

Judy Morrison, Washington State University Tri-Cities; Molly Weinburgh, Texas Christian University; Kristen Brown, Texas Christian University; Danielle Malone, Washington State University Tri-Cities; Alec Bodzin, Lehigh University; Jonah Firestone, Washington State University Tri-Cities; Doug Leeson, Lehigh University

9:45am - 10:45am in Powder Mountain - Session A

In this related paper session, we present three different cases of the Socio-environmental Science Investigations (SESI) curriculum-linked PD approach which supports secondary teachers’ development and implementation of SESI investigations and projects using a variety of GIS tools in different geographic locations in the USA.

Format: Themed Paper Set

Beyond Lecturing: Presentation Tips That Lead to More Engagement, Recall, and Success

Danielle Hennis, Make It Memorable LLC

9:45am - 10:45am in Sidewinder - Session A

Fostering Globalization Teaching Skills in Secondary Science Teacher Candidates Using Scientific Argumentation

Brent Gilles, University of West Georgia

Characterizing Questions Preservice Teachers Pose to Elicit and Guide Students Thinking in Coming to a Consensus

Ronald S Hermann, Towson University

Laura Zangori, University of Missouri, Columbia; Meredith Park Rogers, Indiana University - Bloomington; Rachel B Snider, The College of New Jersey; Tracy Hargrove, University of North Carolina, Wilmington; Shelby Morge, University of North Carolina, Wilmington; Calli Shokell, ETS; Heather Howell, ETS

Science PSTs and math PSTs led consensus building discussions of small student avatar groups within a Mursion™ simulation. We explored the kinds of questioning patterns the PSTs used in their discussions. In this presentation, we share our findings of the question and response patterns the PSTs used.
Teaching the E in STEM: A Synthesis of the Engineering Teaching Self-Efficacy Literature
Sarah Haines, Townson University
Deepika Menon, University of Nebraska-Lincoln; Jeanna Wieselmann, Southern Methodist University; Sumreen Asim, Indiana University Southeast

9:45am - 10:45am in Solitude - Session A
Teacher preparation programs and professional development enhance science teaching self-efficacy. However, there is less evidence surrounding engineering teaching self-efficacy. In this systematic review, we explored: What does the existing literature on self-efficacy reveal about fostering elementary teachers' engineering teaching self-efficacy?

Format: Individual Paper Presentation   Presider: Karthigeyan Subramaniam

Leveraging Professional Development and Practicum Field Experiences to Enhance Elementary Preservice Teachers' Engineering Teaching Efficacy.
Rebekah Hammack, Montana State University
Miracle Moonga, Montana Stte University; Blake Wiehe, Montana State University; Nicholas Lux, Montana State University; Paul Gannon, Montana State University

9:45am - 10:45am in Solitude - Session B
This study investigated the impact of an engineering summer professional development and practicum experience on the teaching efficacy of two elementary pre-service teachers. We found distinct qualitative evidence suggesting that engineering teaching efficacy improved for both PSTs, particularly in regard to emotional and physiological aspects.

Format: Individual Paper Presentation   Presider: Karthigeyan Subramaniam

Middle School Students' Longitudinal Understanding of Engineering Practices
Natasha L Wilkerson, Texas A&M University
Joanne K Olson, Texas A&M University

9:45am - 10:45am in Solitude - Session C
This study examined 30 students' understanding of engineering practices through an analysis of three reflection videos submitted during various weeks of an engineering program. Findings include an overwhelming focus on the end product, reliance on tinkering, and intriguing differences in practices based on the design task.

Format: Individual Paper Presentation   Presider: Karthigeyan Subramaniam

Pathways to Affirming Multilingual Learners' Science Identities in High School Biology Classes: Teacher Understanding and Actions
Molly M Staggs, University of Florida
Julie C Brown, University of Florida

9:45am - 10:45am in Sundance - Session A
This study examined how two high school biology teachers understood and implemented science identity-affirming instruction while participating in a program to support effective science instruction for multilingual learners. Findings suggest that participation in the program expanded their linguistically responsive understanding and practices.

Format: Individual Paper Presentation   Presider: Lynne Zummo
**Identity Work of Successful Women in Science During Their College Years**

*Jonathan L. Hall, California State University, San Bernardino*

9:45am - 10:45am in Sundance - Session B

This study presents the positive identity work of 12 successful women in science during their college years. Participants developed support networks, excelled in authentic science experiences, and studied their science figured worlds. Implications for science educators in promoting women’s positive identity work will be discussed.

Format: Individual Paper Presentation  Presider: Lynne Zummo

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**How Teachers Can Construct Equitable Learning Environments Within the Science Classroom**

*Jamie D Daniels-Favors, Kennesaw State University*

9:45am - 10:45am in Wasatch - Session A

Equitable learning environments are necessary to science classrooms to support the learning of diverse students groups. Teachers play an essential role in creating equitable learning environments. It is challenging and complex for teachers to build these environments for students without the support of equity-focused professional development.

Format: Workshops

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**Arguing About COVID-19: Using Induced Perspective Taking to Inform Arguments About the Use of “Chinavirus”**

*David C. Owens, Georgia Southern University*

*Michael J. Reiss, University College London*

9:45am - 10:45am in Wildcat - Session A

In this study, we tasked 43 pre-service elementary teachers with taking both sides when developing arguments about the appropriateness of referring to COVID-19 as “Chinavirus.” We conclude that induced perspective taking can expose the evidence and reasoning employed by opposing sides of SSI from which progressive dialogue can commence.

Format: Individual Paper Presentation  Presider: Anjar Putro Utomo

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**Using an Agent-Based Computer Model to Investigate the COVID-19 Pandemic**

*April A. Mitchell, Utah State University*

9:45am - 10:45am in Wildcat - Session B

Biology students’ understanding of COVID-19 significantly improves following a curricular intervention. An agent-based computer model of disease was a powerful tool to help students understand not only the biology of the COVID-19 pandemic but the nature and purpose of models in science.

Format: Individual Paper Presentation  Presider: Anjar Putro Utomo
**Promoting Teacher Reflection Through Online Instructional Coaching: A Case Study**

*Jeanna R. Wieselmann, Southern Methodist University*

Marc T. Sager, Southern Methodist University

9:45am - 10:45am in Zoom Room - Session A

This single case study explored online instructional coaching of a first-year science teacher. Findings highlight the coaching moves that prompted teacher reflection, including affirming the teacher, focusing on how students learn, discussing pedagogy, and emphasizing science content knowledge. Implications for instructional coaching are discussed.

Format: Individual Paper Presentation  Presider: Franklin Allaire

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**Faculty Outcomes From the Integrated STEM Guitar Professional Development Institutes**

*Debbie A French, Wake Forest University*

Sean Hauze, San Diego State University; Brad Rhew, Winston-Salem Forsyth County Schools/Gardner Webb University

9:45am - 10:45am in Zoom Room - Session B

This research examined the impact of participating in an integrated STEM professional development (PD) opportunity on faculties’ understanding of integrating STEM topics and incorporating more integrated STEM lessons. Alumni reported creating more integrated STEM lessons and noted the importance of participating in a hands-on PD.

Format: Individual Paper Presentation  Presider: Franklin Allaire

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**Centering Students in Transdisciplinary STEAM Using Positioning Theory**

*Richard B Cox, Winthrop University*

Kristin L. Cook, Bellarmine University

9:45am - 10:45am in Zoom Room - Session C

Integrated STEAM instruction continues to be a major focus of K-12 education. We reviewed existing STEAM frameworks. We found that frameworks remain focused on the teacher, not the student. Our work centers STEAM on students’ right, obligations, and duties within STEAM as way to better refine understanding of student position in STEAM learning.

Format: Individual Paper Presentation  Presider: Franklin Allaire

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**Coffee Break**

10:45am - 11:00am

Format: General
Keynote: *A Geoscience Perspective on Antarctic Climate Change: Ice Shelves, the Underappreciated Brakes on the Antarctic Ice Sheets*
Larry Krissek,
11:00am - 12:30pm in Capitol Reef

Antarctica is often described as “the highest, coldest, driest, windiest place on earth,” yet each year several thousand U.S. scientists and support personnel travel there to conduct research at three permanent bases, at numerous temporary field camps, and aboard research vessels. This talk will introduce you to the physical environment of Antarctica, will describe how and where scientists work in Antarctica, and will identify the major scientific questions that are the present focus of much Antarctic research. We will then focus on the condition of the Antarctic ice sheets and their ice shelves over the past few decades, demonstrating the crucial role that ice shelves play in influencing the rate of ice loss from the large ice sheets. We will conclude by examining the results of an innovative seafloor coring project, which revealed an unexpected history of major climate changes over the past 5 million years, as recorded by the extent of the McMurdo and Ross Ice Shelves. This history of significant past variability suggests that Antarctic sensitivity to future climate change, and its contributions to future sealevel changes, may be larger than originally expected.

Format: General

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**Lunch on Your Own**
12:30pm - 2:00pm

Format: General

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**Graduate Student Workshop**
12:30pm - 2:00pm in Wasatch

Format: General

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**Virtual Poster Session and Networking**
1:00pm - 2:00pm in Zoom Room

Format: General

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**Analysis of Graduate Physics and Astronomy Programs**

*Andria C. Schwortz*, Quinsigamond Community College

*Andrea C. Burrows*, University of Central Florida; *Adam Myers*, University of Wyoming; *Daniel Dale*, University of Wyoming

1:00pm - 2:00pm in Zoom Room - Session Poster

This work attempts to characterize PhD-granting programs in physics and astronomy in the USA, including their requirements for admissions, candidacy, and graduation, using a critical theory lens. Preliminary results for a subset of programs will be presented, including an assessment of graduate courses and credits.

Format: Individual Poster Presentation

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**Equity & Diversity**

**Multilingual Language Learners in Secondary Science Classrooms: A Literature Review**

*Victoria L Corr*, Georgia State University

*Renee Schwartz*, Georgia State University

1:00pm - 2:00pm in Zoom Room - Session Poster

This literature review is an examination of the current state of the literature of multilingual language learners within secondary science classrooms. Multilingual language learners comprise a large and growing subgroup of students with US public schools and consideration will be needed going forward to ensure favorable educational outcomes.

Format: Individual Poster Presentation
Practices of College Science and Math Tutors During Virtual Tutoring

Georgianna L Saunders, Missouri State University

Jenny Rice, Gateway STEM High School

1:00pm - 2:00pm in Zoom Room - Session Poster

College peer tutors can play a vital role in encouraging a struggling student to stay in science. Peer tutors are often only trained in general tutoring strategies; however, they may need more science-specific strategies. Science teacher educators, working with tutoring centers, can provide expertise in developing excellence in science tutoring.

Format: Individual Poster Presentation

Why Should Teachers Have All the Fun? Including Administrators in Science Educators Professional Growth.

Mason A Kuhn, University of Northern Iowa

Scott Worthing, Niroga Institute

1:00pm - 2:00pm in Zoom Room - Session Poster

In this presentation we will discuss a unique approach to professional development that includes principals as partners with teachers as they learn how to implement an Argument-Based Inquiry Approach aligned to the NGSS.

Format: Individual Poster Presentation

Sick Science: The Impact of the COVID-19 Pandemic on Science Instruction at Midwest University

Benedict M Thoms-Warzecha, St. Cloud State University

Felicia Leammukda, St. Cloud State University; Shea Garlock, St. Cloud State University

1:00pm - 2:00pm in Zoom Room - Session Poster

In March 2020, the world was shuttered down due to the pandemic. Education across the board was heavily impacted, but science instruction was impacted significantly due to remote learning and social distancing. As the world returns to a new normal, it is imperative to look at how student impressions of online science instruction have changed.

Format: Individual Poster Presentation

Collaborating With University Supervisors to Support Coherence Between Coursework and Fieldwork

Corinne Lardy, California State University, Sacramento

Donna Ross, San Diego State University; Meredith Vaughn, San Diego State University

1:00pm - 2:00pm in Zoom Room - Session Poster

This multiple case study examines how two universities worked over the past two years to develop coherence between secondary science methods courses and field experiences by fostering collaboration among course instructors and field supervisors. Supports include meetings within and across universities and a set of tools to foster common language.

Format: Individual Poster Presentation
Increasing Student Interest and Identities in STEM Coursework and Careers
Alison A Haugh Nowariak, University of Minnesota
Gillian Roehrig, University of Minnesota, Annika Gehl, University of Oregon
1:00pm - 2:00pm in Zoom Room - Session Poster

This paper discusses two iterations for a STEM outreach program for high school students at a college in the midwest. The first iteration of the program was virtual due to the COVID-19 pandemic, and the second iteration of the program took place in person. Both programs provide insight regarding how to increase student interest and STEM identities.

Format: Individual Poster Presentation

Native Hawaiians in STEM Living at the Threshold of Cultural and Professional Identities
Franklin S. Allaire, University of Houston-Downtown

1:00pm - 2:00pm in Zoom Room - Session Poster

The path for Native Hawaiians to pursue degrees and careers in STEM is not easy as they must balance cultural and professional identities. This poster explores research conducted with ten (10) Native Hawaiians in Hawai’i’s STEM community. Themes provide insight into how the intersecting Native Hawaiian-Scientist identities are balanced.

Format: Individual Poster Presentation

One Approach to Extending the Draw a Scientist Tool
Rachel Gisewhite, University of Southern Mississippi
Anne Gatling, Merrimack College, Stacey Britton, West Georgia University

1:00pm - 2:00pm in Zoom Room - Session WiP Poster

We propose that research regarding the Draw a Scientist Tool has not impacted the K-12 classroom how it was intended originally. After a critical analysis of existing literature and the use of this tool in our own teacher preparation classrooms, we provide suggestions for modifications in relation to STEM education and cultural perspectives.

Format: Individual Poster Presentation

Agronomists as Resources to Enhance STEM in K-12
Comfort M Ateh, Providence College/Associate Professor

1:00pm - 2:00pm in Zoom Room - Session WiP Poster

Agronomy embodies STEM and involves the production of crops and management of the soil. This presentation will focus on the essence of a symbiotic relationship between agronomists and teacher educators in enhancing the teaching of STEM in K-12 while creating a pipeline for agronomists to mitigate hunger and sustain humanity.

Format: Individual Poster Presentation
Evidence of Pre-Service Elementary Teacher Sense-Making Through Nature Journaling

Kelly Feille, University of Oklahoma
Stephanie Hathcock, Oklahoma State University; Claudia Colonello Olivares, University of Oklahoma

2:00pm - 3:00pm in Alta - Session A

This study investigates evidence of science sense-making in PSETs' nature journals. Results indicate that PSETs use nature journaling to attempt to make sense of scientific phenomena as scientists do. We hypothesize that PSETs are then more likely to facilitate student sense-making opportunities through nature journaling in the future.

Moving From “I’m Not Going to Be Good at Teaching Science” to “I Loved Teaching Science!”: One Preservice Elementary Teacher’s Journey

Melissa Hulings, The University of Texas at Arlington

2:00pm - 3:00pm in Alta - Session B

Utilizing a convergent parallel mixed-methods case study design, this study sought to better understand the relationship between classroom teaching experiences and the level of science teaching self-efficacy for one preservice elementary teacher as they progressed from the science methods course through student teaching.

Do You Hear What I Hear? Preservice Teacher Framing and Noticing of Elementary Students’ Thinking

Alison Mercier, University of Wyoming
Tierney Hinman, Auburn University

2:00pm - 3:00pm in Alta - Session C

Effective teaching requires teachers to notice and attend to students' ideas. The findings indicate that expansive noticing of students’ ideas consists of three main aspects: 1) listening for important facets of explanation, 2) using an asset-based approach to reason about foundations of ideas, and 3) responding in ways that honor students’ ideas.

Registration

2:00pm - 5:15pm in Arches

Teacher Observation Reimagined – Using the SeeMeTeach Observation App

Craig Berg,

2:00pm - 3:00pm in Brighton

Participants will get a free account and learn how to use this new online app, a teacher and classroom observation tool designed to collect data on teacher actions and student engagement with instant analysis for feedback and coaching sessions or with research or grant evaluation. No Cost.
**Developing Students’ Compassion in the Context of Socioscientific Issues: An Exploratory Session**

*David C Owens, Georgia Southern University  
Dana L Zeidler, University of South Florida*

2:00pm - 3:00pm in City Creek

In this exploratory session, participants will actively engage in analyzing their own ideas to better understand the compassion construct and explore compassion as a means for motivating the taking of others’ perspectives, and for aiding students’ consideration and development of compassion in the context of socioscientific issues.

**Linking Science Teacher Instructional Intentions and Science Learning by Emergent Multilingual Learner During a Biology Unit**

*Molly Weinburgh, Texas Christian University  
Cecilia Silva, Texas Christian University; Daniella Biffi, Texas Christian University*

2:00pm - 3:00pm in Deer Valley - Session A

This study focused on the link between teacher planning and student learning during a summer science and language program. Analysis showed that the teacher intentions of delivering multimodal instruction, creating a community of learners, and using an epistemological approach of authentic experiences were effectively received by the student.

**Computational Model of Teacher Adaptive Expertise in the Development of Epistemic Tools**

*Richard Lamb, East Carolina University Neurocognition Science Laboratory  
Brian Hand, University of Iowa; Jee Kyung Suh, University of Alabama; Gavin Fulmer, University of Iowa*

2:00pm - 3:00pm in Deer Valley - Session B

Teacher epistemic practices or epistemic tool use involves the use of tools such as dialogue, argumentation, and science language has been used to help elementary teachers create generative learning environments (GLE) in the science classroom.

**Knowledge, Skills, and Attitudes, Related to Team Science**

*Joi Walker, East Carolina University  
Richard Lamb, East Carolina University; Heather Vance-Chalcraft, East Carolina University*

2:00pm - 3:00pm in Deer Valley - Session C

The purpose of this study is to illustrate the validity and reliability of a newly developed measure of Teams Knowledge Attitudes and Skills related to team science implemented in an undergraduate research based interdisciplinary course setting.
Eliciting, Assessing, and Analyzing Teacher Knowledge of the Crosscutting Concepts

Anna M Arias, Kennesaw State University
Amanda Benedict-Chambers, Missouri State University; Julie Contino, American Museum of Natural History; Jeni Davis, Salisbury University; Patrick J Enderle, Georgia State University; Sarah J Fick, Washington State University; Soon Lee, Kennesaw State University; Carrie-Anne Sherwood, Southern Connecticut State University

2:00pm - 3:00pm in Little Cottonwood - Session A
Teacher educators and researchers from multiple institutions share their experiences supporting and studying teachers' knowledge of the crosscutting concepts (CCCs) in 3D learning. The presenters will discuss with participants the challenges and possibilities related to eliciting, assessing, and analyzing this knowledge.

Format: Exploratory Session

Recruiting and Retaining Diverse Secondary STEM Teachers in and for Today's Context

Katherine L Arrington, UTeach, The University of Texas at Austin
Amy Moreland, UTeach, The University of Texas at Austin

2:00pm - 3:00pm in Millcreek - Session A
Recruiting and retaining secondary STEM teachers has become more challenging. Come contribute to a “chalk-talk” about impactful practices including pathways, structures, and strategies with representatives from a network of university-based teacher programs that works toward increasing the number and diversity of the science teacher workforce.

Format: Exploratory Session

A Case Study of Sensemaking Opportunities Provided by the Instructor in General Chemistry Classroom

FNU Desi, University of Minnesota
Gillian Roehrig, University of Minnesota; Anita Schuchardt, University of Minnesota

2:00pm - 3:00pm in Parleys - Session A
Students struggle to solve quantitative science problems because they do not engage in sci-math sensemaking. This struggle relates to a lack of sensemaking opportunities provided by science instructors during instruction. This case study identified multiple types and organization of sensemaking opportunities provided by a chemistry instructor.

Format: Individual Paper Presentation  Presider: Mandi Collins

A Comparison of Three Undergraduates’ Ideas About Carbon Cycling in Trees

Rebecca M Krall, University of Kentucky
Amber Keene, University of Kentucky; Moriah Peel, University of Kentucky; Katherine A Sharp, Stephens College; Sagan Goodpaster, University of Kentucky

2:00pm - 3:00pm in Parleys - Session B
This qualitative grounded study explored three undergraduate students’ understandings of carbon cycling in trees from the macro perspective. A sequence of images of trees in forest environments was used in semi-structured interviews to situate participants’ responses. Findings illustrate the fragmented nature and tentativeness of students.

Format: Individual Paper Presentation  Presider: Mandi Collins
Understanding an International Graduate Student Instructor's Emotional Challenges of Teaching Science During the COVID-19 Pandemic

Qiu Zhong, Indiana University
Tulana Ariyaratne, Indiana University; Jing Yang, Indiana University; Shukufe Rahman, Indiana University; Valarie Akerson.

2:00pm - 3:00pm in Parleys - Session C

This self-study investigates the emotional challenges that an international graduate instructor experienced teaching science during the pandemic in the spring of 2021. We explore the emotional challenges, their sources and how those emotional challenges affect and are affected by the science teacher educator identity development.

Format: Individual Paper Presentation

3D-PD: Professional Development for 3D Printers in Science Classrooms

Kristine M Wilbrecht, University of Nevada, Reno - PhD student
Catherine Connolly, Northwest Regional Professional Development Program, K-12 science coordinator

2:00pm - 3:00pm in Sidewinder - Session A

The United States Department of Education’s 2017 report on education technology, state 18% of reporting districts claim their staff are sufficiently trained for technology use in the classroom. This presentation will show how one Nevada school district is seeking to fill the professional development gap around an emergent technology, 3D printing.

Format: Workshops

Patterns of Interest and Identity in Teacher Preparation Coursework for STEM Undergraduates

Jennifer C Stark, University of West Florida
John Pecore, University of West Florida; Melissa Demetrikopoulos, Director of Scientific Communications Institute for Biomedical Philosophy;
Kwame Owusu-Daaku, University of West Florida

2:00pm - 3:00pm in Snowbird - Session A

This quantitative study examined patterns of interest and identity in introduction to education and STEM methods courses taken by STEM undergraduates. Students expressed favorable attitudes yet about half of them did not continue on the path to teaching. Additionally, those who continued on expressed less interest in teaching in high needs schools.

Format: Individual Paper Presentation  Presider: Selina Bartels

Building a Learning Organization: An Investigation of Two District Science Coordinators

Hatice Ozen-Tasdemir,
Khushbu Singh, Clemson University; Julie Luft, University of Georgia; Brooke A. Whitworth, Clemson University

2:00pm - 3:00pm in Snowbird - Session B

This study examines how two DSCs progress professionally and how they assist science teachers while participating in a professional development program. Interviews, weekly logs of professional learning, and artifacts were collected and analyzed qualitatively. The findings revealed that personal mastery and team learning were important to the DSCs.

Format: Individual Paper Presentation  Presider: Selina Bartels
A Validation of Teaching Efficacy Beliefs Instrument for Certified Chemistry Teachers
Philomena N Agu, University of Houston-Downtown
2:00pm - 3:00pm in Snowbird - Session C
Existing STEBI was developed for elementary and middle school science, creating gap in high schools. STEBI was adapted and its validity and reliability established by Principal Component Analysis and Cronbach’s alpha. The new scale was used to investigate Teaching Efficacy Beliefs of Broad Field and Subject-Specific certified chemistry teachers.

Format: Individual Paper Presentation  Presider: Selina Bartels

Improving Student Reasoning About Technological Issues: a New Role for the “T” in STEM
Jacob Pleasants, University of Oklahoma
2:00pm - 3:00pm in Solitude - Session A
The goal of this conceptual paper is to offer a new way of thinking about the “T” in STEM. It charts a course for STEM education – and STEM teacher education – that prepares students to reason about technological issues.

Format: Individual Paper Presentation  Presider: Allan Feldman

Relationships Between Cross-Cutting Concepts and Practices on the NGSS
Tomoki Saito, Juntendo University
2:00pm - 3:00pm in Solitude - Session B
In this study, the author analyzed the texts on the NGSS and identified certain relationships between seven Crosscutting Concepts and eight Practices. The work was relied on the mixed methods approach and supported by quantitative text mining and qualitative coding. The findings will support educators or teachers developing curriculum.

Format: Individual Paper Presentation  Presider: Allan Feldman

Integrated Content Designed and Enacted: Empowering Students Through Environmental Justice and Data Science
Hillary Henry, University of Pittsburgh
Holly Plank, University of Pittsburgh; Cassie Quigley Ph. D., University of Pittsburgh
2:00pm - 3:00pm in Solitude - Session C
The purpose of this qualitative research study is to understand the process of how teachers design and implement a curriculum that integrates Environmental Justice and data science, as well as, using the findings from this phase of the project to create curricular and instructional supports for justice oriented computer science curriculum.

Format: Individual Paper Presentation  Presider: Allan Feldman
Developing, Implementing, and Refining Approaches for Teaching Science for Social Justice and the Emergence of Teacher Leadership

Emily Lisy, University of Connecticut
Todd Campbell, University of Connecticut

2:00pm - 3:00pm in Sundance - Session A

Teaching science for social justice is an important aim for science teachers. Given this, we present a case study examining how a science department took up this aim across an academic year. Relatively, we also explored the under-examined role of teacher leadership in social justice and equity pursuits in this context.

Format: Individual Paper Presentation  Presider: Jon Lau

A Sociotechnical Approach to Engineering Education: Engineering Social Justice for Elementary Pre-Service Teachers

David Kimori, Minnesota State University, Mankato
Charlene Ellingson

2:00pm - 3:00pm in Sundance - Session B

In this paper, we describe an assignment that we have developed in our Engineering for Elementary Teachers course. The assignment is designed to address issues of social justice within the engineering design process. We share insights pre service teachers gained about the relationship between engineering and issues of social justice.

Format: Individual Paper Presentation  Presider: Jon Lau

INthinking – an Integration-Focused Approach to Teaching for Equity, Inclusion, and Justice

Christopher L Irwin, Florida International University
Joshua Ellis, Florida International University

2:00pm - 3:00pm in Sundance - Session C

INthinking is a framework designed to address the specific challenges of combining science teaching with the goals of promoting equity, inclusion, and social justice. Participants in this interactive session will use INthinking to frame teaching for equity, inclusion, and justice as within the familiar expertise of science teachers.

Format: Individual Paper Presentation  Presider: Jon Lau

Beea Citizen Scientist

Kaitlin U. Campbell
Katherine N. Vela, ; Aurora Villa, ; Tain Curtis, ; Dori Feichko, ; Cynthia Hall, ; Leslie Larsen, ; Shannon Rhodes, ; Lisa Saunderson; Douglas Weber.

2:00pm - 3:00pm in Wasatch

This workshop focuses on how to integrate citizen science into STEAM instruction. We focus on pollinator life cycles, biodiversity, and conservation to engage in scientific practices and cross-cutting concepts. The workshop includes classroom activities which integrate citizen science pollinator projects, mathematics, and hands-on exploration of bookmaking.

Format: General
Engaging in Difficult Discussions on Race in Teacher Educator Preparation Through Visual Media
Felicia M Mensah, Teachers College, Columbia University
2:00pm - 3:00pm in Wildcat - Session A
This study takes a multimodal approach to engage in reflection and dialogue on race and racism, power, and privilege in teacher educator preparation. I use racial literacy and racial consciousness as theoretical lenses for this study that uses visual media artifacts for engaging in difficult discussions in a doctoral course in teacher education.

The Methods of Science Methods: An Analysis of Teacher Education Pedagogy
Joanne K. Olson, Texas A&M University
Holly A. Miller, Texas A&M University
2:00pm - 3:00pm in Wildcat - Session B
This study analyzed video of an entire science methods course to determine what knowledge bases are employed by an expert professor during classroom discourse and in what ways those knowledge bases are used. Timeline coding was employed, and we will share patterns that exist in the use of pedagogical knowledge, content knowledge, and PCK.

Evidence of Reform in Secondary Science Methods Syllabi
Cole J Entress, Teachers College - Columbia University
2:00pm - 3:00pm in Zoom Room - Session A
A qualitative content analysis was performed on 35 secondary science methods course syllabi to assess how well the courses aligned with the goals of the Framework and engaged with issues of diversity, equity, and inclusion. Data suggest that course goals have incorporated the Framework and equity issues, but course assignments do so infrequently.

Using Digital Notebooks in an Elementary Science Methods Course
Ingrid Carter, Metropolitan State University of Denver
Valarie L. Akerson, Indiana University, Bloomington
2:00pm - 3:00pm in Zoom Room - Session B
The purpose of this study was to explore elementary teacher candidates’ ideas about the digital science notebooks they created in an online, asynchronous methods course. Findings elicited the benefits and challenges of using the digital notebook as a student themselves and as a future teacher.
**Why Science Literacy?: A New Tool to Help Teachers Connect With Why They Teach Science**

*Joel D. Donna, University of Wisconsin - River Falls*
*Brant G. Miller, University of Idaho*

2:00pm - 3:00pm in Zoom Room - Session C

Do you have your future or practicing teachers you work with stop and wonder why they teach science and how this might be driving the instructional and curricular choices they make? In this session, we will share a new tool and pilot data from the tool that is designed to help teachers better understand their purposes for teaching science.

*Format: Individual Paper Presentation*

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**Coffee Break**

3:00pm - 3:15pm

*Format: General*

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**Seeking a Broader – Asset-Based and Diversified – View of Pre-Service Elementary Teachers’ Domain-Specific Prior Knowledge of Engineers**

*Karthigeyan Subramaniam, University of North Texas*
*Christopher Sean Long, University of North Texas; Nazia Khan, University of North Texas; Sumreen Asim, Indiana University Southeast; Sarah Losoya, University of North Texas; Chris Ham, University of North Texas; Beck Barton Sinclair, Texas A&M University – Commerce; Mila Rosa Carden, University of North Texas*

3:15pm - 4:15pm in Alta - Session A

The presentation reports on a group of science education researchers seeking a broader asset-based and diversified view of pre-service elementary teachers’ (N = 144) domain-specific prior knowledge of engineers using pre-service elementary teachers’ drawings of engineers and narratives of their drawings.

*Format: Themed Paper Set  Presider: Anna Arias*

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**The Work of District Science Leaders Over a Two-Year Period: What Did These Leaders Focus On?**

*Jose M Pavez, University of Georgia*
*Harleen Singh, Medaille College; Yuki Huan, University of Georgia; Will Gorton, University of Georgia; Joon Kum, University of Georgia; Julie Luft, University of Georgia; Brooke Whitworth, Clemson University*

3:15pm - 4:15pm in Brighton - Session A

This study explores how district science coordinators (DSCs) led their districts during the pandemic academic year (‘20-‘21) and the following year (‘21-‘22). We used a mixed methods design. The analyzed data consisted of DSCs’ reports of their work, a survey, and DSC interviews over two years, and revealed how DSCs prioritized their work.

*Format: Individual Paper Presentation  Presider: Bryan Nichols*
District Science Coordinator Communities of Practice as a Professional Learning Model

*Jennifer M Bateman*, Clemson University

*Brooke A Whitworth*, Clemson University; *Julie A. Luft*, University of Georgia; *Meredith Schwendemann*, Clemson University

3:15 pm - 4:15 pm in Brighton - Session B

This study explored using a Communities of Practice (CoP) model for professional learning with district science coordinators over two years (2020-2022). Results suggest DSCs gained valued from the CoP model and a new network of peers to support their work.

Investigating Science Teachers’ Professional Vision of Argumentation

*Yuxi Huang*, University of Georgia

*Hong Tran*, University of Georgia; *Jose Pavez*, University of Georgia; *Joseph John Deluca*, University of Georgia; *Julie A. Luft*, University of Georgia; *Brooke A. Whitworth*, Clemson University

3:15pm - 4:15pm in Brighton - Session C

We investigated the pattern of science teachers’ professional vision of argumentation and shared a way to elicit and analyze their thoughts when watching argumentation videos.

Simulations and Science Education: A Curious Tale of Epistemic Substitutes

*Ronald W. Rinehart*, University of Northern Iowa

3:15pm - 4:15pm in City Creek - Session A

In this study we examined pre-service teachers’ reasoning about the epistemic status and epistemic function of simulations in the science classroom. The continued rise of evidence based argumentation in science classrooms creates a need to examine how pre-service teachers view simulations and their role in argumentation and model-based inquiry.

Pre-Service Teachers’ Views of Nature of Science After Engaging With a Socioscientific Issues-Based Unit

*Savannah R Graham*, Texas Christian University

*Hayat Hokayem*, Texas Christian University

3:15pm - 4:15pm in City Creek - Session C

This study investigates undergraduate pre-service teachers understanding and views of nature of science before and after engaging with a socioscientific issues-based unit based on the COVID-19 pandemic. In the post-interviews, most students held transitional view of each nature of science aspect (tentativeness, process, society, creativity).
Anchoring Phenomenon-Based STEM Teaching and Learning: Exploring Its Complexities, Promises, and Examples

Sophia Jeong, The Ohio State University
David P Steele, Alder Graduate School of Education; Cynthia Canan, The Ohio State University

3:15pm - 4:15pm in Little Cottonwood - Session A

During this exploratory session, participants will engage in discussion around the use of anchoring phenomenon-based pedagogies, qualities of productive phenomena, as well as brainstorm examples of phenomena to story-line and re-imagine a science or STEM unit. Participants are encouraged to bring examples of their science lessons or units.

Format: Exploratory Session

A Retrospective on Nature of Science Research: A Celebration Norman Lederman's Legacy and Extraordinary Contributions to Science Education

3:15pm - 4:15pm in Millcreek

Format: General

Assessing the Effectiveness of Online Supplemental Instruction in a Community College Introductory Cell and Molecular Biology Course

Jon Lau, University of Nevada Reno

3:15pm - 4:15pm in Parleys - Session A

Here, demographic and environmental variables are assessed through community college STEM students' participation in an online supplemental instruction (OSI) program. The findings suggest that OSI attendance is the strongest predictor of success among multiple student cohorts.

Format: Individual Paper Presentation  Presider: Nate Carnes

General Chemistry Students' Data Analysis and Interpretation Skills and Understanding of Intermolecular Forces

James Nyachwaya, North Dakota State University
Makenzie Jones, University of Northern Iowa; Krystal Grieger, North Dakota State University; Tarah Dahl, North Dakota State University

3:15pm - 4:15pm in Parleys - Session B

This study investigated General Chemistry (II)'s data analysis and interpretation skills, and their ability to explain trends in boiling points of different compounds using knowledge of intermolecular forces.

Format: Individual Paper Presentation  Presider: Nate Carnes
Determining College Students’ Understanding of the Central Dogma of Molecular Biology: A Status Study

Katherine A Sharp, Stephens College
Jeffrey M Chalfant, University of Kentucky; Rebecca M Krall, University of Kentucky

3:15pm - 4:15pm in Parleys - Session C

Misconceptions about the Central Dogma of Molecular Biology persist throughout K12 and college education. This status study determined college students’ understanding while describing the Central Dogma. Students described the relationship between genotype and phenotype but struggled with underlying mechanisms and real-world applications.

Format: Individual Paper Presentation  Presider: Nate Carnes

Re-Envisioning Preservice Teacher Preparation: Integrating Science and Literacy Teaching Experiences

Nicole J Glen, Bridgewater State University
Adam Brieske Ulenski, Bridgewater State University; Shawn O’Neill, Bridgewater State University

3:15pm - 4:15pm in Sidewinder - Session A

This workshop will guide educators to plan experiences for preservice teachers that practice research-based, reform-oriented strategies for teaching disciplinary literacy with science, understand the use of language and linguistics within science learning, fit these within a storyline unit structure, and plan for methods course field placements.

Format: Workshops

The Development of Global Energy Topic Program With the Focus of Democratic Citizenship and Its Implication in Teacher Education

Young Shin Park, Chosun University
Kyoung Lee, Kangwon National University; Hyoong Soo Kim, Korea University; Hyoonyong Lee, Kyoungbook National University; James Green, Chosun University; Jyeon Lee, Chosun University

3:15pm - 4:15pm in Snowbird - Session A

This study explored democratic citizenship (DC) for students by developing eight different components of DC as a framework. This study described the development and implementation of the DC framework for preparing supplemental science curriculum materials that can improve students’ appreciation for democratic citizenship.

Format: Individual Paper Presentation  Presider: Kathryn Green

Embedding Authentic Science Research Activities in an Undergraduate Course for Pre-Service Science Teachers

Allan Feldman, University of South Florida
Rita Ortiz, University of South Florida

3:15pm - 4:15pm in Snowbird - Session B

This study investigated the incorporation into a course for preservice science teachers of Food-Energy-Water nexus authentic science research activities on their learning of the science practices. They increased their ability to engage in the practices, intend to incorporate research activities into their teaching, and found the nexus motivating.

Format: Individual Paper Presentation  Presider: Kathryn Green
Comparing the Knowledge and Beliefs of Preservice Teachers Enacting Different Levels of Reforms-Based Teaching

Sarah Voss, Drake University
Isaiah Kent-Schneider, Drake University; Jami Daniel, Drake University; Jerrid Kruse, Drake University; Maryann Huey, Drake University

3:15pm - 4:15pm in Snowbird - Session C

This study explores PCK of student teachers at different levels of reforms-based teaching. Preservice teachers’ personal and enacted PCK were similar, but there were key differences in knowledge and beliefs about teaching. Personal factors and motivations impacting the preservice teachers’ decision-making will be discussed in the presentation.

Format: Individual Paper Presentation  Presider: Kathryn Green

Evaluation of Teacher Designed Integrated STEM Units

Stephanie S Erickson, University of Minnesota
Gillian Roehrig

3:15pm - 4:15pm in Solitude - Session B

This study evaluates the quality of teacher-designed integrated science, technology, engineering, and mathematics (STEM) units. After receiving professional development in integrated STEM, teams of teachers wrote units. This presentation will report on the results of the units’ cohesiveness, and their alignment to integrated STEM frameworks.

Format: Individual Paper Presentation  Presider: Molly Staggs

Supporting K-12 Classroom Teachers’ Use of Makerspaces

Wendy Ruchti, Idaho State University
Nathan Lammers, American Falls School District

3:15pm - 4:15pm in Solitude - Session C

Learning how to use maker pedagogy and technology takes learning and time for both teachers and students. Our presentation will provide a continuum for framing the process of integrating a makerspace and maker education into the school culture, supporting both self-analysis for schools as well as a roadmap for professional development providers.

Format: Individual Paper Presentation  Presider: Molly Staggs

What Does Science Have to Do With Race and Racism? Preparing and Equipping Anti-Racist Science Educators

Lenora M. Crabtree, University of North Carolina Charlotte
Jeanne T. Chowning, Fred Hutchison Cancer Research Center

3:15pm - 4:15pm in Sundance

Science teachers are often not prepared to address issues of race and racism in the context of science. This workshop will provide science teacher educators with curriculum and instructional strategies to support science teachers’ understanding of the construct of race and equip them to engage in inquiry-oriented, anti-racist science education.

Format: Workshops
Collaborating and Co-Teaching: Making the Most of Connections With Our Public School Partners

Leslie U Bradbury, Appalachian State University
Rachel E Wilson, Appalachian State University; Eric C Groce, Appalachian State University; Kirbi Bell, Green Valley School; Carly Mize, Green Valley School

3:15pm - 4:15pm in Wasatch - Session A

We will describe a project where two science educators collaborated with two fifth grade teachers and a social studies educator to implement a multimodal integrated unit based on the novel Blue (Hostetter, 2006). We will share our planning process along with implementation of two of the hands-on science-based activities from the unit.

Format: Exploratory Session

The Not-So-Hidden Clusters of Scholarship in Contextualized Science Education

Michael Giamellaro, Oregon State University
Cory Buxton, Oregon State University; Joseph Taylor, University of Colorado, Colorado Springs; Jean-Philippe Ayotte-Beaudet, University of Sherbrooke; Kassandra L’Heureux, University of Sherbrooke; Marie-Claude Beaudry, University of Sherbrooke; Talal Alajmi, Oregon State University

3:15pm - 4:15pm in Wildcat - Session A

Contextualization is a crosscutting theme that unites many innovations in science education. Network mapping of 935 academic papers' citation patterns identified 13 clusters of approaches to contextualization. Clusters were analyzed and are used to describe the landscape of contextualized science learning.

Format: Individual Paper Presentation  Presider: Richard Lamb

Pseudoscience, Myths & Misinformation as an Introduction to the SEPs

Brian Foley, California State University Northridge
Thomas B Garcia, California State University Northridge

3:15pm - 4:15pm in Wildcat - Session B

Popular media is filled with pseudoscience and junk science which can be motivating topics for students. Science teachers can explore non-science claims as a way to introduce key concepts and Science and Engineering Practices. This session introduces ways to inquire about pseudoscience and the logical fallacies that lead people to believe them.

Format: Individual Paper Presentation  Presider: Richard Lamb

A Document Analysis of NGSS Hub Climate Change Educational Resources for Socioscientific Issue Representation

Jeff Papa, Kent State University
Bridget K. Mulvey, Kent State University

3:15pm - 4:15pm in Wildcat - Session C

This study uses a semi-structured document analysis to evaluate open access resources for their ability to attend to components of the socioscientific issues (SSI) framework. Resources were obtained from NSTA's NGSS Hub and focused specifically climate change. We present findings for their inclusion of essential components of SSI based instruction.

Format: Individual Paper Presentation  Presider: Richard Lamb
The Impact of STEM Professional Development on Teacher Self-Efficacy
Jessica P Marcolini, Florida Gulf Coast University
3:15pm - 4:15pm in Zoom Room - Session Poster
To address the growing demand for quality STEM educators this roundtable will review findings from a phenomenological mixed-method investigation of the long-term impact of STEM professional development on teacher self-efficacy. Participants will engage in conversations on best practices in STEM teacher PD and the overall impact on STEM education.

Format: Individual Paper Presentation

A Literature Review of Research on Game-Based Learning in Science Education: Research Trends and Critical Analysis
kieun EOM, Seoul National University
Sonya Nichole Martin, Seoul National University
3:15pm - 4:30pm in Zoom Room - Session Poster
Analysis of current trends related to context/participants/content area/research aims for use of game-based learning (GBL) in science education is reported. Recommendations for using GBL to teach science are made based on an analysis of results. Implications for practice and questions for future research on GBL in science education are raised.

Format: Individual Poster Presentation

Enhancing Latinx Preservice Teachers’ Conception of Nature of Science (NOS) Using Culturally Contextualized Pictures
Noushin Nouri, UTRGV
Maryam Saberi, Ministry of Education
3:15pm - 4:15pm in Zoom Room - Session Poster
This study examines the effect of using a culturally contextualized activity for communicating some aspects of NOS (observation/inference, subjectivity, and the socio-cultural aspect) with 12 Latinx preservice teachers. Our results showed the effectiveness of considering the participants’ culture on enhancing their targeted NOS ideas.

Format: Individual Paper Presentation

Elementary Teachers’ Understanding and Enactment of Systems Thinking Instruction
Jennifer L Maeng, University of Virginia
Hamid Nadir, UNG-Greensboro; Amanda L Gonczi, Michigan Technological University; Robert Handler, Michigan Technological University
3:15pm - 4:15pm in Zoom Room - Session Poster
We investigated baseline understanding of and confidence integrating systems thinking (ST) for 41 K-6 teachers. Teachers endorsed including ST in instruction, and had low confidence for teaching ST and limited understanding of systems/ST. Findings suggest K-6 teachers need support understanding and improving confidence for teaching ST.

Format: Individual Paper Presentation

Conference Planning Committee Meeting
4:30pm - 5:30pm in Alta and Zoom Room
Format: General
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Time</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Awards Committee Meeting</strong></td>
<td>Fri, January 13</td>
<td>4:30pm - 5:30pm</td>
<td>Brighton and Zoom Room</td>
</tr>
<tr>
<td><strong>Membership/Participation Committee Meeting</strong></td>
<td>Fri, January 13</td>
<td>4:30pm - 5:30pm</td>
<td>Deer Valley and Zoom Room</td>
</tr>
<tr>
<td><strong>Committee of Forum Chairs</strong></td>
<td>Fri, January 13</td>
<td>4:30pm - 5:30pm</td>
<td>Millcreek and Zoom Room</td>
</tr>
<tr>
<td><strong>Elections Committee Meeting</strong></td>
<td>Fri, January 13</td>
<td>4:30pm - 5:30pm</td>
<td>Powder Mountain and Zoom Room</td>
</tr>
<tr>
<td><strong>Professional Development Committee Meeting</strong></td>
<td>Fri, January 13</td>
<td>4:30pm - 5:30pm</td>
<td>Snowbird and Zoom Room</td>
</tr>
<tr>
<td><strong>Regional Unit Directors Committee Meeting</strong></td>
<td>Fri, January 13</td>
<td>4:30pm - 5:30pm</td>
<td>Solitude and Zoom Room</td>
</tr>
<tr>
<td><strong>Communications Committee Meeting</strong></td>
<td>Fri, January 13</td>
<td>4:30pm - 5:30pm</td>
<td>Sundance and Zoom Room</td>
</tr>
<tr>
<td><strong>Publications Committee Meeting</strong></td>
<td>Fri, January 13</td>
<td>4:30pm - 5:30pm</td>
<td>Wildcat and Zoom Room</td>
</tr>
<tr>
<td><strong>Mentor Walk the Lobby Time</strong></td>
<td>Fri, January 13</td>
<td>5:30pm - 5:45pm</td>
<td>Main Lobby</td>
</tr>
<tr>
<td><strong>WISE Dinner</strong></td>
<td>Fri, January 13</td>
<td>6:00pm - 8:00pm</td>
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<tr>
<td><strong>JSTE Editor Reception (By Invitation Only)</strong></td>
<td>Fri, January 13</td>
<td>6:00pm - 8:00pm</td>
<td>Zion</td>
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<tr>
<td><strong>Graduate Student Social</strong></td>
<td>Fri, January 13</td>
<td>8:00pm - 10:00pm</td>
<td></td>
</tr>
</tbody>
</table>
### Saturday, January 14, 2023

#### Breakfast
7:00am - 8:30am in Capitol Reef  
*Format: General*

#### Birds of a Feather
7:15am - 8:15am in Capitol Reef  
*Format: General*

#### Oversight Committee Meeting
7:15am - 8:15am in Sidewinder  
*Format: General*

#### Equity Committee Meeting #2
7:15am - 8:15am in Wasatch  
*Format: General*

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**Preservice Science Teacher Preparation-ELEMENTARY**

#### Preservice Teachers’ Noticing and Implementation of Ambitious Science Teaching and Funneling Moves Within a TeachLivE™ Simulated Classroom

*Heidi L Masters*, University of Wisconsin - La Crosse  
*Lisa N Pitot*, University of Wisconsin - La Crosse  

8:30am - 9:30am in Alta - Session A  
Learning to implement ambitious science teaching (AST) moves is challenging for preservice teachers (PSTs). Providing multiple opportunities for PSTs to practice implementing AST moves in TeachLivE™ and engage in noticing improves their ability to notice AST moves. PSTs also use fewer funneling moves and more frequently encourage argument critique.  
*Format: Individual Paper Presentation  Presider: Helen Meyer*

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**Preservice Science Teacher Preparation-ELEMENTARY**

#### Mixed-Reality Simulations to Develop Elementary Science Teacher Candidates’ Questioning and Discussion Skills

*Corey E. Nagle*, University of West Florida  
*Minkyung Kim*, University of West Florida; *Melissa Demetrikopoulos*, Institute for Biomedical Philosophy; *Tadlee Welty*, University of West Florida; *John L. Pecore*, University of West Florida  

8:30am - 9:30am in Alta - Session B  
This study explored mixed-reality simulations in online platforms focused on questioning and discussion skills of preservice elementary science teachers. An experiential deliberate practice approach resulted in improved skill competencies of participants. Methods and research findings from this mixed-methods study will be presented.  
*Format: Individual Paper Presentation  Presider: Helen Meyer*
While Living It! Collaborating With Middle School Science and Math Teachers to Teach COVID-19 Public Health Issues
Jawaher Alsultan, Imam Abdulrahman bin Faisal University
Allan Feldman, University of South Florida; Matthew O'Brien, University of South Florida; Irem A Ercan, University of South Florida; David Rosengrant, University of South Florida
8:30am - 9:30am in Brighton - Session A
This study focused on supporting middle school science and math teachers to develop and deliver high-quality online instructional units in the context of the COVID-19 pandemic. Findings include the complexity of teaching during the pandemic, the impact of students' socioeconomic status on teaching, and teachers' engagement in action research.

Exploring a Role Identification Activity for Science Teacher Leaders
Sara C Heredia, University of North Carolina at Greensboro
Michelle Phillips, Exploratorium; Sarah Stallings, University of North Carolina at Greensboro; Ti’Era Worsley, University of North Carolina at Greensboro; Julie Yu, Exploratorium
8:30am - 9:30am in Brighton - Session B
This paper presents data from an activity designed to support science teacher leaders to identify the leadership roles they occupy and would like to develop further through professional development. We explore how this activity supports science teacher educators to understand and design for science teacher leaders' professional learning.

The Whole Science Teacher: Representation of Identity in Science Instruction
Heather Shaffery, University of Oklahoma
8:30am - 9:30am in Brighton - Session C
Using teacher stories, interviews, and classroom observations, this study examines the ways two secondary science teachers' personal identities are represented in their classroom implementation of three-dimensional pedagogy. Emphasis is placed on exploring the complexity of identity beyond a narrow definition of "science teacher".

The Effects of Environmental Education Experiences on Students' Connectedness to Nature
Dylan Burgevin, Towson University
Sarah Haines, Towson University
8:30am - 9:30am in City Creek - Session A
We surveyed students participating in environmental education programs associated with school systems and taught by in-service teachers to determine if these experiences are positively shaping students' connections to nature and promoting environmentally responsible behavior. Implications for teacher preparation and in-service PD are discussed.
Watershed Explorers: A Digital Gameful Learning Experience
Alec Bodzin, Lehigh University
Robson Araujo-Junior, Lehigh University; Thomas Hammond, Lehigh University; David Anastasio, Lehigh University; Daphne Mayer, Delaware & Lehigh National Heritage Corridor; Chad Schwartz, Lehigh Gap Nature Center; Kathryn Semmens, Nurture nature Center; Robert Neitz, Jacobsburg Environmental Education Center
8:30am - 9:30am in City Creek - Session B
In partnership with environmental educators, we developed a desktop virtual reality digital gameful learning experience to learn about our watershed’s socio-economic development since the mid-1800s, its industrial history, the spatial aspects of the watershed, and how it changed over time. Implementation with science teachers are discussed.

Informal/Out-of-School Science Education
Gardening Connects Me to Nature: Middle School Students STEM Capital
Laura Wheeler, Utah State University
Kathy Cabe Trundle, Utah State University; Katherine N. Vela, Utah State University; David Joy, Wahlquist Junior High School; Michelle Parslow, Rita Hagevik, UNC-Pembroke
8:30am - 9:30am in Deer Valley - Session A
This research examined how parental encouragement to spend free time outdoors and time spent gardening may affect students’ connections to nature. We found positive significant relationships between these variables. Informal outdoor experiences hold the promise of environmental benefits, including increased connections to nature.

STEM Education
How Do Students’ Science and Mathematics Identities and Their Connection to Nature Impact Their Desire to Pursue STEAM Careers?
Katherine N Vela, Utah State University
Michelle Parslow, Utah State University; Kathy Cabe Trundle, Utah State University; Laura Wheeler, Utah State University; David Joy, Wahlquist Jr High; Rita Hagevik, UNC-Pembroke
8:30am - 9:30am in Deer Valley - Session B
There is a need for teachers to prepare, nurture, and encourage their students to pursue Science, Technology, Engineering, and Mathematics (STEM) pathways. We argue that improving students’ connection to nature will positively impact their mathematics and/or science identities, which will in turn impact their desire to pursue STEM careers.

Ethnoscience and Environmental Education
Measuring Secondary Students’ Perceptions of Bee Conservation
Rita Hagevik, UNC - Pembroke
Kathy Cabe Trundle, Utah State University; Kaitlin U. Campbell, UNC-P; Katherine N. Vela, Utah State University; Laura Wheeler, Utah State University; Michelle Parslow, Utah State University; David Joy, Utah State University
8:30am - 9:30am in Deer Valley - Session C
This study focused on secondary students’ knowledge and attitudes toward bees. We found that students expressed a desire to protect bees and pollinators but underestimated and misidentified native bees while overestimating and misidentifying the honeybee. These findings show how to connect concern for pollinators to broader conservation efforts.
Prepared Preservice Teachers to Use Universal Design for Learning (UDL): Learning Strategies for Science Methods Courses

Teresa Shume, North Dakota State University
Jennifer Stark, University of West Florida

8:30am - 9:30am in Little Cottonwood - Session A

This workshop presents strategies for integrating UDL as a topic into elementary and secondary science methods courses. Participants will partake in abbreviated versions of model learning activities designed to develop preservice teachers' understanding and application of UDL. Instructional resources will be shared.

Teacher Observations: Maximizing Use of Data and Evidence vs. Impressions

Craig Berg, UW-Milwaukee
Anne Levedusky, U of Florida; Christopher Peerenboom, UW-Milwaukee

8:30am - 9:30am in Powder Mountain - Session A

The focus of this session is the utilization of and research on a web-based app teacher observation tool that facilitates extensive data collection, provides instant and detailed analysis, allows for rich feedback, and sets the groundwork for meaningful, evidence-based coaching and reflection.

Augmented Reality: Expanding Our Pedagogical Toolbox in Elementary Science Method Courses

James Hollenbeck, Indiana University Southeast
Sumreen Asim, Indiana University Southeast

8:30am - 9:30am in Powder Mountain - Session B

This exploratory study details elementary teacher candidates' experiences with learning how to teach with augmented reality for the first time in an undergraduate science methods course. The findings can inform science teacher educators about how to best leverage this technology.

Navigating Free STEM Education Resources: A Joint Presentation From the Federal Science Agencies

Melissa Anley-Mills,

8:30am - 9:30am in Sidewinder

Practice Sharing Session: Equity & Social Justice Focused Science Teacher Education

Deborah L Hanuscin,

8:30am - 9:30am in Sundance

Join the Equity Committee and Elementary Methods Forum for an exploratory "Share A Thon" session of practices, approaches, activities, and assignments related to equity and social justice in elementary science/teacher education.
NSTA Preservice Teacher Chapter Program: Engaging the Next Generation of Educators of Science

Donna Governor, University of North Georgia
Flavio Mendez, National Science Teaching Association

8:30am - 9:30am in Wasatch
Inviting all Preservice Teachers and Faculty Advisors to learn about NSTA’s Preservice Teacher Chapter Program with National and Local Preservice Teacher Chapters options.

NSTA has developed the NSTA Preservice Teacher Chapter Program to encourage and support future teachers as they prepare to enter the profession, as well as help them network and connect with the many resources and opportunities provided by the Association. The NSTA Preservice Teacher Chapter Program consists of two types of chapters:

1. the National Preservice Teacher Chapter
2. the Local Preservice Teacher Chapters at Universities or Colleges.

The National Preservice Teacher Chapter supports all Preservice Teachers (active members of NSTA) who are based at higher education institutions without local chapters or groups. The Local Preservice Teacher Chapters at Universities or Colleges are separate but interdependent organizations that have elected to ally themselves with NSTA to encourage professional learning and networking of preservice teachers of science.

Session participants will learn about the opportunities for increased leadership skills, career growth, and networking for students and faculty that the NSTA Preservice Teacher Chapter Program offers.

Takeaway:
Preservice Teachers and Faculty Advisors walk-away informed to participate in NSTA’s Preservice Teacher Chapter Program.

Format: General


Yvonne Franco, University of Tampa
Tom Dolan, St. Leo University

8:30am - 9:30am in Wildcat - Session A
Critical to the teacher candidate (TC), is acquiring the skill set to facilitate inquiry when teaching science and math in the elementary classroom. This study presents ways two teacher educators facilitated TCs’ inquiry-based instructional disposition and confidence, and provides data to suggest implications for science and math methods courses.

Format: Individual Paper Presentation  Presider: Vanessa Louis

Teacher Candidates' Views of Socioscientific Issues-Based Instruction in K-12 Classrooms

Melanie E. Kinskey, Sam Houston State University
Mark H. Newton, East Carolina University

8:30am - 9:30am in Wildcat - Session B
This study compares how the pedagogical approach used to prepare teacher candidates enrolled in science methods and content courses influences their views of incorporating socioscientific issues-based instruction into K-12 classrooms.

Format: Individual Paper Presentation  Presider: Vanessa Louis
Integrating Problem-Based Learning Into Elementary Teacher Preparation: Developing a Problem-Based, Socially Relevant Science and Engineering Content Course for Preservice Teachers

Carolyn Parker, American University
8:30am - 9:30am in Wildcat - Session C

This study describes an undergraduate, preservice, problem-based, science and engineering content course organized by a socially relevant curriculum that supports a more inclusive approach to elementary science and engineering teaching and learning. I will present the course design, samples of assignments, and student outcome data.

Format: Individual Paper Presentation  Presider: Vanessa Louis

Collaboration Space
9:00am - 11:30am in Big Cottonwood
Format: General

Fireside Chat With Forum Chairs
9:30am - 10:15am in Little Cottonwood
Format: General

Fireside Chat With Journal Editors
9:30am - 10:15am in Millcreek
Format: General

Fireside Chat With Awardees
9:30am - 10:15am in Sidewinder
Format: General

Fireside Chat With Presidential Team
9:30am - 10:15am in Wasatch
Format: General

Fireside Chat With Elections Committee
9:30am - 10:15am in Wildcat
Format: General

Preservice Science Teacher Preparation-MIDDLE/SECONDARY

Using Social and Environmental Justice Issues as Anchoring Phenomena in an Innovative Science Teaching Methods Course

Lynne M Zummo, University of Utah
Lauren Barth-Cohen, University of Utah; Holly Godsey, University of Utah; Mary Burbank, University of Utah; Anne Cook, University of Utah

10:30am - 11:30am in Alta - Session A

We share an innovation in the form of a university-based teaching methods course. Designed to support pre-service teachers in using environmental justice issues as phenomena in three-dimensional teaching, this course addresses several challenges facing teacher education. We describe course elements and offer digital materials for teacher educators.

Format: Individual Paper Presentation  Presider: Wendy Ruchti
Comparing the Knowledge and Beliefs of Preservice Teachers Enacting Different Levels of Reforms-Based Teaching.

**Jerrid Kruse**, Drake University  
**Lucas Menke**, Drake University; **Jami Daniels**, Drake University; **Colin Coulter**, Drake University; **Sarah Voss**, Drake University

10:30am - 11:30am in Alta - Session B

This study investigated use of a learning module to support preservice teachers as they explored an SSI. Preservice teachers added to their reasoning about SSI and valued a wide range of learning outcomes related to SSI for their future students including: nature of technology, nature of science, SSR, media literacy, and critical consciousness.

Developing and Using Models as Assessments to Inform the Teaching Progression in the Science Classroom

**Kristin E Mansell**, Texas Tech University  
**Meagan H Foster**, Texas Tech University

10:30am - 11:30am in Brighton - Session A

The rise and establishment of formative assessment strategies in education has proven the effectiveness of strategically timed and placed questioning techniques by educators that illustrate a more robust picture of student learning progression. This study aims to address teacher understanding of modeling techniques and pedagogical decision making.

Balancing Priorities: The Realities of Pandemic Professional Development

**Kristen A. Brown**, Texas Christian University  
**Molly Weinburgh**, Texas Christian University; **Curby Alexander**, Texas Christian University

10:30am - 11:30am in Brighton - Session B

University researchers provided afterschool and summer PD for teachers over two years during the Covid-19 Pandemic. We explore constraints for teacher participation in PD including campus responsibilities, district expectations, and personal priorities and discuss researcher constraints for providing high quality PD during the ongoing Pandemic.

Efficacy of Professional Development Foci in Dismantling Teacher Misconceptions

**Tyler Hansen**, Utah State University  
**Colby Tofel-Grehl**, Utah State University

10:30am - 11:30am in Brighton - Session C

We conducted a meta-synthesis to better understand the foci of professional developments that are most effective in mitigating teacher misconceptions. Articles were coded by grade level and by either being more content focused or more pedagogy focused. Results indicate the content focused professional developments mitigate teacher misconceptions.
**Into the Water - Engaging Pre-Service Teachers to Grow Environmentally Literate Citizenry in 21st Century Classrooms**

*Sarah Nuss*, Virginia Institute of Marine Science  
*Elizabeth Edmondson*, Virginia Commonwealth University; *Lisa Lawrence*, Virginia Institute of Marine Science; *Robbie Higdon*, James Madison University

10:30am - 11:30am in Little Cottonwood - Session A

Pre-service teachers have been identified in the research as the “most effective long range means of diffusing environmental education”. Learn about the VATIDES project as we examine several hands-on resources created, and provide feedback to project staff on a new online Hub for teacher preparation resources related to environmental education.

Format: Workshops

**Science Teaching Rehearsals: Observing, Enacting, and Debriefing Approximations of Practice**

*Ryan S. Nixon*, Brigham Young University  
*Amanda Benedict-Chambers*, Missouri State University; *Amber S. Bismack*, Oakland University; *Sarah J. Fick*, Washington State University

10:30am - 11:30am in Millcreek - Session A

In this workshop participants will 1) observe a teaching rehearsal with preservice teachers, 2) have an opportunity to act as the teacher educator in a rehearsal, and 3) debrief each of these experiences. The focus will be on the implementation of rehearsals in a science methods course, guided by the authors’ research and years of experience.

Format: Workshops

**Perceptions, Myths, and Positive Messaging: Flipping the Narrative to Advocate for Science Teacher Education**

*Steven J Maier*, Northwestern Oklahoma State University  
*Wendy Adams*, Colorado School of Mines

10:30am - 11:30am in Powder Mountain - Session A

How can we best promote our science teacher education programs when persistent negative narratives about the profession exist? In this exploratory session, findings and effective deliverables from the NSF funded program Get the Facts Out will be shared. New ways to celebrate and frame the positives of the profession will be explored.

Format: Exploratory Session
**Engaging Science Teachers in Dialogic Collaborative Action Research to Address “Wicked” Educational Problems**

**Allan Feldman,** University of South Florida  
**Jawaher Alsultan,** Imam Abdulrahman bin Faisal University; **Katie Laux,** Upper Iowa University; **Molly Nation,** Florida Gulf Coast University

10:30am - 11:30am in Sidewinder - Session A

Participants will be introduced to dialogic collaborative action research (D-CAR) and explore its methodological underpinnings. They will also engage in D-CAR as we discuss “wicked problems” associated with recognizing students' identity and voice, as well as those accompanying the evolution of classroom space and personal professional practice.

Format: Workshops

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**Bug Camp: An Alternative Practicum for Future Science Educators**

**Mark Enfield,** Elon University  
**Jen Hamel,** Elon University; **Rebecca Carranza,** Elon University; **Faith Minor,** Elon University

10:30am - 11:30am in Snowbird - Session A

Bug Camp offered two undergraduate students, pursuing futures as science educators, opportunities to explore and practice teaching science to middle school students. Reflexive journaling explored how they developed their identities as educators, learned pedagogies and practices of science teaching, and about educator professionalism.

Format: Individual Paper Presentation  
**Presider:** Alexis Rutt

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**Using the 5 Practice Framework in a Secondary Science Methods Course**

**David Steele,** Alder GSE  
**Sophia Jeong,** The Ohio State University; **Alison Mercier,** University of Wyoming

10:30am - 11:30am in Snowbird - Session B

As preservice teacher educators, we took up the challenge of planning and implementing instruction and facilitating learning opportunities that would prepare PSTs to be well versed in teaching practices and frameworks that can best meet the challenges they might encounter.

Format: Individual Paper Presentation  
**Presider:** Alexis Rutt

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**High School Science Students’ Source of Knowledge**

**Kathryn Green,** Clarke Central High School  
**Lisa Borgerding,** Kent State University; **Claude Gonzalez,** Clarke Central High School

10:30am - 11:30am in Snowbird - Session C

We present research on the sources of knowledge students turn to when answering scientific questions. The results from this mixed-methods study indicates that students have varying beliefs on what constitutes expertise and how to consult the correct expert when learning about science. These beliefs are increasingly important in today's world.

Format: Individual Paper Presentation  
**Presider:** Lenora Crabtree
**How Can STEM Educators Support Veterans Transitioning Into STEM Majors?**

*Kylie J Swanson, UCCS*

*Phillip Morris, UCCS; Lisa M Hines, UCCS*

10:30am - 11:30am in Sundance - Session A

While many veterans try to pursue STEM degrees following the military, they often face hardships that impact their ability to attain their STEM career goals. The goal of this mixed-methods study was to identify factors that contributed to attaining a STEM degree among students who participated in the Military STEM Scholarship Program.

**Geek Culture and STEM Career Attainment**

*Jocelyn A Miller, Texas Tech University*

*Missie J Olson, Texas Tech University; Gina M Childers, Texas Tech University; Kania A Greer, Georgia Southern University*

10:30am - 11:30am in Sundance - Session B

This study explores how geek culture relates to STEM career attainment. Sci-fi convention attendees were interviewed about their experiences with geek culture and STEM. The results suggest that despite participation in geek culture and high interest in science/STEM, the likelihood of holding a career in STEM echoes national demographic trends.

**Tools and Resources for Observing Integrated STEM Education in K-12 Science and Engineering Classrooms**

*Emily A Dare, Florida International University*

*Joshua A Ellis, Florida International University; Gillian H Roehrig, University of Minnesota; Elizabeth A Ring-Whalen, Khomson Keratithamkul, University of Minnesota; Benny Hiwatig, University of Minnesota; Farah Faruqi, University of Minnesota; Latanya Robinson, Florida International University; Mark Rouleau, Michigan Technological University; Christopher Irwin, Florida International University*

10:30am - 11:30am in Wasatch - Session A

This workshop will engage attendees in learning about a new observation protocol designed for observing integrated STEM lessons. Participants will use the protocol with example classroom video of integrated STEM lessons in the context of an online platform designed to support new users. Multiple uses of the protocol will also be discussed.

**Evaluating the Effectiveness of a Flipped Instructional Model on a Student's Cognitive Load, Performance, and Motivation While Learning Chemical Bonding in a General Chemistry Coursework.**

*Bharath S Kumar, Independent Status*

10:30am - 11:30am in Wildcat - Session A

The study showcases how the flipped curriculum can support active learning, higher order thinking, conceptual understanding, and performance in a chemistry unit on chemical bonding. In addition, students' motivation, and cognitive load through the lens of self-determination and cognitive load theories will be examined.
An Assessment of Ideal and Potential States of Laboratory Instruction in Higher Education Introductory Science Settings: A Continuation
William McComas, University of Arkansas
Kate I Walker, University of Arkansas
10:30am - 11:30am in Wildcat - Session B
This session builds on prior work developing a survey of students in four large enrollment, introductory college science classes to determine current practices and gauge perspectives of literature-derived suggestions for the enhancement of laboratory pedagogy. Implications for survey development and teacher education are provided.

Assessments on Confidence and Learning in the Laboratory
Kate I Walker, University of Arkansas
10:30am - 11:30am in Wildcat - Session C
Laboratory experiments remain crucial to student understanding of science concepts. This research addresses the gap in the literature on using pre/post-assessment measures to check students’ knowledge and confidence in learning in the laboratory. Students responded with increased confidence and knowledge in the learning objective after experiments.

Awards Lunch and Business Meeting
12:00pm - 1:30pm in Capitol Reef

Executive Committee Meeting
2:30pm - 4:30pm in Executive Boardroom

Board of Directors Meeting
5:00pm - 8:00pm in Executive Boardroom

Executive Committee Meeting
8:00pm - 8:30pm in Executive Boardroom
Post-Conference Field Trip: Remix: The Geoscience Perspective on Climate Change in Utah: Evidence From Lakes and Glaciers
Larry Krissek
8:00am - 1:00pm
Cost $25
Includes: transportation, field experience, museum admission
Does not include: snacks, water, lunch
Tentative Itinerary
8:00 AM Meet at hotel lobby and travel by van to G.K. Gilbert Geologic View Park
10:00 AM – 11:30 PM Curation of Great Salt Lake and Green River Formation exhibits at Natural History Museum of Utah
11:30 AM – 1:00 PM Tour the Museum on your own
1:15 PM Vans return to hotel OR you can stay until the museum closes at 5:00 PM but you will need to find your own way back to the hotel
Overview:
Utah’s geology and geography provide tremendous scenic beauty, but also carry records of major climatic changes over timescales of thousands to millions of years. This fieldtrip will visit several localities in the Salt Lake City area where evidence of these climatic changes can be observed, with an emphasis on the climate records produced by glaciers and large internally drained lakes (i.e., lakes without an outflowing river, such as the present Great Salt Lake). The focus of this fieldtrip on the geological record of past climate links closely with the topic of the conference keynote address and with Krissek’s workshop on “thinking like a geologist”.

The first stop requires <100 m of walking on a flat paved sidewalk, and the second portion of the fieldtrip is inside an ADA-compliant building.

First Stop:
The first stop will be at the G.K. Gilbert Geologic View Park in Sandy, UT, at the mouth of Little Cottonwood Canyon (see https://geology.utah.gov/map-pub/survey-notes/geosights/g-k-gilbert-geologic-view-park/). At this park a short walk on a flat paved sidewalk allows views of a variety of geologic features: 1) bedrock in the canyon that ranges from 1.7 billion to 31 million years old; 2) a classic U-shaped valley carved by glaciers within the last 100,000 years; 3) the highest elevation shoreline formed by Lake Bonneville, an expanded version of the Great Salt Lake, approximately 18,000 years ago; and 4) evidence of multiple movements on the Wasatch Fault during the last 10,000 years.

If time and weather allow, this portion of the fieldtrip will conclude with stops at the Temple Granite Quarry Historical Monument in Little Cottonwood Canyon (including an optional 0.4 mile walk on a paved path) and at two other locations between Little Cottonwood and Big Cottonwood Canyons to see Lake Bonneville shorelines and sediments.
Second portion:

The second portion of the fieldtrip will consist of a visit to the Natural History Museum of Utah (see [https://nhmu.utah.edu/](https://nhmu.utah.edu/)), where our group discussions will focus on the exhibits of the Great Salt Lake and its immediate predecessors (e.g., Lake Bonneville) and the Green River Formation. In addition to its sedimentary record of past climates, the Green River Formation exhibit at the NHMU also shows excellent examples of exquisitely preserved fauna (e.g., fish, insects) and flora, which themselves carry information about past climates.

After our group visits to the Great Salt Lake and Green River Formation exhibits, participants will have time to explore the remainder of the NHMU on their own. Vans will leave for the conference hotel at approximately 1 p.m. However, the museum stays open until 5 p.m. on Sundays, so those wishing to stay longer can do so and make their own way back to the conference hotel.

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**Presiders**

Franklin Allaire

Dan Alston

Anna Arias

Katey Arrington

Selina Bartels

Jennifer Bateman

Mike Borowczak

Stacey Britton

Kristen Brown

Stephen Burgin

Nate Carnes

Gina Childers

Mandi Collins

Kate Cook

Lenora Crabtree

Iliana De La Cruz

Mark Enfield

Allan Feldman

Brian Foley

Brent Gilles

Kathryn Green

Rebekah Hammad

Sara Heredia

Ron Hermann

Melissa Hulings

Richard Lamb

Jon Lau

Katie Laux

Lindsay Lightner

Vanessa Louis

Alison Mercier

Helen Meyer

Jamie Mikeska

Felicia Moore

Mensah

Bridget Mulvey

Younkyeong Nam

Bryan Nichols

Carolyn Parker

Tamara Peffer

Anjar Putro Utomo

Matt Reynolds

Jeffrey Rozelle

Wendy Rucht

Alexis Rutt

Heather Shaffery

Teresa Shume

Demetrice Smith-Mutegi

David Sparks

Molly Staggs

Jessica Stephenson

Reaves

Karthigeyan

Subramaniam

Ryan Summers

Stephen Thompson

Regina Toolin

Angela Webb

Omah Williams-Duncan

Lynne Zummo
# Past Presidents

## Past ASTE Presidents

<table>
<thead>
<tr>
<th>Years</th>
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<tbody>
<tr>
<td>1957-58</td>
<td>June Lewis</td>
<td>1985-86</td>
<td>Marvin Druger</td>
<td>2012-2013</td>
<td>John Tillotson</td>
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<tr>
<td>1965-66</td>
<td>Ralph Lefler</td>
<td>1993-94</td>
<td>Peter A. Rubba</td>
<td>2020-2021</td>
<td>Gilbert Naizer</td>
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<tr>
<td>1967-68</td>
<td>Sylvan Mickelson</td>
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Past Award Winners

Outstanding Science Educator of the Year (Award I)

1973 Gerald Krockover, Purdue University
1974 No Award Given
1975 Vincent Lunetta, University of Iowa
1976 No Award Given
1977 No Award Given
1978 Harold Jaus, University of Illinois-Chicago
1979 Roger W. Bybee, BSCS
1980 Anton Lawson, Arizona State University
1983 William R. Capie, University of Georgia
1985 James Dudley Herron, Purdue University
1986 Charles R. Coble, East Carolina University
1987 John Penick, University of Iowa
1988 James Barufaldi, University of Texas
1989 Lawrence F. Lowery, University of California
1990 William C. Kyle, Jr., Purdue University
1991 Barry Fraser, Curtin University of Technology, Australia
1993 Cherl Mason, San Diego State University
1994 Patricia Simmons, University of Georgia
1995 J. Preston Prather, University of Virginia
1996 Sandra Abell, Purdue University
1997 Bonnie Shapiro, University of Calgary
1998 William F. McComas, University of Southern California
1999 Patricia Simpson, St. Cloud State University
2000 Wolf-Michael Roth, University of Victoria
2001 John Settlage, Cleveland State University
2002 No Award Given
2003 (10+ yrs): Ronald Bonnstetter, University of Nebraska; (<10 yrs): Michael Clough, Iowa State University
2004 No Award Given
2005 (10+ yrs): Larry Yore, University of Victoria, Canada (<10 yrs): Joanne Olson, Iowa State University
2006 (10+ yrs): Penny J. Gilmer, Florida State University (<10 yrs): John W. Tillotson, Syracuse University
2007 (10+ yrs): James A. Shymansky, University of Missouri-St. Louis (<10 yrs): G. Nathan Carnes, University of South Carolina
2008 (10+ yrs): Kathryn Scantlebury, University of Delaware (<10 yrs): Kathy Cabe Trundle, The Ohio State University
2009 (10+ yrs): Deborah Tippins, University of Georgia (<10 yrs): Catherine Milne, New York University
2010 (10+ yrs): Julie A. Luft, Arizona State University (<10 yrs): Randy L. Bell, University of Virginia
2011 (10+ yrs): Julie Gess-Newsome, Northern Arizona University
2012 (<10 yrs): Rebecca Schneider, University of Toledo
2013 (10+ yrs): Lynn Bryan, Purdue University (<10 yrs): Carla Johnson, University of Cincinnati
2014 Alec Bodzin, Lehigh University (10+ yrs)
2015 Gail Jones, North Carolina State Univ. (10+ yrs); Deborah Hanuscin, Univ. of Missouri (<10 yrs)
2016 Rose Pringle, University of Florida (10+ yrs); Erin Peters-Burton, George Mason University (<10 years)
2017 Felicia Moore Mensah, Columbia University, (10+ yrs)
2018 Ron Hermann, Towson University (<10 yrs)
2019 Lisa Martin-Hansen, California State University, Long Beach (10+ yrs); Jerrid Kruse, Drake University (<10 yrs)
2020 Colby Tofel-Grehl, Utah State University (<10 yrs); Gillian Roehrig, University of Minnesota (>10 yrs)
2021 Lauren Madden, The College of New Jersey (<10 yrs); Andrea Burrows, University of Wyoming (<10 yrs)
2022 Julie Contino, American Museum of Natural History (<10 yrs)

**Outstanding Mentor (Award II)**

1997 John Penick, University of Iowa
1998 Hans Anderson, Indiana University
1999 Norman Lederman, Oregon State University
2000 Robert K. James, Texas A & M University
2001 Robert E. Yager, University of Iowa
2002 Walter S. Smith, Ball State University
2003 Larry Enoch, Oregon State University
2004 Catherine Yeotis, Wichita State University
2005 Sandra Abell, University of Missouri-Columbia
2006 Tom Koballa, University of Georgia
2007 Kenneth Tobin, Graduate Center of the City University of New York
2008 Dana Zeidler, University of South Florida
2009 Lloyd Barrow, University of Missouri, Columbia
2010 Kathryn Scantlebury, University 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
2018 William McComas, University of Arkansas
Emeritus Awards/Outstanding Longtime Service to ASTE (Award III)

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

Innovations in Teaching Science Teachers (Award IV)

1990  A Reflective Approach to Science Methods Courses for Preservice Elementary Teachers, Dorothy Rosenthal, California State University-Long Beach
1991  Enhancing Science and Mathematics Teaching, Kenneth Tobin, Nancy Davis, Kenneth Shaw, and Elizabeth Jakubowski, Florida State University
1992  The Learning Cycle as a Model for the Design of Science Teacher Preservice and Inservice Education, Peter Rubba, Pennsylvania State University
1993  Reconstructing Science Teacher Education Within Communities of Learners, Deborah Tippins, University of Georgia, Sharon Nichols, Florida State University, and Kenneth Tobin, Florida State University
1994  No Award Given
1995  Science for Early Adolescence Teachers (Science FEAT): A Program for Research and Learning, Samuel Spiegel, Angelo Collins, and Penny J. Gilmer, Florida State University
1997  Reconceptualizing the Elementary Science Methods Course Using Reflective Orientation, Sandra Abell and Lynn Bryan, Purdue University
1998  What Science Education Standards Say: Implications for Teacher Education, Penny Hammrich, Temple University
1999  No Award Given
2000  Professional Development Programs for Elementary Science Teachers: An Analysis of Teacher Self-Efficacy Beliefs and The Professional Development Model, Tracy J. Posnanski, University of Wisconsin-Milwaukee
2001  Empowering Teachers as Researchers and Inquirers, Anne M. (Amy) Cox-Petersen, California State University, Fullerton
2002  Being There and Not Being “There:” The Experience of Teaching an Elementary Science Education Course on the Internet, Janice Koch and Michael Barriere, Hofstra University
2003  Using a Card-sorting Task to Elicit and Clarify Science Teaching Orientations, Patricia Friedrichsen, University of Missouri-Columbia and Thomas Dana, Pennsylvania University
2004  An Inquiry-based Laboratory Lesson to Construct an Understanding of Earth’s Seasons, Paul Ashcraft, Clarion University and Susan Courson, Clarion University
2005  No Award given
2006  No Award given
2007  Using Historical Non-fiction and Literature Circles to Develop Elementary Teachers' Nature of Science Understanding, Sharon E. Nichols, The University of Alabama & William Straits, California State University Long Beach
2008  A Case Study of Fifth Grade Teachers’ Changes in Methodology During a Two-Year Timeframe, Anita Martin and Brian Hand, University of Iowa
2009  Flexibly adaptive professional development in support of teaching science with geospatial technology, Nancy M. Trautmann, Cornell University & James G. MaKinster Hobart & William Smith Colleges
2010  Learning to Teach Science Through Collaboration: Coteaching and Cogenerative Dialogue in Elementary Science Methods Courses, Christina Siry, University of Luxembourg, Nicole Lowell, Elizabeth Zawatski, Manhattanville College
2011  Exploring Multiple Outcomes: Using Cogenerative Dialogues and Coteaching in a Middle School Science Classroom, Nicole K. Grimes, The Graduate Center, The City University of New York What about those left behind? A template for developing quality science lessons for English language learners, Susan Gomez-Zwiep and William J. Straits, California State University, 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 Adolphus 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 & 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
2018, Collaborating to teach elementary science methods in the field with K-6 classroom teachers: Benefits for in-service and pre-service teachers.  Matthew Vick, University of Wisconsin, Whitewater; Patricia Falk Mukwonago Area School District
2019, A Curriculum-linked Professional Development Approach to Support Teachers’ Adoption of Socio-Environmental Science Investigation Alec Bodzin, Lehigh University; Thomas Hammond, Lehigh University; Kate Popejoy, Popejoy STEM LLC; William Farina, Lehigh University, David Anastasia, Breena Holland, James Carrigan, Scott Rutzmoser, Dork Sahagian
2020, CyberSecurity and Technology: How do they Fit into a Science Classroom? Andrea C. Burrows and Mike Borowczak, University of Wyoming.
Implications of Research for Educational Practice (Award V)

1978 Teacher Behavior Does Make a Difference in Hands-On Science Classrooms, James A. Shymansky, University of Iowa, and John E. Penick, University of Iowa
1981 Wait-time and Learning in Science, Kenneth Tobin, Western Australia Institute of Technology and William Capie, University of Georgia
1983 The Disadvantaged Majority: Science Education for Women, Jane Butler Kahle, Purdue University
1984 Training Science Teachers to Use Better Teaching Strategies, Russell H. Yeany and Michael J. Padilla, University 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, University of Georgia
1987 Training Teachers to Teach Effectively in the Laboratory, Pinchas Tamir, The Hebrew University
1988 What Can Be Learned From Investigations of Exemplary Teaching Practice, Kenneth Tobin, Florida State University
1990 Helping Students Learn How to Learn: A View from a Teacher-Researcher, Joe Novak, Cornell University
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 University
1994 Teaching Evolution: Designing Successful Instruction, Lawrence Scharmann, Kansas State University
1995 Using Visits to Interactive Science and Technology Centers, Museums, Aquaria and Zoos to Promote Learning in Science, Leonie Rennie and Terrence McClafferty
1996 General Biology: Creating a Positive Learning Environment for Elementary Education Majors, Larry Scharmann and Ann Stanheim-Smith, Kansas State University
1997 Empowering Science Teachers: A Model for Professional Development, Ann Howe, University of North Carolina at Raleigh and Harriet Stubbs, North Carolina State University
1999 A Dynamical Systems Based Model of Conceptual Change, Andrew Hurford, Haskell Indian Nations University
2000 Teachers and Technology: A Case Study From an Implementation Project, Myra Halpin and Ann Howe, North Carolina School of Science and Mathematics, and North Carolina State University

2002 What Knowledge is of Most Worth for Lateral Entry Secondary Science Teachers? William R. Veal, University of North Carolina at Chapel Hill

2003 Teacher Student Con-Construction in Middle School Life Science, Maria Nunez-Oviedo, University of Massachusetts-Amherst, Mary Ann Rea-Ramirez, Hampshire College, John Clement and Mary Jane Else, both of, University of Massachusetts-Amherst


2005 Culturalized Science Instruction: Exploring Its Influence upon Black and White Students’ Achievement, Eileen Parsons, North Carolina State University

2006 No Award given

2007 Narrative of Community: Visualizing Culturally Relevant Science Pedagogy Through the Identities of Black Middle School Teachers, M. Jenice Goldston and Sharon E. Nichols, The University of Alabama


Co-Winner: Paper 2 – Expanding the Ways in Which Urban Students Participate in Science Education: Rituals, Transactions, and Fundamental Interactions, Christopher Emdin, Teachers College, Columbia University

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

2010 Exploring Multiple Outcomes: Using Cogenerative Dialogues and Coteaching in a Middle School Science Classroom, Nicole K. Grimes, The Graduate Center, The City University of New York

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

2012 A Mixed Methods Study of Mid-Career Science Teachers: The Growth of Professional Empowerment, Amy Moreland and Mary Hobbs, both of University of Texas at Austin

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

2014 Educational Turbulence: The Influence of Macro and Micro Policy on Science Education Reform, Carla Johnson, Purdue University

2015 Using our Heads and HARTSS (Humanities, ARTs, and Social Sciences): Developing Perspective-Taking Skills for Socioscientific Reasoning, Sami Kahn & Dana Zeidler, University of South Florida.

2016, No Award Given

2017, Prevalence and predictors of out-of-field in the first five years. Ryan Nixon, Brigham Young University; Richard J. Ross, University of Georgia; Julie A. Luft, University of Georgia

2018, No Award Given

2019, Supporting Elementary Teachers’ Enactment of Nature of Science Instruction: A Randomized Controlled Trial. Jennifer Maeng, University of Virginia; Randy Bell, Oregon State University; Tyler St. Clair, SUNY Potsdam;
Amanda Gonczi, Michigan Technological University; Brooke Whitworth, University of Mississippi
2021, A Reform without Time: NGSS and Time for Sense-Making in Elementary Classrooms Joanne Olson, Texas A & M University; Jacob Pleasants, Keene State College; and Kristina Tank, Iowa State University 2021 (graduate student), Challenges of Elementary Preservice Teachers as they Implement Socioscientific Issues in the Elementary Classroom Melanie Kinskey, Sam Houston State University
2022 Developing and Empirically Grounding the Draw-An-Engineering-Teacher Test (DAETT) Tina Vo, University of Nevada, Las Vegas; and Rebekah Hammack, Montana State University 2022 (graduate student), Supporting Secondary Science Preservice Teachers by Exploring Their Science Teaching Identities Regina McCurdy, now a new faculty member at Georgia Southern University.

Past winners of the John C. Park National Technology Leadership Initiative Fellowship

Park, J. C. (2003). Now that we have new technology tools, what is being built? Association for the Education of Teachers in Science (AETS), St. Louis MO. (North Carolina State University)

Irving, K. and Bell, R. (2004). Educational technology use during secondary science student teaching: Three case studies. Association for the Education of Teachers in Science (AETS), Nashville TN. (The Ohio State University, University of Virginia)


Schneider, R. M. (2007). Examining the instructional design of a technology enhanced course for new mentor teachers. Association of Science Teacher Education, Clearwater Beach, FL. (University of Toledo)


Hagevik, R., & Stinger-Barnes, P. (2011). The effects of geospatial informational technologies on preservice science teachers’ technological pedagogical content knowledge. Association for Science Teacher Education, Minneapolis, MN (The University of Tennessee, Carson-Newman University)

Young, T., Farnsworth, B., Grabe, C., & Guy, M. (2012). Exploring new technology tools to enhance astronomy teaching & learning in grades 3-8 classrooms: Year one implementation. Association for Science Teacher Education, Clearwater Beach FL. (University of North Dakota)


CyberSecurity and Technology: How do they Fit into a Science Classroom? (2019). Andrea C. Burrows and Mike Borowczak, University of Wyoming.
2024 ASTE Conference

Building an ethos of care and inclusion in science teacher education

New Orleans, Louisiana January 10-13, 2024

The SASTE region and conference planning committee invite you to join us in New Orleans at the Sheraton on Canal St. near the historic French Quarter next January! Pre-conference adventures begin on Wednesday, January 10th and conclude with the ASTE awards and business luncheon on Saturday, January 13th.

New Orleans was named the #3 Top Destination for City Lovers in the United States in 2022.

*Tripadvisor, Travelers’ Choice - Best of the Best, 2022.*

Here are some reasons to visit this unique southern city.

1. **Weather:** The weather is mild and you can leave your parka at home!
2. **Food:** There are over 1,400 restaurants in New Orleans. The city is home to some of the world’s most unique cuisines. When you come to New Orleans, come hungry.
3. **Music and nightlife:** Jazz bands play live music on the street and in venues such as the famous Preservation Hall.
4. **History:** The city’s historic architecture was constructed over a period of almost three hundred years. New Orleans is home to the National World War II Museum and the Backstreet Cultural Museum among others.

**Nature:** Visit the Audubon Aquarium, Insectarium and Zoo, which are all in the city. Take a short drive to explore the swamps, marshes and bayous of Jean Lafitte National Historical Park and Preserve.

We look forward to hosting you in THE BIG EASY!