On Designing a Science Education Conference Logo in a Pandemic

By Gabriella Fluette
College of Charleston ‘21
Elementary Education Major + Studio Art Minor
South Carolina Teaching Fellow

When hearing the location for the conference, I was instantly inspired. I grew up between Columbia and Newberry, and always loved visiting the upstate. Greenville is especially beautiful, and I knew I wanted to try to capture the natural elements you can find throughout the city. My mind also went to the many bridges and the rivers in our state of South Carolina. With the theme of this conference being “Why Science Education?” (as I student teach in a Pandemic), my mind went to the Heart and to our Health.

As a future educator myself, I want to incorporate science throughout the day and, as an artist, I want to take a STEAM approach. Whether that be through direct instruction, or woven into other lessons and subjects, my goal as a teacher is for my students to recognize the importance of different scientific concepts in their day to day lives. I want them to experiment, interact with the world around them to better understand it, and become familiar with the critical thinking that comes with science learning.

I wasn’t entirely sure what medium I wanted to do this in—I work with many different mediums—but torn collage just felt like the right thing to do. It gives texture in a more abstract way. I also wanted to break up the paper collage with hand-drawn bits, and that’s where I went in with colored pencil for the bridge and water to the left.

Overall, the piece to me represents the importance of nature and how closely related to human health and life it can be. We must care for our environment, as it cares for us. The EKG scan is meant to show how the heart is essential in all teaching.
2022
ASTE Conference Program

Greenville, SC
January 5-8, 2022
# At a Glance

## Wednesday, January 05

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00am—2:30pm</td>
<td>Storying a Place: The Transformative Power of Eco-Experiential Learning (Sponsored by PDE &amp; Stroud)</td>
</tr>
<tr>
<td>3:00pm—5:00pm</td>
<td>Kids Making Sense Workshop</td>
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<tr>
<td>5:00pm—9:00pm</td>
<td>Registration</td>
</tr>
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## Thursday, January 06

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>6:30am—7:30am</td>
<td>Science Teacher Shuffle - Fun Run/Walk</td>
</tr>
<tr>
<td>7:00am—8:30am</td>
<td>Continental Breakfast</td>
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<tr>
<td>8:00am—2:00pm</td>
<td>Registration</td>
</tr>
<tr>
<td>8:00am—8:15am</td>
<td>Presidential &amp; Mayoral Welcome</td>
</tr>
<tr>
<td>8:30am—9:15am</td>
<td>Poster Session 1 &amp; 3MT Viewing</td>
</tr>
<tr>
<td>9:15am—9:30am</td>
<td>Coffee Break &amp; Mini Outdoor Explore</td>
</tr>
<tr>
<td>9:30am—10:15am</td>
<td>Poster Session 2 &amp; 3MT Viewing</td>
</tr>
<tr>
<td>10:30am—11:30am</td>
<td>Concurrent session #1</td>
</tr>
<tr>
<td>11:30am—12:30pm</td>
<td>Lunch on your own/Graduate Student Luncheon</td>
</tr>
<tr>
<td>12:45pm—1:45pm</td>
<td>Concurrent session #2</td>
</tr>
<tr>
<td>2:00pm—4:45pm</td>
<td>Experiential Sessions &amp; Exploring Greenville</td>
</tr>
<tr>
<td>2:00pm—4:45pm</td>
<td>Roper Mountain Science Center Trip</td>
</tr>
<tr>
<td>2:00pm—4:45pm</td>
<td>Restorative Eco-Experiential Drawing</td>
</tr>
<tr>
<td>2:00pm—4:45pm</td>
<td>Falls Park Stream Study</td>
</tr>
<tr>
<td>2:00pm—4:45pm</td>
<td>Exploring the Swamp Rabbit Trail by Bike</td>
</tr>
<tr>
<td>2:00pm—4:45pm</td>
<td>Yoga &amp; Meditation in the Ballroom</td>
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<tr>
<td>4:45pm—5:00pm</td>
<td>Afternoon Coffee Break</td>
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<tr>
<td>5:00pm—6:00pm</td>
<td>Regional Meetings &amp; Equity Committee Meeting</td>
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<tr>
<td>6:00pm—8:00pm</td>
<td>Welcome Reception</td>
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<tr>
<td>8:00pm—9:00pm</td>
<td>President’s (Virtual) Welcome Session</td>
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## Friday, January 07

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<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>7:00am—8:30am</td>
<td>Hot Breakfast</td>
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<tr>
<td>7:15am—8:15am</td>
<td>Forum Meetings - Mentor Mentee Nexus</td>
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<tr>
<td>8:00am—11:00am</td>
<td>Registration</td>
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<tr>
<td>8:30am—5:15pm</td>
<td>Virtual Poster Hall</td>
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<tr>
<td>8:30am—9:30am</td>
<td>Concurrent session #3</td>
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<tr>
<td>9:45am—10:45am</td>
<td>Concurrent session #4</td>
</tr>
<tr>
<td>10:45am—11:00am</td>
<td>Coffee Break &amp; Mini Outdoor Explore</td>
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<tr>
<td>11:00am—12:30pm</td>
<td>Key Note</td>
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<tr>
<td>12:30pm—2:00pm</td>
<td>Lunch on your own/Graduate Student Workshop</td>
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<tr>
<td>2:00pm—5:15pm</td>
<td>Registration</td>
</tr>
<tr>
<td>2:00pm—3:00pm</td>
<td>Concurrent session #5</td>
</tr>
<tr>
<td>3:05pm—4:05pm</td>
<td>Coffee, Cookies, and Committees</td>
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<tr>
<td>3:05pm—4:05pm</td>
<td>Virtual Concurrent Sessions</td>
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<tr>
<td>4:15pm—5:15pm</td>
<td>Concurrent session #6</td>
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<tr>
<td>5:15pm—6:00pm</td>
<td>Mentor Mentee Nexus</td>
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<tr>
<td>5:15pm—6:15pm</td>
<td>JSTE Reception (by invitation only)</td>
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<tr>
<td>6:00pm—7:30pm</td>
<td>Six at Six Social Dinner Meet-ups</td>
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<tr>
<td>6:00pm—8:00pm</td>
<td>WISE Dinner</td>
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**Saturday, January 08**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
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<tbody>
<tr>
<td>7:00am</td>
<td>Continental Breakfast</td>
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<tr>
<td>7:15am</td>
<td>Birds of a Feather</td>
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<tr>
<td>8:30am</td>
<td>Concurrent session #7</td>
</tr>
<tr>
<td>9:30am</td>
<td>Coffee Break &amp; Fireside Chats (President, Awards, Meet the Editors)</td>
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<tr>
<td>9:30am</td>
<td>Fireside Chat with President</td>
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<tr>
<td>9:30am</td>
<td>Fireside Chat with CITE Editors</td>
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<tr>
<td>9:30am</td>
<td>Fireside Chat with Innovations Editors</td>
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<tr>
<td>9:30am</td>
<td>Fireside Chat with ASTE Awardees</td>
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<tr>
<td>9:30am</td>
<td>Fireside Chat with Forum Leaders</td>
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<td>9:30am</td>
<td>Fireside Chat with Elections Committee</td>
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<tr>
<td>9:30am</td>
<td>Fireside Chat with Regional Leaders</td>
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<tr>
<td>9:30am</td>
<td>Fireside Chat with Thread Coordinators</td>
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<td>9:30am</td>
<td>Fireside Chat with NSTA Student Chapter Advisors</td>
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<tr>
<td>9:30am</td>
<td>Fireside Chat with JSTE Editors</td>
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<tr>
<td>10:30am</td>
<td>Concurrent session #8</td>
</tr>
<tr>
<td>12:00pm</td>
<td>Awards Luncheon &amp; Business Meeting</td>
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<tr>
<td>4:00pm</td>
<td>Greenville Food &amp; Drink Tour (not sponsored by ASTE)</td>
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2022 Conference Exhibitors

National Science Teaching Association

Kids Making Sense

Pennsylvania Department of Education, Pennsylvania Meaningful Watershed Educational Experience, & Stroud Water Research Center

Meaningful Watershed Educational Experience

www.stroudcenter.org
Welcome to the 2022 ASTE Annual International Conference

Welcome to the annual meeting in beautiful Greenville, South Carolina. We are especially excited to return to an in-person conference and hope the conference provides an opportunity to reconnect with peers, colleagues, and friends. The last couple of years have presented many professional and personal challenges and we hope this conference is an opportunity to reflect and grow on the new lessons we have learned over the past two years. The pandemic, climate change and social justices issues centered on diversity and inclusion, have reminded us of the importance of science education for the health of ourselves, communities, and nation. For this reason, we chose a conference theme of Why Science Education? We hope the conference presents an opportunity to reflect on the importance of science education so that we can then better explore what constitutes good science education and how to best teach.

We are fortunate this year that the local conference committee, notably Merrie Koester, and the ASTE Environmental Education Forum have prepared an outstanding package of environmentally focused experiences that take advantage of the natural beauty in Greenville. The pre-conference trip Storying a Place: The transformative power of eco-experiential learning is wonderful opportunity to explore Falls Park and experience first-hand the healing power of an urban park. The Thursday opportunities include exploring the Swamp Rabbit Trail by eBike and a visit to the Roper Mountain Science Center.

During the conference we hope you will take advantage of the various ways to connect with each other including the Birds of a Feather breakfast, meeting with a Mentor, Fireside Chats, participating in regional forums, and attending a committee meeting. Each of these present opportunities to network and to get involved.

Our host hotel, the Hyatt Regency, is located at the top of Greenville’s award-winning Main Street. We hope you enjoy the weather and have an opportunity to explore the exciting restaurants, boutiques, and green spaces of the city. Within walking distance of the hotel are the Children’s Museum, History Museum, as well as Falls Park, the Swamp Rabbit Trail, and over 100 restaurants and bars. You can catch the Swamp Rabbit Hockey team take on Atlanta on Friday night. We hope you find time to explore the city just outside the doors of the hotel to find out why Greenville is one of the top trending destinations in the US and one of the top food destinations in the Southeast. You can find more information at https://www.visitgreenvillesc.com/.

Thank you for coming to Greenville and we hope that you will find the conference and the city to be a rewarding professional experience.

Michael Svec (chair), Nate Carnes, Michelle Cook, Cynthia Deaton, Merrie Koester, Christine Lotter, Stephen Thompson, Meta Van Sickle, William Veal

2022 Conference planning committee

Cover art by Gabriella Fluette, pre-service elementary teacher from College of Charleston
Welcome to the 2022 Conference from the ASTE President

Dear Colleagues,

On behalf of the ASTE Board of Directors, it is my sincere pleasure to welcome you to Greenville, South Carolina as we celebrate our 29th Annual ASTE Conference! Planning a conference is never easy—much less planning an in-person conference (with a virtual option) during a pandemic. I would like to acknowledge and thank the 2022 ASTE Conference Planning Committee, chaired by Andrea Burrows; our Conference Program Coordinator, Brooke Whitworth; and the Local Planning Committee, chaired by Michael Svec, as well as our Director of Electronic Services and Executive Director. Thank you as well to the many committee members and volunteers who have helped make this event come to fruition.

The conference is a time to both renew and expand our personal and professional networks, and to support the advancement of science teacher education through sharing our research and practice. For those of you participating in our online conference, I look forward to connecting with you at the President’s virtual social—and hope that you will find the poster hall and concurrent sessions valuable in advancing your own work and building professional connections. We are so thankful we can come together despite geographical distance! For those of you attending in-person, I hope you will take advantage of the opportunities in this year’s program to network with others, and encourage each of us to take the necessary precautions to ensure we can all feel safe doing so.

Birds of a Feather
At breakfast, we encourage you to meet new people—look for table signs to find ‘birds of a feather’ who share similar interests, hobbies, and passions!

Fireside Chats
Take advantage of these informal gatherings during coffee breaks to sit down with the ASTE leadership, journal editors, and others!

Committee Meetings
Grab some coffee and/or cookies and head to one of our committee meetings! These are open to ALL MEMBERS—you can learn more about the work of the committees and opportunities to serve our organization through committee membership.

Regional Meetings
Regions are a great way to connect with other members in your geographic area, and provide additional opportunities for professional growth.

Forums
Forums are member-initiated affinity groups that focus on shared interests and issues—membership in forums is free and open to all! Join a meeting to connect with others and to find out more about ways you can participate in the organization and provide leadership!

It has been my absolute pleasure serving as your President this year, and I thank you for this opportunity. I hope that this organization will be a continued source of inspiration, fellowship, and support for each of you, as it has been for me.

Sincerely,

Deborah (Debi) Hanuscik
ASTE President
# ASTE Leadership

ASTE is governed by a Board of Directors. Directors chair a variety of committees that help conduct the work of the organization in accordance with our Bylaws and Standard Operating Procedures (SOPs).

## 2021 Board Members

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>President*</td>
<td>Debi Hanuscin</td>
<td>Western Washington University</td>
</tr>
<tr>
<td>President Elect*</td>
<td>Rommel Miranda</td>
<td>Towson University</td>
</tr>
<tr>
<td>Past President*</td>
<td>Gil Naizer</td>
<td>Texas A&amp;M Commerce</td>
</tr>
<tr>
<td>Senior Board Member*</td>
<td>Margaret Blanchard</td>
<td>North Carolina State University</td>
</tr>
<tr>
<td>Senior Board Member*</td>
<td>Andrea Burrows</td>
<td>University of Wyoming</td>
</tr>
<tr>
<td>At large Board Member</td>
<td>Judith Morrison</td>
<td>Washington State University Tri-Cities</td>
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<tr>
<td>At large Board Member</td>
<td>Jerrid Kruse</td>
<td>Drake University</td>
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<tr>
<td>At large Board Member</td>
<td>Xavier Fazio</td>
<td>Brock University</td>
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<tr>
<td>At large Board Member</td>
<td>Vanashri Nargund-Joshi</td>
<td>New Jersey City University</td>
</tr>
<tr>
<td>Senior Regional Representative*</td>
<td>Jonah Firestone</td>
<td>Washington State University</td>
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<tr>
<td>Regional Representative</td>
<td>Jennifer Stark</td>
<td>University of West Florida</td>
</tr>
<tr>
<td>Regional Representative</td>
<td>Corrine Lardy</td>
<td>Sacramento State</td>
</tr>
<tr>
<td>Graduate Student Representative</td>
<td>Alexis Riley</td>
<td>Columbia University</td>
</tr>
<tr>
<td>NSTA Director of Preservice Teacher Ed</td>
<td>Donna Governor</td>
<td>University of North Georgia</td>
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</tbody>
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* indicates membership on the Executive Committee

## Administrative Members

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Director</td>
<td>Kate Popejoy</td>
<td>Popejoy STEM, LLC</td>
</tr>
<tr>
<td>Director of Electronic Services</td>
<td>John Rhea</td>
<td>John Rhea Designs</td>
</tr>
<tr>
<td>Conference Program Coordinator</td>
<td>Brooke Whitworth</td>
<td>Clemson University</td>
</tr>
</tbody>
</table>
Session Formats

Concurrent Session Formats

There are several different session formats featured at our annual conference on a regular basis. New formats and events may be planned by the conference chairs, in addition to those listed below.

- **Individual Paper Presentation**: Each one-hour session consists of three individual papers related to the same thread as determined by the conference chairs. Each presenter will discuss a research study, philosophical viewpoint, position, or innovative idea. The session presider will manage the time and facilitate the transition from one presenter to the next. (20 minutes per presenter)

- **Themed Paper or Poster Set**: Each one-hour session consists of a group of presentations related to a common theme as determined by the authors. The proposals must be submitted as a group to be considered as a single themed session. Each presenter will discuss research, a philosophical viewpoint, position, or innovative idea. A discussant may be chosen by the group submitting the themed paper set, but will not be provided by ASTE. Authors will need to determine how to use the allotted time.

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

- **Small Group Roundtables**: Each (one-hour) session offers the opportunity for participants to share and discuss creative pedagogy, issues and trends, culture, history, and research in an intimate and informal manner. Presenters will be paired with two to five presenters with papers on a similar topic. A presider will allow each presenter to provide a brief synopsis (5-7 minutes) and then allow time for whole table group discussion to share perspectives on the issues presented. Audience members may circulate among tables throughout the session.

- **Syllabus Sharing**: This format has been designed for the purpose of sharing science education syllabi. Presenters should include evidence of outcomes or student learning to support the course activities and assessments. To submit a syllabus, select all the appropriate descriptors for this course. These presentations will be grouped into a single poster session. *Syllabus sharing does not apply to the limits on first authorship.

- **Exploratory Session**: This session type is intended to elicit the creativity of our membership to share innovative ideas in innovative ways. Do you envision something relevant to the ASTE membership that doesn’t quite fit a workshop or other format above? Propose this type of format to engage members in a 1-hour session on a topic of your choice. *Keep in mind that this is an “alternative” session type. Attendees will be coming to your session expecting a different experience in some noticeable way. Don’t approach the planning the same way you would any other format, and make sure they leave feeling like it was correctly labeled as an exploratory session.
Session Threads

Conference Threads

The ASTE conference is organized by ‘Threads’ that bring together sessions and topics related to a variety of member interests. Our current Conference Threads and Chairs are listed below.

- **College and University Science Education**: Proposals for this strand will address issues such as conceptual change, content knowledge, pedagogical content knowledge, etc. that are pertinent to higher education science faculty who work with science teachers or science teacher educators, community, and after-school programs.
  
  **Chairs**: Leslie Bradbury and Katie Green

- **Curriculum, Pedagogy, and Assessment**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about curriculum, pedagogy and assessment for current and future science teachers as used by science teacher educators and in science departments.
  
  **Chairs**: Kimberly Lott and Laura Schisler

- **Educational Technology**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about technology use and training for present and future science teachers as used by science teacher educators.
  
  **Chairs**: Jesse Wilcox and Colby Tofel-Grehl

- **Equity & Diversity**: Proposals for this strand will address equity and diversity issues that current and future science teacher educators encounter.
  
  **Chairs**: Terri Bebert and Preethi Titu

- **Ethnoscience and Environmental Education**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about culture, diversity and environmental education for current and future teachers.
  
  **Chairs**: Sarah Carrier and Sarah Haines

- **History, Philosophy, and Nature of Science**: Proposals for this strand will be in the form of practice, theory or research pieces that inform science teacher educators about history, philosophy and the nature of science (not limited to science practices) for current and future science teachers.
  
  **Chairs**: Ryan Summers and Alister Olson

- **Informal/Out-of-School Science Education**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about informal science education for current and future science teachers.
  
  **Chairs**: Michael Dentzay and Michelle Forsythe

- **Policy, Advocacy and Reform**: Proposals for this strand will be in the form of practice, white papers, position statements or research pieces that inform science teacher educators about policy and reform and how each impacts science teacher educators and education.
  
  **Chairs**: Joanne Olson and Daniel Carpenter

- **Preservice Science Teacher Preparation-ELEMENTARY**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about science teacher preparation programs.
  
  **Chairs**: Karl Jung and Tina Vo

- **Preservice Science Teacher Preparation-MIDDLE/SECONDARY**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about science teacher preparation programs.
  
  **Chairs**: Stephanie Phillip and Rachel Sparks

- **Professional Development for Science Teacher Educators (Workshops)**: Proposals for one-hour workshops for science teacher educators can be submitted to this strand. Workshops are currently embedded in the conference schedule, rather than being scheduled preconference.
  
  **Chaired by the PD Committee**
• **Science Teacher Professional Development-ELEMENTARY**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about science teacher professional development.
  *Chairs*: Selena Bartels and Wendy Ruchti

• **Science Teacher Professional Development-MIDDLE/SECONDARY**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about science teacher professional development.
  *Chairs*: Patrick Enderle and Debbie French

• **STEM Education**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about STEM education, our understanding of what STEM means and the National Standards for STEM for future and current science teachers.
  *Chairs*: Ingrid Carter and Emily Dare

• **Student Learning P-12**: Proposals for this strand will be in the form of practice or research pieces that inform science teacher educators about the relationship between student learning and current and future science teachers.
  *Chairs*: Richard Lamb and Stephen Thompson
### Pre-Program & Program Sessions

**Wednesday, January 5**

**Conference Office**  
*7:00am - 8:00pm in Meeting Planner Office*  
*Format: General*

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**Wed, January 05**  
**Storying a Place: The Transformative Power of Eco-Experiential Learning**  
*9:00am - 2:30pm in Redbud A & B*  
Registration Fee $25 (includes lunch, transportation, and materials). Limit 25.

Join local natural resource and conservation specialists, and environmental justice advocates as they guide participants through a multidisciplinary field experience that integrates place-based inquiry practice.

This session is designed to reveal an emerging story that follows the intertwined environmental and social histories of the Reedy River watershed. Navigating the river’s pathway from the urban boundaries of Greenville, our exploration begins on foot at the Hyatt, down to Falls Park on the Reedy, and then continue via shuttle downstream to the Conestee Nature Preserve. The session unravels the threads which make up the tapestry of a Southern community seeking to restore, preserve, and conserve its natural and human assets and emphasizes how individual tales, when united, create an even more resilient fabric. This session frames our conference theme “Why Science?” in a real-world scenario, revealing why our relationships with the land, the air, the water, and all living things matter now, more than ever.

ASTE’s own Merrie Koester will facilitate the workshop which highlights strategies for making the most of taking science and environmental learning outside. Guest presenters include: Brad Wyche, conservationist and founder/former executive director of Upstate Forever, Sylvia Palmer Sustaining Way Board Member, environmental justice activist, and former science teacher in Greenville County Public Schools (among these and many other notable distinctions, Mrs. Palmer was the first African American teacher at Greenville Junior High School), and Sarah Whitmire, Conestee Nature Preserve’s education director.

Note: Be sure to wear comfy shoes and weather appropriate clothes. Please bring a refillable water bottle and a pencil for drawing and journaling  
*Format: General*

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**Wed, January 05**  
**Board of Directors**  
*10:00am - 3:00pm in Boardroom*  
*Format: General*

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**Wed, January 05**  
**Executive Committee**  
*3:00pm - 5:00pm in Boardroom*  
*Format: General*

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**Wed, January 05**  
**University and College Instructors: Engage Your Students With NSTA!**

*Flavio Mendez, NSTA*

*William Veal, College of Charleston*  
*Julianne Wenner, Clemson University*  
*Nathan Carnes, University of South Carolina*  
*Donna Governor, University of North Georgia*  
*Lindsay Simmons, Francis Marion University*

*3:00pm - 5:00pm in Crepe Myrtle*

The mission of the National Science Teaching Association is to promote excellence and innovation in science teaching and learning for all. Presenters will share how they use NSTA’s website to increase their students’ ability to become lifelong learners and how NSTA resources and experiences can help in implementing the NSTA/ASTE 2020 Science Standards for Teacher Preparation. Bring your laptop computer.  
*Format: General*
Hands-on Air Quality Education Through Low-Cost Air Sensors
Olivia Ryder, Kids Making Sense
Josette Marrero, Kids Making Sense

3:00pm - 5:00pm in Redbud A & B

The Kids Making Sense® curriculum unites STEM education with hands-on projects and low-cost sensors to teach students about air pollution and empower them to drive positive change in their communities. We provide educators with resources to teach students how to measure and monitor air quality and how to interpret the data they collect.

Registration
5:00pm - 9:00pm in Atrium Lobby
Format: General
Thursday, January 6

Continental Breakfast
7:00am - 8:30am in Regency A & B
Format: General

Preservice Science Teacher Preparation-MIDDLE/SECONDARY
Thu, January 06

A Science Teaching Competency Framework for Online Learning

Environment
jina Yoon, biology education
Younkyeong Nam, Pusan National University
8:30am - 9:15am in Regency C - Poster
본 연구는 과학예비교사의 온라인 교수실태를 분석하고 교육역량 향상을 위한 온라인 교수설계 프레임워크를 제안한다. 연구의 결과, 온라인 교수설계 프레임워크는 과학 교수설계를 위한
6단계로 도출되었다.
Format: Individual Poster Presentation

Age of Inference: Cultivating a Scientific Mindset

Philip C Short, Austin Peay State University
Harvey Henson, Southern Illinois University; John R McConnell, Austin Peay State University
8:30am - 9:15am in Regency C - Poster
Implications of the swift inundation of data in the Information Age sans the capacity for inferencing skills and ethical applications will be discussed. The relevance and urgency of interdisciplinary alignments among science and education, with an emphasis on analysis and inference, will be highlighted as the Age of Inference is introduced.
Format: Individual Poster Presentation

Using the 5Es to Plan and Implement an Asynchronous Online Course in Science Education

Stephanie Eldridge, University of Georgia
Elgin Leary, University of Georgia
8:30am - 9:15am in Regency C - Poster
We report on the development of a masters’ level online asynchronous course following a 5E structure to support pre-service and in-service science teachers’ curricular planning.
Format: Individual Poster Presentation

Preservice Science Teacher Preparation-ELEMENTARY
Thu, January 06

Examining Preservice Teachers’ Reflection on Their Science Teaching Using Epistemic Network Analysis.

Khushbu Singh, Clemson University
Dr. Cynthia Deaton, Clemson University; Hazel Vega Quesada, Clemson University
8:30am - 9:15am in Regency C - Poster
The study explores prospective elementary teachers’ beliefs about teaching science and the factors they believe are crucial in defining their new role as science teachers. The study used preservice teachers’ philosophy statements for scientific education provided as part of reflective practice.
Format: Individual Poster Presentation
Technology Enhanced Formative Assessment and Argumentation in Virtual/hybrid Classroom

Sharfun Islam Nancy, University of South Florida
Karl G. Jung, University of South Florida

8:30am - 9:15am in Regency C - Poster

This presentation examines one middle school science teacher’s exploration of technology tools for the purpose of incorporating formative assessment and science discourse and argumentation in her online and hybrid classroom during Covid-19 pandemic.

Format: Individual Poster Presentation

Examining Computational Thinking in a Preservice Teacher Education Course

Kristina M Tank, Iowa State University
Mollie H Appelgate, Iowa State University

8:30am - 9:15am in Regency C - Poster

As Computational Thinking (CT) has gained traction, STEM has been suggested as a context for integrating CT into K-12. A multiple case study design was used to examine a model for preparing preservice elementary teachers to embed CT into elementary classrooms. Major themes, potential barriers and implications for teacher education will be shared.

Format: Individual Poster Presentation

Star Stuff: Igniting Imagination in Elementary Science

Richard B Cox, Jr., Winthrop University
Kristin L Cook, Bellarmine University; Sarah B Bush, University of Central Florida

8:30am - 9:15am in Regency C - Poster

How might elementary science instruction be made more imaginative through STEAM? Explore equity and empathy through storytelling, heroic qualities and humanization of content...just a few tools that allow us to provide students with imagination-focused science teaching and learning.

Format: Individual Poster Presentation

The Development and Testing of a Force & Motion Simulation

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

8:30am - 9:15am in Regency C - Poster

This poster session chronicles the development and usability testing of an interactive simulation designed to help elementary school preservice teachers re-learn core concepts regarding force and motion.

Format: Individual Poster Presentation

The Impact of Teacher Residency Programs on STEM Teacher Outcomes

Ji Yun Lee, UC Berkeley
Wendy Yau, Trellis Education; Megan Taylor, Trellis Education

8:30am - 9:15am in Regency C - Poster

The study explored the emerging differences between STEM teachers in residency programs and those from other pathways. The findings suggest that teachers in the residency program reported significantly higher levels of commitment than their counterparts. Although other findings were non-significant, the study is promising support for residencies.

Format: Individual Poster Presentation
Virtual Professional Development for Postsecondary Science and Mathematics 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; Barry Margulies, Towson University; Vanessa Beauchamp, Towson University
8:30am - 9:15am in Regency C - Poster
This HHMI-funded Inclusive Excellence PD Program presentation focuses on: 1) providing professional development for postsecondary science and mathematics faculty to promote effective inclusive teaching practices, and 2) reforming laboratory courses to incorporate authentic research experiences via course-based undergraduate research experiences.
Format: Individual Poster Presentation

Beyond the Bench: Exploring Student Perceptions of Peer-Review and Publication Within the Research Process
Sarah Fankhauser, Oxford College of Emory University
8:30am - 9:15am in Regency C - Poster
The primary literature is an essential component to doing science, yet is generally absent from the science classroom. In this study we examined student perceptions of scientific inquiry, confidence, self-efficacy and identity in STEM after they engaged in a peer-review and publication process of their science research projects.
Format: Individual Poster Presentation

Graduate Teaching Assistants' Conceptions of Science Teaching and Self-Efficacy for Inquiry.
Frackson Mumba, University of Virginia
John C Ojeogwu, University of Virginia
8:30am - 9:15am in Regency C - Poster
We assessed the changes in the conceptions of science teaching and self-efficacy of graduate teaching assistants (GTAs) at a research university before and after an intervention on science teaching in higher education. We also assessed the possible correlation between the GTAs' conceptions of science teaching and self-efficacy.
Format: Individual Poster Presentation

Climate Change Educational Resources at National Parks
Breanna C Beaver, Kent State University
Shannon L Navy, Kent State University
8:30am - 9:15am in Regency C - Poster
Effective climate change education is vital to understanding climate change and mitigating the impacts of climate change. However, it is unknown what climate change educational resources exist across the National Parks in the United States. This study surveyed the National Parks to understand their available climate change educational resources.
Format: Individual Poster Presentation
Comparing Levels of Scientific Proficiency in Exam Questions From the US & Singapore

Jayme K Del Mario, Texas Christian University
Shelly Wu, Texas Christian University

8:30am - 9:15am in Regency C - Poster

The purpose of this exploratory study is to compare the levels of scientific proficiency within a Singapore science content exam and a standardized biology test from the US. The findings showed that the US exam had a high frequency of lower-level science proficiency questions, and the exam from Singapore tested more process skills.

Format: Individual Poster Presentation

Using Data Analytics to Support School Community Scientific Literacy: A Pilot Study

Robert J Ceglie, Queens University of Charlotte

8:30am - 9:15am in Regency C - Poster

Our study provides a unique approach to increasing science literacy in a cohort of preservice teachers. Using data analytics tools and authentic research articles, our teachers created artifacts that demonstrated their scientific literacy knowledge. This study is the beginning of a multi-year exploration of how to better teach scientific literacy.

Format: Individual Poster Presentation

Improving Moroccan Science Professors’ Nature of Science Conceptions and Perceptions of the Relevance of NOS Instruction Through Professional Development

Mila Rosa L. Librea-Carden, Arizona State University
Farnaz Avarzamani, Arizona State University; Peter Rillero, Arizona State University; Florence Hamel, Arizona State University

9:30am - 10:15am in Regency C - Poster

Moroccan pre-service elementary science professors’ conceptions and views of the value of Nature of Science instruction were explored through a professional development program. Overall, findings showed significant improvements in understanding socio-cultural impacts on science and distinguishing between observations and inferences.

Format: Individual Poster Presentation

Fourth Graders Application of Electricity and Environmental Concepts When Designing a Flashlight

Vanashri Nargund-Joshi, New Jersey City University
Heidi Masters, University of Wisconsin-La Crosse (UWL)

9:30am - 10:15am in Regency C - Poster

This study examines application of electricity and environmental concepts in fourth grade classrooms while designing a Flashlight. This case study utilizes the conceptual framework of energy literacy.

Format: Individual Poster Presentation
A Critical Exploration of Rural Science Teachers’ Perspectives of and Relationship to Rural Places and the Implications for Rural Science Teacher Education.

Christine G. Lord, University of Florida

9:30am - 10:15am in Regency C - Poster

To better prepare and support rural science teachers, this qualitative study examines the lived experience of rural science teachers including their perspectives of and relationship to rural places and the influence of their relationship to rural places on their science teaching practices.

Format: Individual Poster Presentation

Preservice Science Teacher Preparation-ELEMENTARY
Thu, January 06

Teaching Innovation: Compassionate Teaching as a Framework to Support Preservice Teachers as Learners and Teachers During and About COVID-19 Pandemic

Bridget K. Mulvey, Kent State University-Main Campus
Jeffrey Papa, Kent State University-Main Campus; Mila Rosa Librea-Carden, Arizona State University; Breanna Beaver, Kent State University-Main Campus

9:30am - 10:15am in Regency C - Poster

We will share a teaching innovation for a compassionate teaching framework with ambitious science teaching practices to support K-3 preservice teachers in a science methods course focused on modeling safety, access, connection, consistency/predictability, flexibility, and empowerment of learners.

Format: Individual Poster Presentation

History, Philosophy, and Nature of Science
Thu, January 06

Weaving History and Content Throughout Science Instruction

Shelby A. Watson, University of Mississippi
Whitney Jackson, University of Mississippi

9:30am - 10:15am in Regency C - Poster

In this study, a professional development session was developed for K-12 science teachers focused on finding, evaluating, and incorporating primary source materials in science instruction. We discuss the design of the session and findings related to teacher outcomes.

Format: Individual Poster Presentation

Student Learning P-12
Thu, January 06

The Age of Dinosaurs: Young Children’s Understandings of Prehistoric Time

Lisa Borgerding, Kent State University

9:30am - 10:15am in Regency C - Poster

This study investigates young children’s understandings of deep time, extinction, and paleontological inferences during a one-week S.T.E.A.M. camp about dinosaurs. Children’s understandings of deep time, succession, and the tentative nature of paleontology varied by age. Very little pre-to-post gains in understanding were documented.

Format: Individual Poster Presentation

Ethnoscience and Environmental Education
Thu, January 06

Interactions Between Religion and Science Education

Mark A. Bloom, Dallas Baptist University
Ian C. Binns, UNC Charlotte

9:30am - 10:15am in Regency C - Poster
This poster will share diverse perspectives and research findings regarding the interactions between religion and science education provided by Sinai and Synapses Fellows and compiled in a special issue of the Electronic Journal for Research in Science & Mathematics Education (EJRSME).

**Format:** Individual Poster Presentation

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**Educational Technology**  
**Thu, January 06**

**Examining the Science and Engineering Practices Implemented by Teachers Through Multiple Instructional Formats**

*Brooke A Whitworth, Clemson University*  
*Hong Tran, University of Georgia; Shaugnessy McCann, University of Georgia; Cheng-Wen He, University of Georgia; Yamil Ruiz, Clemson University; Julie A Luft, University of Georgia*

9:30am - 10:15am in Regency C - Poster  
We examine how science teachers implement science and engineering practices (SEPs) through multiple instructional formats. The study focuses on the relationship between SEPs and the format of instruction.  
**Format:** Individual Poster Presentation

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**Educational Technology**  
**Thu, January 06**

**Reading Reading Science Text With Mixed Reality: Magic Leap vs. Microsoft HoloLens**

*Leonard Annetta, East Carolina University*  
*Denise Bressler, East Carolina University; Ashley Holder, Fayetteville State University; Alexis Dunekak, East Carolina University*

9:30am - 10:15am in Regency C - Poster  
This follow-up study explored whether different mixed reality headsets alter students’ reactions to a science reading activity. Both headsets offered similar benefits to improve the reading experience including audio and visual enhancements. However, students discussed that the HoloLens is good for reading, and the Magic Leap is good for learning.  
**Format:** Individual Poster Presentation

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**Preservice Science Teacher Preparation-MIDDLE/SECONDARY**  
**Thu, January 06**

**The Power of Connection: How Collaborative Co-Planning Between Pre-Service Science Educators and Special Educators Increased Teacher Preparedness and Student Engagement in Their Individual Classrooms**

*Elizabeth Sullivan, Teachers College, Columbia University*  
*Deborah Alexander, Teachers College, Columbia University*

9:30am - 10:15am in Regency C - Poster  
This presentation focuses on collaborative co-planning processes between pre-service science and special educators to increase student engagement via social-emotional learning. The presentation includes a rationale for collaboration, findings from using the strategy and the effects on student learning and participation in different learning spaces.  
**Format:** Individual Poster Presentation

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**Ethnoscience and Environmental Education**  
**Thu, January 06**

**Science Teacher Use of Student Culture**

*Jennifer Heisler, Kent State University*

9:30am - 10:15am in Regency C - Poster  
The purpose of this research was to understand how international middle school science teachers incorporate student culture. A qualitative interpretive approach with interviews was utilized. Specific themes from this study include specific strategies that teachers use, student-teacher relationships, and the role of teachers' funds of knowledge.  
**Format:** Individual Poster Presentation
Modeling “Bellwork” to Pave a Path for a New Parallel Curriculum That Facilitates an Adult Learning Environment in a Science Content Course: A Developing Investigation

Steven J. Maier, Northwestern Oklahoma State University
9:30am - 10:15am in Regency C - Poster
Pilot study findings to be shared of this developing work will include perservice students’ perceptions of the relevance of “Bellwork” regarding content, pedagogy, science disposition, and the nature of science. In addition, a plan for investigating an observed shift to an adult learning environment will be explored.

Format: Individual Poster Presentation

Examining Opportunity Gaps for Students With Disabilities and Students Experiencing Difficulty in Science Using Equity Analytics

Rachel L. Juergensen, University of Missouri Columbia
9:30am - 10:15am in Regency C - Poster
Achievement gap or opportunity gap? Classroom observations of whole-class discussions were conducted in three middle school science classrooms. Equity ratios and results from a chi-square test of independence will be shared as well as examples of instruction that allowed for more equitable participation from students with disabilities difficulaties.

Format: Individual Poster Presentation

Promoting Teachers’ Understanding of the Relationship and Difference Between Science and Engineering: A Novel Set of Instructional Materials

Jacob Pleasants, University of Oklahoma
Jennifer Parrish, University of Northern Colorado; Sofia Alvarez-Briglie, University of Oklahoma; Claudia Colonnello-Olivares, University of Oklahoma; Mariah Warren, University of Oklahoma
9:30am - 10:15am in Regency C - Poster
In this poster, we present a sequence of activities and instructional materials designed to help science teachers deepen their understanding of the difference between science and engineering, and to apply that understanding to classroom science and engineering instruction.

Format: Individual Poster Presentation

A Systematic Review of Science Teacher Identity Development Among Elementary Preservice Teachers: Implications for Science Teacher Educators

Jenna Gist, Purdue University
Brenda Capobianco, Purdue University; Kendra Erk, Purdue University
9:30am - 10:15am in Regency C - Poster
This poster outlines the development of a systematic literature review to identify a new line of research in science teacher education. Results reveal several ways science teacher identity has been conceptualized and provides suggestions for teacher educators to help preservice teachers develop positive identities for reform-based science teaching.

Format: Individual Poster Presentation
Low-Tech...Love or Loathe? Exploring How Tabletop Games Can Benefit Science Education

Denise M. Bressler, East Carolina University
M. Shane Tutwiler, University of Rhode Island; Leonard A. Annetta, East Carolina University

10:30am - 11:30am in Crepe Myrtle

Research shows that high-tech does not always provide a better learning environment than low-tech. This session will make the case that there are extremely valuable low-tech options for science education. Attendees will play with different tabletop science games and discuss the pros/cons of such low-tech options in contrast to high-tech activities.

Elementary Pre-Service Teacher’s Philosophy of Teaching Science Equitably

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

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

This study explores the question: How do elementary teacher candidates’ beliefs about equitable science teaching change from the beginning to the end of a revamped science methods course? Shifts in TCs’ thinking about equitable science instruction, including aspects of culturally responsive teaching and ambitious science teaching are described.

Using Cases to Discuss LGBTQ+ Families With Preservice Elementary Science Teachers

Chelsea M Sexton, University of Georgia
Stephanie S. Eldridge, University of Georgia; David Steele; Sophia Jeong

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

This paper presents an innovation in preservice teacher education with the use of case-based learning to open discussions of LGBTQ+ in elementary science classrooms. Students share their reflections and realizations about how conversations around gender and family structure affect their students in ways they did not realize.

Investigating Pre-Service Teachers’ Noticing of the Cultural Foundations of Children’s Scientific Explanations

Alison Mercier, University of Wyoming
Tierney Hinman, Auburn University

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

This study investigated preservice teachers’ understandings of elementary students’ explanations of scientific phenomena and their cultural foundations, and the discursive moves teacher educators can enact to expand noticings and interpretations.

Creating the Amalgamation: A Study Examining the Characteristics of Preservice Science Teachers’ PCK and PCK Development

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

10:30am - 11:30am in Magnolia - Session A
This longitudinal case study investigated the characteristics of PCK and PCK development among six preservice science teachers during their last year of an undergraduate teacher preparation program, including student teaching and the edTPA portfolio creation process. Implications for science teacher education and future research are discussed.

Preservice Science Teacher Preparation-MIDDLE/SECONDARY
Thu, January 06

**Agency and Conflict: How Two Pre-Service Teachers Navigated a Multi-Tiered Mentoring Program in Science Teacher Education**

*Emelia Pelliccio, Teachers College*

*Jessica Riccio, Teachers College*

**10:30am - 11:30am in Magnolia - Session B**

A multi-tiered model of pre-service teacher mentorship was developed and implemented throughout a one-semester Student Teaching in Science Education course. This study follows two pre-service teachers as they navigated their experiences of learning to teach with each type of mentor in the multi-tiered model.

*Format: Individual Paper Presentation  Presider: Matt Reynolds*

Preservice Science Teacher Preparation-MIDDLE/SECONDARY
Thu, January 06

**One of Our Own: How a First-Year Mentor and Program Alumna Helped a Preservice Chemistry Teacher Learn to Teach Science in Reform-Oriented Ways**

*Ellen Barnett, Trinity University*

**10:30am - 11:30am in Magnolia - Session C**

Mentor teachers play a critical role in preservice teacher (PST) education. This study describes how a first-time mentor and program alumna leveraged knowledge of the science teacher preparation program to provide a more cohesive learning experience between the university and school context and help the PST enact more reform-oriented teaching.

*Format: Individual Paper Presentation  Presider: Matt Reynolds*

**Those Who Don’t Teach...Should Learn**

*Julianne A Wenner, Clemson University*

*Paul J Simmonds, Boise State University; Megan Frary, Boise State University; Donna Llewellyn, Boise State University*

**10:30am - 11:30am in Redbud A & B - Session A**

“Those who can’t do, teach.” This adage is common, perhaps because the general public does not fully understand what teachers do. We will discuss a project that supported graduate students in better understanding science teaching after working with elementary teacher candidates.

*Format: Small Group Roundtables  Presider: Catherine Quinlan*

**Black Novice and Pre-Service Teachers on Choosing Science Teaching**

*Demetrice M Smith-Mutegi, Old Dominion University*

**10:30am - 11:30am in Redbud A & B - Session B**

This study, framed in Expectancy Value Theory (EVT) and Factors Influencing Teaching (FIT) Choice model, employed an explanatory sequential mixed methods research design to explain what factors influence Black novice and pre-service teachers (NPSTs) to pursue a career in science education.

*Format: Small Group Roundtables  Presider: Catherine Quinlan*
Carolyn Parker, American University
Dia Jones, American University

10:30am - 11:30am in Redbud A & B - Session C
The purpose of this study is to understand better the social and emotional supports adolescent Black girls need to pursue and persist in the STEM disciplines and eventual careers. Black girls have a unique set of social and emotional needs in school. Our study gives Black girls the opportunity to give voice to those needs.
Format: Small Group Roundtables Presider: Catherine Quinlan

The Influence of COVID-19 Science Perceptions and Sociocultural Membership on University Biology Students’ COVID-19 Decisions and Policy Support
Benjamin Herman, Texas A&M University
Michael Clough, Texas A&M University; Asha Rao, Texas A&M University; Sarah Poor, Texas A&M University; Ben Janney, Texas A&M University; Alex Sobotka, Texas A&M University; Aaron Kidd, Texas A&M University

10:30am - 11:30am in Redbud C - Session A
This session will address research and pedagogical recommendations based on how 475 university biology students’ perceptions about COVID-19 science (e.g., prevention knowledge and NOS) and sociocultural membership associates with their: 1) COVID-19 behaviors; and 2) feelings that enacted COVID-19 policies are justified.

University Biology Students’ Perceptions of Policymakers’ and Scientists’ COVID-19 Responses
Alex J Sobotka, Texas A&M University
Benjamin A Janney, Texas A&M University; Benjamin C Herman, Texas A&M University; Sarah V Poor, Texas A&M University; Aaron Kidd, Texas A&M University; Michael P Clough, Texas A&M University; Asha Rao, Texas A&M University

10:30am - 11:30am in Redbud C - Session B
Research has identified that complex factors influence socioscientific positions and engagement. Through understanding prevalent justifications associated with levels of support for policymakers and scientists engaged in an emerging socioscientific issue, science educators can better situate content relevant to science and its nature (i.e. NOS).

Philosophy of Science: The Central Issues for Science Education
Michael P. Clough, Texas A&M University
Alister R. Olson, Texas A&M University; Alex J. Sobotka, Texas A&M University

10:30am - 11:30am in Redbud C - Session C
We examined central issues in the philosophy of science (Curd & Cover, 1998; Curd, Cover, & Pinock, 2012) to determine their relevance for preparing (a) teachers to promote robust understanding of science content, science practices, and HNOS; and (b) future HNOS researchers. Pragmatic resources addressing the identified central issues are provided
Pedagogical Practices: Using the 5R Instructional Model and Multimodal Language to Scaffold Entry Into a Chemistry Community of Practice

Molly H Weinburgh, Texas Christian University
Heather Thompson, Texas Christian University

10:30am - 11:30am in Regency G - Session A

We studied a chemistry teacher’s pedagogical practices as he used the 5R Instructional Model and multimodal language during lab. Examples of each R (repeat, reveal, reload, reposition, replace) and four modes provide evidence of opportunities for high school students to use authentic chemistry research as entry into a community of practice.

Format: Individual Paper Presentation  Presider: Kate Walker

General Chemistry Students’ Understanding and Use of ‘Academic Language’ in the Context of a Precipitation Reaction

James Nyachwaya, North Dakota State University
krystal Grieger, North Dakota State University; Tarah Dahl, North Dakota State University

10:30am - 11:30am in Regency G - Session B

This study explored college level general chemistry students’ understanding and use of academic language within the context of a precipitation reaction. The study looked at students’ use of context appropriate vocabulary, and interpretation of academic language.

Format: Individual Paper Presentation  Presider: Kate Walker

Science Teacher Education: Using Conceptual Change Model to Promote Pre-Service Teachers’ Conceptual Understanding of Electrostatics

Johannes Addido, University of Wyoming
Andrea Burrows, University of Wyoming

10:30am - 11:30am in Regency G - Session C

This action research study investigated the efficacy of the Conceptual Change Model (CCM) in addressing pre-service elementary teachers’ misconceptions and promoting conceptual understanding of electrostatics. Results showed that the CCM improved participants’ conceptual understanding and also minimized their misconceptions about electrostatics.

Format: Individual Paper Presentation  Presider: Kate Walker

Validation of a Science Teacher and Local Community Survey

Xavier Fazio, Brock University
Austin Anderson, Brock University

10:30am - 11:30am in Regency H - Session A

One-way to engage students in authentic, relevant and meaningful learning activities is to nest science teaching in their local school communities, that is community-based science. This paper presentation reports on validation of a science teacher and local communities survey highlighting its potential use in future research.

Learn Scientific Research and Experimental Design Through Ethnic Education: A Participatory Action Research in an Indigenous Community in Taiwan.

Mu-Yin Lin, UNIVERSITY OF GEORGIA
10:30am - 11:30am in Regency H - Session B
To connect students’ lifeworlds with the culture of school science, this participatory action research took place in a high school in an Indigenous community. A science education researcher works with teachers and community members to seek what role science education can play in a co-teaching culture-based ethnic education class in Taiwan.

How Environmental Education Can Inform Science Teaching in the COVID-19 Era

Michelle Forsythe, Texas State University
Yun-Wen Chan, Texas State University
10:30am - 11:30am in Regency H - Session C
The pandemic has highlighted the complexity of what people must understand to be functionally literate in the COVID-19 era. Much of this centers on the sociopolitical dimensions of science—dimensions often absent in science classrooms. This theoretical paper argues how Environmental Education can help address these gaps to improve science teaching.

Impact of an External Professional Development Program on Teacher Leadership Identity

Steve G Barth, University of South Carolina
Christine Lotter, University of South Carolina; Jan A Yow, University of South Carolina; Gresi B IrdamBrea Ratliff, Auburn University
10:30am - 11:30am in Studio 220 @ NOMA A - Session A
This study investigated the impact of a 6-year professional development program on secondary STEM teachers’ perceptions of their teacher leader identity. We present the factors identified by the participants as influencing their growth as teacher leaders as well as insights towards understanding the mechanism by which this growth can be promoted.
Format: Individual Paper Presentation  Presider: Brent Giles

Defining Science Teacher Leadership in Practice

Sara C Heredia, University of North Carolina at Greensboro
Michelle Phillips, Exploratorium; Hadrian Pollard, University of North Carolina at Greensboro; Sarah Stallings, University of North Carolina at Greensboro; Ti’Era Worsley, University of North Carolina at Greensboro; Julie Yu, Exploratorium
10:30am - 11:30am in Studio 220 @ NOMA A - Session B
This paper presents definitions of science teacher leadership in practice as narrated by current science teacher leaders working to support the implementation of NGSS. We argue that the huge variation in how science teacher leadership is organized requires local and situated theories of learning to support their professional learning.
Format: Individual Paper Presentation  Presider: Brent Giles
How Do District Science Coordinators Lead the Districts During the Pandemic?

Jose M Pavez, University of Georgia
Harleen Singh, University of Georgia; Yuxie Huang, University of Georgia; Julie Luft, University of Georgia; Brooke Whitworth, Clemson University

10:30am - 11:30am in Studio 220 @ NOMA A - Session C

The purpose of this study is to understand how district science coordinators (DSCs) lead districts during the pandemic. We followed a mixed method design. From the surveys, we identified groups of activities in which DSCs engaged (or not). And from interviews we identified main areas covered by DSCs. Discussion and contribution are provided.

Format: Individual Paper Presentation Presider: Brent Giles

Teaching Universal Design for Learning (UDL) in Elementary and Secondary Science Methods Courses

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

10:30am - 11:30am in Studio 220 @ NOMA B & C

Workshop participants will learn strategies for integrating UDL as a topic into elementary and secondary science methods courses. Participants will experience model teaching and learning activities designed to uncover common barriers to teacher candidates’ understanding and application of UDL. Instructional resources will be shared.

Format: Workshops

Connecting Real-World STEM Research to the Middle and High School Classroom With the Army Education Outreach Program (AEOP) Research Experiences for STEM Teachers and Educators (RESET)

Jennifer R. Meadows, TN Tech University
Kelly Moore, TN Tech University; Leslie Suters, TN Tech University

10:30am - 11:30am in Teal Ballroom

AEOP RESET’s goal is to provide high school and middle school teachers working serving underserved populations a summer research experience at participating Army laboratories and research centers then translate this knowledge and experience into enhanced STEM research curricula.

Format: Exploratory Session

Community-Based Design Research to Promote Equity Oriented Science Education and STEM Careers

Sandra L Yarema, Wayne State University
Jasmine Ulmer, Wayne State University; Marion J Tate, Wayne State University; Joan Chadde, Michigan Technological University; Amy Emmert, Belle Isle Aquarium; June Teisan, Belle Isle Aquarium; Jeffrey Ram, Wayne State University; James Salvo, Wayne State University

10:30am - 11:30am in Think Tank @ NOMA - Session A

This project provided teachers from a large urban school district with interactive workshops and resources to engage their students in place-based STEM activities, including a field trip at a public Aquarium. These learning opportunities were designed to spark excitement in STEM and STEM-related careers amongst diverse students.

Format: Individual Paper Presentation Presider: Lauren Madden
Exploring an Elementary Preservice Teacher’s Evolving Understanding of How to Integrate Multilingual Students’ Lives and Cultural Practices Into Reform-Oriented Science Instruction

Karina Méndez Pérez, University of Texas at Austin
María González-Howard, University of Texas at Austin; Sage Andersen, University of Texas at Austin

10:30am - 11:30am in Think Tank @ NOMA - Session B

In this presentation we describe a case study of a multilingual Latina elementary preservice teacher’s evolving understanding of how to incorporate multilingual students’ lives and cultural practices into planning of reform-oriented science instruction. Findings suggest tensions over student and teacher roles regarding scientific sensemaking.

Format: Individual Paper Presentation  Presider: Lauren Madden

Does Biological Sex Still Influence Students’ Attitudes Toward Science? an Investigation Into One Population of Middle School Students

Michelle L Schpakow, Monmouth University
Jillian L Wendt, University of the District of Columbia

10:30am - 11:30am in Think Tank @ NOMA - Session C

This individual paper presentation will discuss a recent study exploring middle school students’ attitudes toward science based on biological sex. The study used My Attitudes Toward Science (MATS) survey designed to evaluate the multidimensional nature of attitudes toward science. Findings and potential implications will be shared.

Format: Individual Paper Presentation  Presider: Lauren Madden

Lunch on Your Own

11:30am - 12:30pm

Format: General

Graduate Student Luncheon

11:30am - 12:30pm in Regency A & B

Format: General

Educational Technology for Secondary Science Education Methods

Stephanie Philipp, University of Tennessee at Chattanooga
Lauren Angelone, Xavier University (Ohio)

12:45pm - 1:45pm in Crepe Myrtle

This exploratory session will lead participants through a design thinking exercise to consider how we might continue using educational technology in the future based on what we learned from the past year.

Format: Exploratory Session

Opportunities for Teacher Leaders in a Time of Turmoil

Amanda L Gonczi, Michigan Technological University
Christine Lotter, University of South Carolina

12:45pm - 1:45pm in Dogwood - Session A
Data were analyzed to determine if and how 40 teacher leaders influenced educational systems during COVID. The TLs worked to positively influence their systems in a number of ways that facilitated reforms-based science instruction. Findings have implications for how schools can insulate themselves from future educational disruptions.

**Policy, Advocacy and Reform**  
Thu, January 06  

**Merging Disciplines: Clarity, Confusion, or Conflation?**  
*Joanne K. Olson, Texas A&M University*  
*Iliana E. De La Cruz, Texas A&M University; Jacob Pleasants, University of Oklahoma; Chaztin Stigers, Texas A&M University; Syahrul Amin, Texas A&M University*  
12:45pm - 1:45pm in Dogwood - Session B  
In this study, we investigate ways in which teachers and engineers describe to distinguish the science and engineering disciplines after a semester-long collaboration with explicit instruction on both disciplines. We found that more than conflating, individuals struggled to develop clear and distinguishing descriptions of either discipline.

**Development of a Walkthrough Matrix Through Principals' Epistemic Orientation of Science Education**  
*William E Hansen, University of Iowa*  
12:45pm - 1:45pm in Dogwood - Session C  
This presentation explores what public school principals consider to be critical aspects of science education and how these facets can be represented in a walkthrough matrix to assist science teacher evaluation.

**Mentorship for Professional Preparation and Development of Science Teacher Educators**  
*Yvonne Franco, University of Tampa*  
*Stephanie A Arthur, Sharfun Islam Nancy,*  
12:45pm - 1:45pm in Magnolia - Session A  
Acknowledging the need for mentorship for professional development of science teacher educators, this study seeks to understand, in what ways do recent doctoral students describe the relationship among facets of their science-teacher-educator preparation, when mentored? Findings suggest strategies for cultivating skilled science teacher educators.

**Exploring How a Professional Development Program Adapts to Support Elementary Teachers Learning to Teach Science With Representations**  
*Alex Gerber*  
*Meredith Park Rogers, Indiana University; Dionne Cross Francis, University of North Carolina; Joshua Danish, Indiana University; Valerie Akerson, Indiana University*  
12:45pm - 1:45pm in Magnolia - Session B  
In this presentation, I will present work from my dissertation that describes an adaptive PD project and how it supported elementary teachers in learning to teach science with representations. Details will be shared for how the teachers’ practices evolved and how the PD changed throughout one year of the project.
Elementary Teachers’ Emotions Related to Holistic, Individualized Coaching and Students’ Thinking About Representations

Dionne C Cross Francis, University of North Carolina
Alex Gerber, Indiana University; Andrea Phillips, Indiana University; Meredith Park Rogers, Indiana University
12:45pm - 1:45pm in Magnolia - Session C

In this session, we will discuss four elementary teachers’ emotions as they experience holistic individualized coaching during a two-year long PD cycle. Specifically, we examine their emotions around planning, implementing, and reflecting on their science teaching.


Impact of Internship on Undergraduate STEM Students’ Interest in STEM Teaching Introduction

Kristin Cook, Bellarmine University
Akhtar Mahmood, Bellarmine University; Cody Nygard, Bellarmine University; Mira Gentry-Johnson, Kentucky Science Center; Mellisa Blankenship, Kentucky Science Center
12:45pm - 1:45pm in Redbud A & B - Session A

As a part of a NSF funded Noyce Capacity Building project aiming to inspire college-level STEM students to pursue a career in K-12 teaching, this study reports on a partnership between a regional science center and a university efforts to strengthen K-12 STEM teacher education pathways.

Format: Small Group Roundtables Presider: Franklin Allaire

Multidisciplinary STEM Learning Through Archaeology

Laurie E Miroff, Binghamton University
Amber M. Simpson, Binghamton University; Nina M. Versaggi, Binghamton University; Lynda Carroll, Binghamton University; Luann Kida, Binghamton University
12:45pm - 1:45pm in Redbud A & B - Session B

This pilot project, sponsored by the National Science Foundation, explores how archaeology can be used to teach STEM concepts to middle school learners. We present the features of the after-school program and address how the program engaged students' interests and supported their participation as science learners.

Format: Small Group Roundtables Presider: Franklin Allaire

Creation and Implementation of a Virtual Afterschool STEM Club for Elementary Students and Preservice STEM Teachers

Gayle N. Evans, University of Florida
Kristen Apraiz, University of Florida
12:45pm - 1:45pm in Redbud A & B - Session C

We will share insights from our afterschool virtual STEM club for K-5th grade students led by preservice teachers to build a community of learning transcending geography, and other limitations related to in-person attendance. Over two semesters, with three classes of PSTs we discovered benefits a virtual club offers for both K-5 students and PSTs.

Format: Small Group Roundtables Presider: Franklin Allaire
Impacts of NOS on Science Teacher Identity Development and Instructional Goals

*Emily Turner, Georgia State University*
*Robert Bennett, Georgia State University; Renee Schwartz, Georgia State University*

**12:45pm - 1:45pm in Redbud C - Session A**

This presentation will share results of a research study investigating the impacts of explicit and reflective NOS instruction on science teacher identity development and NOS understandings during an online NOS course for secondary science teachers. Implications include suggestions for NOS instruction in science teacher prep programs.

**Format:** Individual Paper Presentation  
**Presenter:** Ben Herman

Appraising Nature of Science Instructional Materials From TeachersPayTeachers for the Middle Grades With a Focus on NGSS Alignment

*Ryan Summers, University of North Dakota*
*Jazmin Nelson, University of North Dakota; Lacey Dickerman, University of North Dakota*

**12:45pm - 1:45pm in Redbud C - Session B**

Today’s teachers are turning to online educational marketplaces, such as TeachersPayTeachers.com (TpT). We conducted a content analysis of 38 highly rated products marketed for grades 6 to 8. We examined the alignment of these materials to the Next Generation Science Standards (NGSS) and representation of nature of science (NOS) ideas.

**Format:** Individual Paper Presentation  
**Presenter:** Ben Herman

Cases on Online Physics Teaching During the Pandemic

*Jaclyn K Murray, Augusta University*

**12:45pm - 1:45pm in Redbud C - Session C**

During Spring 2020, the world shifted to online learning due to the pandemic, and teachers had to quickly transform lessons to adapt to a new and changing environment. How did teachers engage students in physics learning during the pandemic in an online learning environment?

**Format:** Individual Paper Presentation  
**Presenter:** Ben Herman

Supporting SSI-Based Teaching Through Modeling Integration of Complex Social Dimensions

*Rebecca Rawson, University of North Carolina*
*Troy Sadler, University of North Carolina; Patricia Friedrichsen, University of Missouri; Li Ke, University of North Carolina*

**12:45pm - 1:45pm in Regency G - Session A**

This paper demonstrates integrating complex social dimensions into socio-scientific issues-based teaching by using a unit developed around COVID-19 as an example. These instructional activities serve as a model for future SSI teaching approaches by providing opportunities for learners to engage with the social facets of a socio-scientific issue.

**Format:** Individual Paper Presentation  
**Presenter:** Sharfun Islam Nancy

Teaching the Nature of Science With Social Justice in Mind: A Case Approach

*Helen Meyer, University of Cincinnati*
*Lillian Sims, University of Cincinnati; Randall Gibson, University of Cincinnati*

**12:45pm - 1:45pm in Regency G - Session B**

This presentation will share results of a research study investigating the impacts of explicit and reflective NOS instruction on science teacher identity development and NOS understandings during an online NOS course for secondary science teachers. Implications include suggestions for NOS instruction in science teacher prep programs.
The study connects PSTs' NOS and social justice beliefs. We focused on the PSTs' views of the science as a human activity and beliefs about social justice teaching. Over three implementation cycles we gathered data and made refinements to the processes & products. We share our findings about the impact of the project on the PSTs beliefs.


Curriculum, Pedagogy, and Assessment
Thu, January 06

**Middle Grades STEM Teacher’s Engagement With Socioscientific Issues**

Melanie Kinskey, Sam Houston State University  
12:45pm - 1:45pm in Regency G - Session C  
This study explores how middle grades teachers earning a master’s degree in STEM engaged with socioscientific issues during an earth science course.


Preservice Science Teacher Preparation-ELEMENTARY  
Thu, January 06

**Using Nature Journaling to Engage Non-Traditional Learners as Next Generation Elementary Science Teachers**

Meenakshi Sharma, Mercer University  
12:45pm - 1:45pm in Regency H - Session A  
Preparing non-traditional teacher candidates (NTTC) as science teachers is challenging because of their unique learning needs. I used nature journaling and wonder as a pedagogy in an 8-week long, blended, science methods course that specifically served NTTC. It afforded choice, flexibility, and opportunity for experiential learning during pandemic.

Format: Individual Paper Presentation  Presider: Allan Feldman

Ethnoscience and Environmental Education  
Thu, January 06

**Learning About Environmental Issues With a Desktop Virtual Reality Field Trip**

Alec Bodzin, Lehigh University  
Robson Araujo Junior, Lehigh University; Chad Schwartz, Lehigh Gap Nature Center; David Anastasio, Lehigh University; Thomas Hammond, Lehigh University; Brian Birchak, Lehigh Gap Nature Center  
12:45pm - 1:45pm in Regency H - Session B  
A design partnership with informal environmental educators developed a desktop virtual reality field trip (dVFT) to learn about an environmental issue and was implemented in a course with preservice and inservice science teachers. Implications for science teacher educators interested in developing a dVFT are presented.

Format: Individual Paper Presentation  Presider: Allan Feldman

Ethnoscience and Environmental Education  
Thu, January 06

**Nature and Youth - an Exploration of Undergraduates' Childhood Activities in Nature**

Lisa A Gross, Appalachian State University  
Jennifer McGee, Appalachian State University; Mandy Harrison, Appalachian State University  
12:45pm - 1:45pm in Regency H - Session C  
The purpose of this study is to examine the childhood environmental socialization (ES) experiences of two groups of undergraduates enrolled in a course that focuses on nature awareness. Using a convergent mixed methods design, this study identifies and explores connections between ES and current nature experiences.

Format: Individual Paper Presentation  Presider: Allan Feldman
THE IMPACT of EPISTEMOLOGICAL BELIEFS CURRICULAR MATERIALS on the DOMAIN-GENERAL and DOMAIN-SPECIFIC EPISTEMOLOGICAL BELIEFS of MIDDLE SCHOOL SCIENCE STUDENTS

Jaclyn M Easter, Grand View University
Jerrid W Kruse, Drake University; Jesse Wilcox, University of Northern Iowa
12:45pm - 1:45pm in Studio 220 @ NOMA A - Session A

Given the barriers of learning when epistemological beliefs are more traditional, this research seeks to examine how historical short stories with explicit and reflective questions targeting epistemological beliefs concepts may help students develop more sophisticated domain-general and domain-specific science epistemological beliefs (EBs).

Format: Individual Paper Presentation  Presider: Jennifer Oramous

Design Principles for Considering Local/Global Problems Within Project-Based Curriculum Materials

Anna M Arias, Kennesaw State University
Rasheda Likely, Kennesaw State University; Jessica Stephenson Reaves, Kennesaw State University
12:45pm - 1:45pm in Studio 220 @ NOMA A - Session B

Honoring the expertise of students, teachers, and communities to solve global-local problems within curriculum materials requires application of theory and research to support student and teacher learning. This presentation outlines design principles based on theory and research, with examples from a project-based unit for investigating water.

Format: Individual Paper Presentation  Presider: Jennifer Oramous

STEM Coursework and the Development of STEM Self-Efficacy, Outcome Expectations, Interests, and Goals

Drew Gossen, University of South Alabama
12:45pm - 1:45pm in Studio 220 @ NOMA A - Session C

This study examined the relationship between students’ high school course participation and their intent to pursue a STEM career along with the attitudes that play a role in goal selection. This presentation will discuss how certain courses affected students’ attitudes and how these constructs relate to career choice.

Format: Individual Paper Presentation  Presider: Jennifer Oramous

Innovating and Ideating- Leadership and Networking Strategies for Women in Science (WISE)

Jessica F. Riccio, Wise Forum Chair
12:45pm - 1:45pm in Teal Ballroom

This exploratory session will address the unique issues related to Women in Science Education. We will specifically engage in practices to discuss how networks support innovative practices, can be used to develop strengths and review the relationship between innovation and transformational leadership.

Format: Exploratory Session

Identifying District Science Coordinators' Strategies to Promote Equity

Yamil E Ruiz, Clemson University
Shaunegssey McCann, University of Georgia; Julie A Luft, University of Georgia; Brooke A Whitworth, Clemson University
12:45pm - 1:45pm in Think Tank @ NOMA - Session A
District Science Coordinators play an important role in improving teacher practice by developing and leading professional development. Here we report on how district science leaders prioritize equity and what strategies they utilize to promote equity.

**Format:** Individual Paper Presentation  **Presider:** Lisa Pitot

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**Equity and Diversity**  
**Thu, January 06**

**Changing Perceptions: Implicit Use of Gendered and Gender Inclusive Language in a Scientific Context**

*Jocelyn A Miller, Texas Tech University*  
*Missie J Olson, Texas Tech University; Connor G Bryant, Texas Tech University; Rebecca L Hite, Texas Tech University; Gina M Childers, Texas Tech University*

**12:45pm - 1:45pm in Think Tank @ NOMA - Session B**

Language reflects institutional norms and implicit perceptions established in childhood. This study explores how students describe scientists and found that 19.35% of students describe scientists with gender-inclusive language. Further analysis suggests that characteristics students assign to scientists are not associated with gendered language.

**Format:** Individual Paper Presentation  **Presider:** Lisa Pitot

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**Equity and Diversity**  
**Thu, January 06**

**Troubling the Cube: Removing Gender Binarism From a Cube Activity Used to Help Learners Engage in Inquiry-Based Science and Scientific Argumentation**

*Pamela S. Lottero-Perdue, Towson University*

**12:45pm - 1:45pm in Think Tank @ NOMA - Session C**

This work presents a critique and redesign of a cube activity originally developed by the National Academy of Sciences to teach learners about the nature of science. The original activity provides opportunities for learners to engage in argumentation. However, it is problematic in that it reinforces male/female gender dualism.

**Format:** Individual Paper Presentation  **Presider:** Lisa Pitot

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**Thu, January 06**

**Exploring the Swamp Rabbit Trail by Bike**

**2:00pm - 4:45pm in Lobby**

- Registration Fee $32 (price includes highly discounted equipment eBike and helmet rental and tour fees)
- Join host Environmental Education Forum Co-Chair Matthew Clay (Assistant Professor, Fort Hays State University), on a Reedy Rides eBike tour along the Swamp Rabbit Trail (SRT). This SRT is a 22-mile multi-use (walking and bicycling) greenway that traverses along the Reedy River, an old railroad corridor and City parks to connect Travelers Rest with the City of Greenville, South Carolina. Our tour will originate at the Hyatt, move through downtown Greenville via a section adjacent to the Falls Park on the Reedy and onward into explore the blend of nature and history that abounds.

*Note: Participants will be asked to sign a waiver form.*

**Format:** General

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**Thu, January 06**

**Yoga & Meditation in the Ballroom**

**2:00pm - 4:45pm in Regency C**

Join us for one or both 70-minute Mindful Flow and Meditation classes in the Ballroom. A breath-focused flow offering fluid sequences using foundational poses for any level practitioner. Come prepared to breathe, move and finish the practice with a short mediation. One class will run 2:00-3:10pm and a second class will run 3:20-4:30pm. If you’re willing and able, please bring $10 that will be donated to a charity in lieu of paying for the class(es).

**Format:** General
Thu, January 06

**R.E.E.D.ing the Stories in a Park: Restorative Eco-Experiential Drawing as Transformative Practice**

2:00pm - 4:45pm in Studio 220 @ NOMA A

Capacity: 30 No Fee Join science educator and naturalist artist, Merrie Koester, (Director STEAM, Project Draw for Science, Kids Teaching Flood Resilience, University of South Carolina) in Falls Park by the Reedy to create a “storyboard” of your own experience of beauty in an outdoor setting. This session exemplifies an instructional practice appropriate for all forms of interdisciplinary inquiry with a place-based context for learners of all ages, from pre-K through adulthood and can be implemented in urban, suburban, rural, natural, or manmade environments. By encouraging “students” to journal and storyboard and discoveries and observations in their own hand, learners use drawing and visual thinking to connect their classroom experiences to the space in which they live. The “students” expand both cognitively and emotionally, while providing educators insight about the depth and accuracy of their phenomenological and system understanding. Note: Bring a pencil or sketching implement of your choice.

*Format: General*

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Thu, January 06

**Roper Mountain Science Center Field Trip**

2:00pm - 4:45pm in Teal Ballroom

Registration Fee $15 (pays for the bus) - The Roper Mountain Science Center is a unique and innovative education facility supporting the Greenville County School District. The 62-acre center includes a new Environmental and Sustainability center, 23-inch refractor from Princeton University, as well as planetarium, dinosaur trail, living history farm, and other beautiful STEM facilities. The center provides programing for school children, the community, and teacher professional development. Visit [https://www.ropermountain.org/](https://www.ropermountain.org/) for a full description. A bus/coach will provide transportation.

*Format: General*

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Thu, January 06

**Stream Study in Falls Park**

2:00pm - 4:45pm in Think Tank @ NOMA

Capacity: 30 - No Fee Join Environmental Education Forum co-chair Tamara Peffer, (Environment and Ecology Content Advisor, Pennsylvania Department of Education), Steve Kerlin, (Director of Education, Stroud Water Research Center), and Katie Callahan, (Director, Clemson University Center for Watershed Excellence) as for a multidimensional exploration of the Reedy River section that flows though Falls Park. Watershed and stream study practice brings geography, geology, ecology, sociology, economics, hydrology, biology, physics, and chemistry and many other disciplines into one space of impact and understanding. Learn about site assessment, biological survey/collection and inventories, and chemical and physical parameter measurement and calculation protocols and how to bring these practices to life in your preservice programs and in-service professional development offerings. Note: Be sure to wear comfy shoes and weather appropriate clothes. Please bring a refillable water bottle and a pencil for note taking and journaling.

*Format: General*

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Thu, January 06

**Coffee Break**

4:45pm - 5:00pm in Prefunction Area

*Format: General*

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Thu, January 06

**Region Meetings**

5:00pm - 6:00pm

- Mid-Atlantic Region Meeting - Crepe Myrtle
- Southwest Region Meeting - Dogwood
- Northwest Region Meeting - Redbud A & B
- Southeast Region Meeting - Redbud C
- International Region Meeting - Regency G
- Far West Region Meeting - Regency H
- North Central Region Meeting - Studio 220 @ NOMA B & C
- Northeast Region Meeting - Think Tank @ NOMA

*Format: General*
Thu, January 06

**Equity Committee Meeting**
5:00pm - 6:00pm in Magnolia
*Format: General*

Thu, January 06

**Welcome Reception**
6:00pm - 8:00pm in the Atrium
*Format: General*

Thu, January 06

**President's Virtual Welcome Session**
8:00pm - 9:00pm in AS TE Zoom Room
*Format: General*
**Friday, January 7**

**Hot Breakfast**
7:00am - 8:30am in Regency A & B  
*Format: General*

**Forum Meetings**
7:15am - 8:15am
- Women in Science Education Forum - **Crepe Myrtle**
- Technology Forum - **Dogwood**
- Environmental Science Education Forum - **Magnolia**
- Small Colleges and Programs Forum - **Redbud C**
- Graduate Student Forum - **Regency G**
- Inclusive Science Education Forum - **Regency H**
- Policy and Government Relations Forum - **Studio 220 @ NOMA B & C**
- Elementary Methods for Methods - **Think Tank @ NOMA**

*Format: General*

**Mentor-Mentee Nexus**
7:15am - 8:15am in Redbud A & B
*Format: General*

**Regional Director Meeting**
7:15am - 8:15am in Studio 220 @ NOMA A
*Format: General*

**Registration**
8:00am - 11:00am in Atrium Lobby
*Format: General*

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**Curriculum, Pedagogy, and Assessment**

**Science Discourse Patterns Compared With Pedagogical Content Knowledge During a Maker Project in an Elementary School Classroom**

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

8:30am - 9:00am in ASTE Zoom Room - **Session A**

This exploratory case study examines teacher student discourse patterns in science during a Maker project in an elementary school classroom in semi-rural Utah. Our findings indicated that attempts at dialogic discourse during lessons regarding science were hindered by a lack of content knowledge and pedagogical knowledge in the sciences.

*Format: Individual Paper Presentation  
*Presider: Colby Tofel-Grehl*

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**Program Readiness for the 2020 ASTE/NSTA Standards for Science Teacher Preparation**

*Cole J Entress, Teachers College - Columbia University*

8:30am - 9:00am in ASTE Zoom Room - **Session B**
In 2020, both ASTE and NSTA approved a new set of standards to guide teacher preparation programs. Teacher education programs were surveyed about if, and how, their current program addresses these new standards. Results from 25 responding programs indicate that some aspects of the standards may currently be neglected in science teacher education.

**Educational Technology**

**Fri, January 07**

**Enhancement or Transformation? Exploring Experienced Science Teachers’ Technology Integration**

**AKARAT TANAK, Faculty of Education, Kasetsart University, Thailand**  
**SUPPALERK TANAK, Department of Education, Kasetsart University, Thailand**  
**PAULA R DAGON, Woodring College of Education, Western Washington University**

*8:30am - 9:00am in ASTE Zoom Room - Session C*

We examined teachers’ types of technology integration into a science content-specific teaching approach for transforming student learning. We found that teachers’ most commonly integrate technology for 'Enhancement' rather than 'Transformation'. We argue that this contributes to the problem of student-centric pedagogical practices.

**Equity and Diversity**

**Fri, January 07**

**Supporting Equitable, Place-Based Science Education for Early Elementary Children and Their Teachers**

**Tasha Williams, The George Washington University**  
**Kassondra Chappell, The George Washington University**  
**Tiffany-Rose Sikorski, The George Washington University**

*8:30am - 9:30am in Crepe Myrtle*

Place-based education shows promise as a way to help young learners strengthen connections with their local community while studying natural phenomena. Join this exploratory session to collectively imagine what it would take to support early elementary teachers who wish to create equitable, place-based science education for their learners.

**Preservice Science Teacher Preparation-ELEMENTARY**

**Fri, January 07**

**Understanding Identity in Preservice Elementary Science Teachers’ Science Learning Experience Essays**

**Ayca K. Fackler, University of Georgia**

*8:30am - 9:30am in Dogwood - Session A*

How science teachers teach is closely related to how they conceptualize science as a subject to learn and to how they perceive themselves as science learners. Drawing on Gee’s identity theory, this qualitative study examined identity in preservice elementary science teacher’s science learning experience essays.

**Preservice Science Teacher Preparation-ELEMENTARY**

**Fri, January 07**


**Kristina Brendel, University of Central Florida**  
**Malcolm Butler, University of Central Florida**

*8:30am - 9:30am in Dogwood - Session B*

Using a constructivist, positive psychology approach, a teacher educator used group reflection to facilitate discussion of teaching practice amongst elementary preservice teachers. After multiple sessions, there were interesting observations that may prompt research using this approach to improve teacher self-efficacy and reflection rates.
Utilizing Lesson Study for Laying the Foundation for Preservice Teachers to Begin Shaping Elementary Students’ Scientific Literacy

Selina L. Bartels, Valparaiso University

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

This study examined how an integrated preservice elementary education program used lesson study to deepen the practice and planning of scientific literacy intentional teaching during a practicum experience with the science methods.


Science Teacher Candidates’ Questioning and Discussion Skill Performance in a Virtual Simulation Using Experiential Deliberate Practice

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

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

Effective questioning and discussion are fundamental instructional skills for science teacher candidates to master. An experiential deliberate practice approach that provides a virtual learning simulation experience resulted in improved skill competencies of participants. Methods and research findings from this case study will be presented.

Format: Individual Paper Presentation  Presider: Kristin Cook

Assessing Science Teacher Education Programs for Developing Disciplinary Attentiveness

Leslie Atkins Elliott, Boise State University
Michele Carney, Boise State University; Sara Hagenah, Boise State University; Emily Hansen, Boise State University; Simon Pintar, Boise State University

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

In this presentation, we describe item development for an assessment to evaluate a critical aspect of science educator preparation programs: the ability to accurately interpret and productively respond to students’ ideas. We will highlight the need for such an assessment, progress in developing items for this assessment, and future plans.

Format: Individual Paper Presentation  Presider: Kristin Cook

Exploration of Prospective Science Teacher Knowledge Development, Noticing and Their Relationship in Site-Based Teacher Education Courses

Lu Wang, Indiana University Kokomo

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

This study investigated prospective science teachers’ PCK, characterized their noticing, and connected their noticing with their PCK development in site-based teacher education courses. Results indicated that PSTs PCK and noticing are idiosyncratic, but their knowledge development is dependent on what and how they noticed in the practicum.

Format: Individual Paper Presentation  Presider: Kristin Cook
### Structuring Successful STEM Teaching Professional Development for In-Service Teachers

**Amanda M Gunning, Mercy College & Mercy College Center for STEM Education**  
**Meghan E Marrero, Mercy College & Mercy College Center for STEM Education**

**8:30am - 9:30am in Redbud A & B**  
Finding ways to prepare in-service teachers for STEM teaching is a pressing need as the NGSS and societal demands call for more STEM-focused work in K-12 environments. This workshop will focus on teacher-centered approaches to support in-service K-12 teachers’ development of STEM teaching methods using adult learning and equity frameworks.

*Format: Workshops*

### Exploring Why K-12 STEM Teachers Join Communities of Practice at Informal Organizations

**Becky Kamas, Texas Tech University**  
**Gina Childers, Texas Tech University; Joshua Cruz, Texas Tech University; Jill Hoffman, Texas Tech University**

**8:30am - 9:30am in Redbud C - Session A**  
This research investigates why K-12 STEM teachers participate in a community of practice (CoP) facilitated by an informal organization by exploring the CoP critical elements of domain, community, and practice; perceived benefits from participation; and any influences stemming from the facilitating organization.

*Format: Individual Paper Presentation  Presider: Emma Refvem*

### Strands of Learning in Informal Settings Within Pre Service Teacher Education

**Natasha Cooke-Nieves, American Museum of Natural History Richard Gilder Graduate School-MAT Program**

**8:30am - 9:30am in Redbud C - Session B**  
Attendees will be introduced to how the strands of informal science learning are weaved into two preservice science teaching courses in an MAT Program. The innovative model presented can draw connections between formal and informal science education, and as a means to further science education reforms and standards.

*Format: Individual Poster Presentation  Presider: Emma Refvem*

### The Influence of Role-Taking Experiences and Individuals on Science Teaching Career Choice

**Emma Refvem, North Carolina State University**  
**M. Gail Jones, North Carolina State University; Sarah Carrier, North Carolina State University; Tammy Lee, East Carolina University; Amy Taylor, UNC Wilmington; Julianna Nieuwsma, North Carolina State University; Kathryn Rende, North Carolina State University**

**8:30am - 9:30am in Redbud C - Session C**  
This study explored the relationship of science experiences as factors that contribute to science teacher career aspirations. Teachers reported that having teaching- and leadership-related experiences in informal science settings such as being a teaching assistant or tutor and volunteering at a museum were influential in shaping career aspirations.

*Format: Individual Paper Presentation  Presider: Emma Refvem*

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### Collaboration & Writing Space

**8:30am - 6:00pm in Regency F**  
*Format: General*
Beliefs About Inquiry and Science Teaching Self-Efficacy of GTAs After Inquiry Methods Course

**John C Ojeogwu, University of Virginia**

**Frackson Mumba, University of Virginia**

**8:30am - 9:30am in Regency G - Session A**

We report on graduate teaching assistants' (GTAs) beliefs and inquiry science teaching self-efficacy before and after a teaching methods course. There was a significant change in GTAs self-efficacy for science teaching. There was no change in their beliefs about inquiry. There was a significant correlation between their beliefs and self-efficacy.

*Format: Individual Paper Presentation*  
*Presenter: Sandra Yarema*

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I Was a Good Classroom Teacher, Why Do I Feel So Lost Now? Examining a Doctoral Student’s Transition With Becoming a Teacher Educator During and Post Pandemic.

**Kraig R Kitts, Indiana University**

**Meredith Park Rogers, Indiana University; Spencer Perry, Indiana University**

**8:30am - 9:30am in Regency G - Session B**

This self-study examines the tensions impacting the transition of identity from science teacher to science teacher educator. The transition begins fall 2020 during the pandemic, but this study focuses on the challenges a novice teacher educator faces as he learns to shift from online teaching to in-person teaching post pandemic.

*Format: Individual Paper Presentation*  
*Presenter: Sandra Yarema*

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Iceberg of Culturally Relevant Science and Mathematics Pedagogy: a Pedagogical and Analytical Tool for Teacher Education

**Paula A. Magee, Indiana University**

**Craig J Willey, Indiana University**

**8:30am - 9:30am in Regency G - Session C**

This presentation discusses an approach that helps preservice teachers identify culturally relevant science and math pedagogy. The approach develops a connection between theory and practice by identifying different teacher practices and mapping them back to tenets of culturally relevant pedagogy. The practices are also evaluated for criticality.

*Format: Individual Paper Presentation*  
*Presenter: Sandra Yarema*

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Teaching and Learning Online: Science for Elementary Grade Levels

**Franklin S Allaire, University of Houston-Downtown**

**Jennifer E Killham, University of La Verne**

**8:30am - 9:30am in Regency H**

The expansion of online environments for education poses logistical and pedagogical challenges for early childhood and elementary science teachers and early learners. This themed paper set features five papers exploring the benefits and challenges of teaching elementary science in online environments.

*Format: Themed Paper Set*
Biology Teachers' Interaction Patterns With Online Professional Learning Resources

Niki Koukoulidis, University of Florida
Julie C. Brown, University of Florida; Karl G. Jung, University of South Florida

8:30am - 9:30am in Studio 220 @ NOMA A - Session A

This case study describes the patterns of engagement of four high school life science teachers in an online professional development program on culturally and linguistically responsive instruction (CLRI). This proposal presents trends observed in teachers' engagement and elements they reported to support their knowledge of CLRI.


Designing the Differentiation of Online Professional Development

Brooke A Whitworth, Clemson University
Yuxi Huang, University of Georgia; Harleen Singh, University of Georgia; Shelby Watson, University of Mississippi; Hatice Ozen-Tasdemir, University of Georgia; Julie A Luft, University of Georgia

8:30am - 9:30am in Studio 220 @ NOMA A - Session B

In this study, a differentiated online professional development program was developed for district science coordinators that focused on: equitable science instruction, curriculum alignment, and professional development programming. We discuss design elements and what we learned through the process.


An Examination of Middle School Stakeholders Adoption and Professional Learning Around OpenSciEd

Tina Vo, University of Nevada, Las Vegas
Kristoffer Carroll, Clark County School District; Lori Henrickson, Clark County School District; Bret Sibley, Southern Nevada Regional Professional Development Program

8:30am - 9:30am in Studio 220 @ NOMA A - Session C

This exploratory case study seeks to understand the considerations of different science education stakeholders (e.g., teachers, admin, district reps) as they adopt an open-source science curriculum into their district and schools. Further, it investigates the types of supports each group provides and requires as they prepare for implementation.


Black Representation in the Science Curriculum (BRISC) Project

Catherine Quinlan, Howard University School of Education

8:30am - 9:30am in Studio 220 @ NOMA B & C

This workshop is part of a larger NSF funded project that situates the lived experiences and narratives of Black heritage, particularly the African American Gullah Geechee in the science curriculum. This workshop is the culmination (version 1) of a series of lessons using the 5E model and inquiry to explore science concepts using various data.

Format: Workshops

An Exploration of Nature Journaling as a Core Instructional Process Guided by the Learning in Places Phenology Framework

Jennifer Kreps Frisch, University of Minnesota Duluth

8:30am - 9:30am in Teal Ballroom
This presentation will give you an opportunity to explore the Learning in Places Phenology Framework as supported by nature journaling activities (both paper-based and digital) in the context of an elementary science methods course. We will practice activities and collaboratively discuss the importance of nature-culture relations in our courses.

**Format:** Exploratory Session

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**Informal/Out-of-School Science Education**  
Fri, January 07

**Getting Their Feet Wet With Watersheds and Water Quality Concepts: Designing and Enacting a Virtual Summer Science Program for Middle-School Girls During the Pandemic**

*Joanne B Vakil, The Ohio State University*  
*Kate Cahill, The Ohio State University*

**8:30am - 5:15pm in The App**

This study reviews evaluations of an annual, residential summer camp for middle-school girls and its transition and implementation of a virtual program necessitated by the pandemic. Implications for the design of an effective watershed-focused science camp to address the underrepresentation of women in STEM fields are discussed.

**Format:** Individual Poster Presentation

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**Equity and Diversity**  
Fri, January 07

**Perceptions of Assistive and Supportive Technologies by Students Who Are Blind or Visually Impaired**

*Rhea L Miles, East Carolina University*

**8:30am - 5:15pm in The App**

Discoveries in Earth Science (DES) is a science enrichment program for students with Blind or Visual Impairments (BVI). Participants report on their perception of the use of assistive and supportive technologies to conduct earth science investigations at the K-12 level.

**Format:** Individual Poster Presentation

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**Ethnoscience and Environmental Education**  
Fri, January 07

**Enhancing Undergraduate Students’ Environmental Literacy Through an Introductory Environmental Science Course**

*Mahsa Kazempour, Penn State Berks*

**8:30am - 5:15pm in The App**

This presentation will focus on the discussion of the key components of an introductory undergraduate environmental science course for nonscience majors, including elementary pre-service teachers, as well as the impact of such components on the participants’ knowledge, views, and attitude toward science and environmental issues and action.

**Format:** Individual Paper Presentation

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**Curriculum, Pedagogy, and Assessment**  
Fri, January 07

**The Science-Technology-Society Framework: A Review of Literature on Teacher Beliefs and Preparation**

*Aidin Amirshokoohi, DeSales University*  
*Madison Soyer, DeSales University*

**8:30am - 9:00am in The App**

This presentation will focus on the review of the literature pertaining to in-service and pre-service teachers' beliefs about the Science, Technology, Society (STS) framework and the scope and effectiveness of teacher education courses and programs in shaping teacher beliefs and practices.

**Format:** Individual Paper Presentation
Primary Student Attitudes Toward Science After Inquiry Instruction

Caleb Ackland, The University of Queensland
Patricia D Morrell, The University of Queensland

8:30am - 5:15pm in The App

The purpose of this study is to examine the attitudes toward science class of a grade six class taught throughout their primary years using an inquiry-based approach. This type of methodology has been suggested as having a positive impact on student attitude, though examination of this on primary-aged students is scarce.

Format: Individual Poster Presentation

Exploring Three Visions of Scientific Literacy as a Professional Development Strategy for Reforming How and What We Do in Science Education

Travis T Fuchs, University of British Columbia
Anthony Clarke, University of British Columbia

8:30am - 5:15pm in The App

How do features of a PD program enable British Columbian science teachers to successfully respond to socio-scientific issue-oriented curricular reform in their classrooms? Features included forming an ongoing learning community and using a theoretical framework to scaffold the sense-making and articulation of pedagogical choices.

Format: Individual Poster Presentation

Integrating Language and Science for Multilingual Learners: Results of a Two-Year Professional Development Collaboration

David Crowther, University of Nevada, Reno
Rita MacDonalld, University of Wisconsin - Madison

8:30am - 9:30am in Think Tank @ NOMA - Session A

This session will report on a two-year qualitative case 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 Presider: Joi Merritt


Teresa J. Shume, North Dakota State University

8:30am - 9:30am in Think Tank @ NOMA - Session B

This critical discourse analysis of a secondary science methods textbook reveals how the book relies on the medical/deficit model of disability to portray the mainstreaming of students with disabilities. Implications for strengthening equity and social justice dimensions of preservice science teacher preparation are explored.

Format: Individual Paper Presentation Presider: Joi Merritt

The Science Interest of an Elementary Age Black Girl in an Independent School: A Case Study

Heather F Lavender, Louisiana State University

8:30am - 9:30am in Think Tank @ NOMA - Session C
This ethnographic single case study sought to understand the perceptions, views, and interest in science of a 5th grade Black girl at an independent school in her science classroom. Critical race feminism and sociocultural perspective expose the impact of peers, teachers, and home life on her science interest.

*Format: Individual Paper Presentation* *Presider: Joi Merritt*

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**STEM Education**  
**Fri, January 07**

**A LESSON PREPARATION METHOD for ART INTEGRATED STEAM: TA>SM>EA**

*Hasan Uştu, Turkish Ministry of Education*  
*Tomoki Saito, Juntendo University*

**9:00am - 9:30am in ASTE Zoom Room - Session A**

This is an action research study generating an art-integrated STEAM activity planning method (T>SM>EA) with primary school teachers. The model founded is practical and useful for interdisciplinary art integrated STEAM activity planning at the primary level. It can be used for planning art integrated STEAM activities by teachers.

*Format: Individual Paper Presentation* *Presider: Amy Tankersley*

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**STEM Education**  
**Fri, January 07**

**THE CHALLENGES of EMBEDDED ENGINEERING FEATURES INTO the STEM LESSON PLANS**

*Tharuesean Prasoplarb, Kasetsart University*  
*Kornkanok Lertdechapat, Chulalongkorn University; Chatree Faikhamta, Kasetsart University*

**9:00am - 9:30am in ASTE Zoom Room - Session B**

In this paper, we explore how the characteristics of engineering, including the engineering views, engineering scopes, engineering tasks, and engineering contexts, were addressed in nine STEM lesson plans. Results highlight how the STEM lesson plans should be designed regarding the assumption that engineering is a drive of the STEM activities.

*Format: Individual Paper Presentation* *Presider: Amy Tankersley*

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**Secondary Science Teachers’ Curricular Use of NGSS Engineering Practices**

*Elizabeth F Hasseler, University of Nebraska-Lincoln*  
*Amy Tankersley, University of Nebraska-Lincoln; Ana Rivero, Seattle University; Lyrica Lucas, University of Nebraska-Lincoln; Elizabeth Lewis, University of Nebraska-Lincoln*

**9:00am - 9:30am in ASTE Zoom Room - Session C**

We investigated how often teachers integrated engineering into science lessons to address NGSS performance expectations using data from a multi-year study of secondary science teachers. Only 7.14% of MS lessons contained engineering practices. Engineering was included in lessons for students to apply or support the learning of scientific content.

*Format: Individual Paper Presentation* *Presider: Amy Tankersley*

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**Science Teacher Professional Development-MIDDLE/SECONDARY**  
**Fri, January 07**

**The COVID-19 Community of Practice: A Self-Study of the Facilitation of Science Teachers’ Action Research**

*Allan Feldman, University of South Florida*  
*Jawaher Alsultan, University of South Florida*

**9:45am - 10:15am in ASTE Zoom Room - Session A**

This self-study focused on the problematic role of science teacher educators facilitating science teachers engaged in action research during the COVID-19 pandemic. Findings include factors that impacted the facilitation, including the development of trust, tensions, and the gap between teachers' and teachers' educators' knowledge of practice.

*Format: Individual Paper Presentation* *Presider: Allan Feldman*
Listening to Find Integrated STEM Discourse: Power and Positioning During a Teacher Professional Development STEM Activity

Andria C Schwortz, University of Wyoming  
Andrea C Burrows, University of Wyoming

9:45am - 10:15am in ASTE Zoom Room - Session B

In this case study, the authors characterized the discussions of in-service STEM teachers. The participants positioned group members with higher social status as peer mentors who controlled the computer and guided the others to develop pedagogical content knowledge. Participants integrated STEM and science-adjacent concepts in their discussions.

Format: Individual Paper Presentation  Presider: Allan Feldman

A Case Study of the Long-Term Effects of Teacher PD: What Is Success?

Joanna Philippoff, University of Hawaii at Manoa

9:45am - 10:15am in ASTE Zoom Room - Session C

The long-term effects of a teacher PD were examined by administering the same instruments pre- and post-PD and 2.5 years later and interviewing teachers. Results indicate that PD leads to self-perceived meaningful changes in practice. However, declines in knowledge and activity implementation indicates that PD has an expiration date.

Format: Individual Paper Presentation  Presider: Allan Feldman

Constructing Collaborative Experiences in Special Education and Science: Exploring With Collaborative Preservice Student Teaching Dyads

Jessica F. Riccio, Teachers College Columbia University
Amanda Mazin, Teachers College Columbia University; Lauren Andersen, Teachers College Columbia University; Lilly Sullivan, Teachers College Columbia University; Johnathan So, Teachers College Columbia University; Debby Alexander, Teachers College Columbia University; Abigail Breeding, Teachers College Columbia University; Carol Lian, Teachers College Columbia University

9:45am - 10:45am in Crepe Myrtle

This presentation will include the steps to create co-planning collaborative spaces for preservice special education and preservice content-area teachers to work alongside one another to plan and implement strategy-based instruction in diverse teaching environments.

Format: Exploratory Session

Models of Science Teacher Identity: The Multiple Representations of Pre-Service Elementary Science Educators

Kelly Feille, University of Oklahoma
kristen shelton, University of Oklahoma

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

This project focuses on pre-service teacher (PST) science teaching development by investigating the ways science teaching identity is represented throughout methods course experiences by analyzing survey responses and course artifacts. PST attitudes towards science teaching tended to shift from reluctant towards promising and high potential.

Format: Individual Paper Presentation  Presider: Khushbu Singh
A Research-Based Framework for Teacher Self-Efficacy and Connections to Effectiveness and Retention

Sarah Haines, Towson University
Deepika Menon, University Nebraska Lincoln; Jeanna Weiselmann, Southern Methodist University; Sumreen Asim, Indiana University Southeast
9:45am - 10:45am in Dogwood - Session B

Self-efficacy is a key variable that can be linked to teacher effectiveness and retention in the field. We propose a framework for elementary teacher science and engineering teaching self-efficacy, guided by prior research, with the goal of generating a set of recommendations and guidelines for researchers working in the field of self-efficacy.

Format: Individual Paper Presentation
Presider: Khushbu Singh

Connecting the Science Practices to Teaching and Learning: Preservice Elementary Teachers’ Beliefs and Perceptions

Adam Bennion, Brigham Young University
Elizabeth Davis, University of Michigan
9:45am - 10:45am in Dogwood - Session C

To understand how preservice elementary teachers perceive the science practices, we focus on the connections they make between the practices, teaching, and learning. We followed the participants through their teacher preparation program to develop themes like Autonomy & Curiosity. The themes remained consistent and showcased their sensemaking.

Format: Individual Paper Presentation
Presider: Khushbu Singh

Lessons Learned: Successes and Challenges of Fostering Cross-Stakeholder Collaborations to Enhance the Effectiveness and Coherence of Secondary Science Preservice Preparation Programs

Abraham S Lo, BSCS Science Learning
Robert Gagnon, University of Colorado, Colorado Springs; Connie Hvidsten, BSCS Science Learning; Andrew Martin, University of Colorado, Boulder; Jennifer Newberg, Skyview Middle School, Colorado Springs, CO; David Slykhuis, University of Northern Colorado, Greeley; Josie Smith, University of Colorado, Colorado Springs; Betty Stennett, BSCS Science Learning; Paul Strode, Fairview High School, Boulder, CO
9:45am - 10:45am in Magnolia

This presentation describes a model for developing a common vision and community among stakeholders to enhance the effectiveness and coherence of secondary teacher preparation programs. Each university team will describe program innovations, the challenges and successes in building cross-stakeholder communities, and lessons learned.

Format: Themed Paper Set

Developing a New Role in a Collaborative Research Study: Research Team Teachers

Elaine V. Howes, American Museum of Natural History
Jamie Wallace, American Museum of Natural History; Elizabeth Edmondson, Virginia Commonwealth University
9:45am - 10:45am in Redbud A & B - Session A

In this roundtable, we will describe a role created for a grant-funded five-year research study: Research Team Teacher (RTT). We will discuss with participants our theory-based rationale for recruiting RTTs as co-researchers, and our learning about the successes and challenges of working with teachers in this role, particularly during the pandemic.

Format: Small Group Roundtables
Presider: Elizabeth Edmondson
Professional Learning Communities as a Site of Support for Noyce Scholars and Teachers: An Exploration of Access and Meaning Making

Angela W Webb, James Madison University

Kerry O Cresawn, James Madison University

9:45am - 10:45am in Redbud A & B - Session B

Work to advance better beginnings in the classroom for newly hired science teachers can begin in teacher education programs and must continue into initial years on the job. This study explores the ways in which a university’s Noyce Scholars and Teachers access and make meaning of various activities within an active professional learning community.

Format: Small Group Roundtables Presider: Elizabeth Edmondson

Nevada CONNECTS: Partnering STEM Professionals and Teachers to Develop NGSS Aligned Assessment Tasks With Local Phenomena and Scenarios

Catherine Pozarski Connolly, Northwest Regional Professional Development Program

Lori Henrickson, Clark County School District; Stacy Bird, Southern Nevada Regional Professional Development Program

9:45am - 10:45am in Redbud A & B - Session C

This presentation shares the development and results of a project partnering teachers with local STEM professionals to develop NGSS aligned assessment tasks with real-world scenarios and local phenomena, in addition to building teacher capacity in the NGSS and providing avenues for professionals to collaborate in formal science education settings.

Format: Individual Paper Presentation Presider: Elizabeth Edmondson

Using Subject Camera Eyeglasses to Explore Learning Level Interactions at an Informal Environmental Learning Institute

Michael Dentzau, Columbus State University

Patricia Patrick, Columbus State University

9:45am - 10:45am in Redbud C - Session A

Thirty-eight groups that engaged in a self-guided visit to an informal environmental learning center participated in a study to explore learning levels expressed by group dialogue. Interactions as documented through audio and video of camera eyeglasses worn by one participant were used to understand intergroup interactions.

Format: Individual Paper Presentation Presider: Stephanie Hathcock

Growing Seeds, Minds, and Community: a Case Study Evaluation of an Out-of-School Garden Program

William R. Veal, College of Charleston

Carly Burner, College of Charleston

9:45am - 10:45am in Redbud C - Session B

Community gardens are home to a variety of place-based environmental education programs. Situated learning theory and place-based environmental education provide the theoretical context for this study. This research study evaluated a youth internship program, which aimed to teach youth about career preparedness, healthy living, and citizenship.

Format: Individual Paper Presentation Presider: Stephanie Hathcock
Rationale, Construction and Use of Outdoor Spaces for Science Learning and Play

Sherri L. Brown, University of Louisville
Meg Gravil, University of Louisville; Jill Jacobi-Vessels, University of Louisville; Claude Stephens, Bernheim Arboretum and Forest

9:45am - 10:45am in Redbud C - Session C
This study provides analysis of rationale and construction of an informal center’s outdoor Play Zone area from several site visits, as well as its use from pre-service elementary science methods students’ (n=14) perspective. It provides background information and guidance in constructing outdoor nature-based purposeful play for science learning.

Format: Individual Paper Presentation Presider: Stephanie Hathcock

Professional Development During COVID-19: Using Socio-Environmental Science Investigations to Promote Geospatial Thinking

Kristen A Brown, Texas Christian University
Molly Weinburgh, Texas Christian University; Curby Alexander, Texas Christian University; Kate Popejoy, Popejoy STEM LLC; Alec Bodzin, Lehigh University; Judith Morrison, Washington State University Tri-Cities; Jonah Firestone, Washington State University Tri-Cities; Danielle Malone, Washington State University Tri-Cities

9:45am - 10:45am in Regency G
Professional development using a geospatial curriculum approach for socio-environmental science investigations at three sites [PA/DE, TX, WA] during the COVID-19 pandemic are presented. PD learning activities and implemented geospatial activities with students working at home during the project’s first year are included in this themed paper set.

Format: Themed Paper Set

Virtual Reality, Stress, Creativity, and Preservice Science Teachers.

Richard Lamb, East Carolina University
Rebekah Lamb, Wake Country Public Schools; Trinity Lamb, Apex Friendship High School; Kyler Lamb, Thales Academy

9:45am - 10:45am in Regency H - Session A
The purpose of this study is to investigate and compare how VR based Preservice teachers (PST) experiences and microteaching experiences differ and manifest acute stress, creativity, and cognitive demand.

Format: Individual Paper Presentation Presider: Richard Lamb

“Unnatural How Natural It Was”: Using a Performance Task and Simulated Classroom for Preservice Secondary Teachers to Practice Engaging Student Avatars in Scientific Argumentation

Jamie N. Mikeska, ETS
Calli Shekell, ETS; Jennifer Dix, Towson University; Pamela S. Lottero-Perdue, Towson University

9:45am - 10:45am in Regency H - Session B
We report on study findings examining preservice teachers’ perceptions and approaches to using one science performance task and an online, simulated classroom environment consisting of five middle school student avatars to practice facilitating discussions that engage students in scientific argumentation.

Format: Individual Paper Presentation Presider: Richard Lamb
Using an Agent-Based Computer Model to Investigate the Covid-19 Pandemic

April Mitchell, Utah State University
9:45am - 10:45am in Regency H - Session C

The Covid-19 pandemic has heightened the need to understand disease transmission and management. Here, I describe biology students’ conceptions of the Covid-19 pandemic after using an agent-based computer model to simulate contagion. The study provides evidence the model deepened students’ understanding of how vaccination can end the pandemic.

Format: Individual Paper Presentation Presider: Richard Lamb

Measuring Integrated STEM Education in Practice: Comparing Science Content and Grade Level Observations

Emily A Dare, Florida International University
Joshua A Ellis, Florida International University; Elizabeth A Ring-Whalen, St. Catherine University; Gillian H Roehrig, University of Minnesota
9:45am - 10:45am in Studio 220 @ NOMA A - Session A

This research uses a new 10-item observation protocol designed for K-12 integrated STEM teaching to explore how integrated STEM education may vary across science content and grade levels. Our results suggest that certain components of integrated STEM education occur more frequently in physical science and elementary classrooms.

Format: Individual Paper Presentation Presider: Emily Dare

Curriculum-Embedded Coaching in an Integrated STEM Unit

Jeanna R. Wieselmann, Southern Methodist University
Marc T. Sager, Southern Methodist University
9:45am - 10:45am in Studio 220 @ NOMA A - Session B

In this mixed-methods study, a first-year science teacher was provided with curriculum resources, materials resources, and coaching support to implement an integrated STEM unit with a combination of students attending in-person and online due to COVID-19. We consider how the teacher’s practices and perceptions of teaching shifted with this support.

Format: Individual Paper Presentation Presider: Emily Dare

Relationship Between Context Integration and Content Integration in the Implementation of Integrated STEM

Benny Mart Hiwatig, University of Minnesota
Joshua Ellis, Florida International University; Emily Dare, Florida International University; Elizabeth Ring-Whalen, St. Catherine University; Elizabeth Forde, Florida International University; Gillian Roehrig, University of Minnesota
9:45am - 10:45am in Studio 220 @ NOMA A - Session C

One prominent theme arising from various researchers’ definitions of integrated STEM is the connection between context integration and content integration. Using correlational analysis, we examined this relationship and found a statistically significant moderate, positive relationship between the two constructs with respect to our aggregate data.

Format: Individual Paper Presentation Presider: Emily Dare
**Professional Development for Science Teacher Educators (Workshops)**

**Using the MASTER Model to Understand the Work of Scientists and Engineers and Develop Related Curriculum for the Science Classroom**

*Kathleen M. Hill, Pennsylvania State University*

*Jennifer B. Jackson, Pennsylvania State University*

9:45 am - 10:45am in Studio 220 @ NOMA B & C

Penn State Center for Science and the Schools will run a workshop focused on a tool called the Modeling Authentic Science, Technology, and Engineering Research model. Attendees will learn how to: (1) create MASTER models with scientists and engineers, and (2) design curriculum that engages students in authentic science and engineering practices.

**Format:** Workshops

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**Connecting Children’s Nonfiction Picture Books to College Biology Content**

*Mary A Gobbett, University of Indianapolis*

9:45 am - 10:45am in Teal Ballroom

Learn how children’s nonfiction picture books are being integrated into a preservice biology course. A set of children’s picture books for a genetics unit, a sample ecosystem project, and hands on biology activities will be available during the session. Attendees will also participate in a hands-on elementary genetics activity.

**Format:** Exploratory Session

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**(Re)Learning to Teach Science: An Auto-Ethnographic Study**

*Deborah L Hanuscin, Western Washington University*

*Spencer Green, Western Washington University*

9:45 am - 10:45am in Think Tank @ NOMA - Session C

Despite growing interest in inclusive education, there has been little attention to the inclusion of students with disabilities in teacher education. As a teacher educator and a preservice teacher with hearing-related disabilities, we draw on our lived experience, to explore inclusion through shared narratives of our learning to (re)teach science.

**Format:** Individual Paper Presentation  
**Presider:** Meredith Kier

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**Making Science Relevant to Students: How Teachers Access and Incorporate Funds of Knowledge in the High School Biology Classroom**

*Molly M Staggs, University of South Florida*

*Karl G Jung, University of South Florida; Julie C Brown, University of Florida*

9:45am - 10:45am in Think Tank @ NOMA - Session A

Emergent Bilingual students bring to the science classroom a wealth of cultural and personal experiences known as funds of knowledge. This study examines the ways in which high school biology teachers access and incorporate these funds, as well as the types of funds leverage in their science instruction.

**Format:** Individual Paper Presentation  
**Presider:** Meredith Kier

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**Why Do They Stay?: An Exploratory Analysis of Identities and Commitment Factors Associated With Teaching Retention in High-Need School Contexts**

*Meredith W Kier, William & Mary*

*Monica Grillo, William & Mary*

9:45am - 10:45am in Think Tank @ NOMA - Session B
This study examines science and mathematics teachers who had accepted a university scholarship to teach in high needs schools (HNSs) following graduation from a teacher preparation program. We sought to understand the aspects of their identities and social experiences that supported their commitment to continue teaching within this context.

**Preservice Science Teacher Preparation-ELEMENTARY**

**Fri, January 07**

**Failure as a Process and a Product: Preservice Elementary Teachers’ Fears and Views of Failure**

*Shannon L. Navy, Kent State University*
*Breanna Beaver, Kent State University*

10:15am - 10:45am in ASTE Zoom Room - Session A

Failure can be a productive and essential part of the learning process, especially in STEM fields. However, little is known about preservice teachers' perceptions of failure. Therefore, this study investigated 157 preservice teachers' fear of failure and views of failure to help understand how failure might be presented to K-12 students.

**Format:** Individual Paper Presentation  **Presider:** Shannon Navy

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**Preservice Science Teacher Preparation-ELEMENTARY**

**Fri, January 07**

**PLANNING and CARRYING OUT SCIENCE INVESTIGATIONS in TWO DISCIPLINES: A CASE STUDY of a PRESERVICE TEACHER**

*Kornkanok Lertdechapat, Chulalongkorn University*
*Deborah Hanuscin, Western Washington University; Chatree Faikhamta, Kasetsart University*

10:15am - 10:45am in ASTE Zoom Room - Session B

In this paper, we focus on preservice teacher’s lesson enactment for teaching planning and carrying out investigations in the context of two different disciplinary topics. Our results highlight how the conflation of epistemic and pedagogical knowledge can impede effective enactment of this practice.

**Format:** Individual Paper Presentation  **Presider:** Shannon Navy

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**Preservice Science Teacher Preparation-ELEMENTARY**

**Fri, January 07**

**A Self-Study of an Asynchronous Online Elementary Science and Health Methods Course**

*Ingrid Carter, Metropolitan State University of Denver*
*Valarie Akerson, Indiana University, Bloomington; Claire Cesljarev, Indiana University, Bloomington*

10:15am - 10:45am in ASTE Zoom Room - Session C

This self-study focuses on my experience teaching a fully asynchronous online preservice elementary science and health methods course during the Covid-19 pandemic. My hope is that this systematic exploration and description will offer helpful insights to others who teach or may teach a fully asynchronous online elementary science methods course.

**Format:** Individual Paper Presentation  **Presider:** Shannon Navy

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**Fri, January 07**

**Mini Outdoor Explore**

10:45am - 11:00am in Lobby

**Format:** General

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**Fri, January 07**

**Coffee Break**

10:45am - 11:00am in Prefunction Area

**Format:** General
Keynote: *We Are Science: A Look at Land and People in an Ever-Changing environment.*

11:00am - 12:30pm in Regency C

Ms. Nikki Tulley is a member of the Navajo Nation, pursuing a Ph.D. at the University of Arizona in the Department of Environmental Science. Her research focuses on how climate adaptation influences water resource management approaches in Indigenous and rural communities. She is an Alfred P. Sloan 2018-2021 Scholar, American Indian Graduate Center Fellow, and an American Indian Science and Engineering Society Sequoyah Fellow. Ms. Tulley received a Bachelor of Science Degree in Environmental Science and a Master of Science Degree in Water Resources from the University of New Mexico.

*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 Regency A & B

*Format:* General

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**Equity and Diversity**

Fri, January 07

**Diversifying Engineering via Identity Congruent Experiences (DE-ICE)**

*Amanda Obery, Central Washington University*

*Nicholas Lux, Montana State University; Paul Gannon, Montana State University*

2:00pm - 2:30pm in ASTE Zoom Room - Session A

This study explores how rural and American Indian elementary students conceptualize engineering, and how those conceptions can help frame engineering education interventions that integrate culturally-responsive approaches. Findings suggest difference by gender and by community in student’s willingness to consider engineering in the future.

*Format:* Individual Paper Presentation  
*Presider:* Laura Peña-Telfer

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**Equity and Diversity**

Fri, January 07

**Improving the Recruitment of Quality STEM Teachers Into High-Need Schools**

*Jasmine Sami*

*Larry Medsker, George Washington University*

2:00pm - 2:30pm in ASTE Zoom Room - Session B

Our research addresses how to improve the recruitment and retention of STEM teachers for high need schools through service scholarships like the GW Noyce Scholarship Program and on-campus support. Questions related to STEM teaching careers, the GW Noyce Scholarship program, and university efforts to promote teaching as a viable career path.

*Format:* Individual Paper Presentation  
*Presider:* Laura Peña-Telfer

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**Equity and Diversity**

Fri, January 07

**Inclusivity and Care in STEM Programming by Leveraging Latinx Families' Funds of Knowledge.**

*Laura Peña-Telfer, Georgia State University*

*Natalie King, Georgia State University*

2:00pm - 2:30pm in ASTE Zoom Room - Session C
This mixed methods study investigates the ways in which Latinx parents engage with their daughters’ STEM learning experiences and the ways in which Latinx parents perceive their role and the school’s role in their daughter’s education.

Format: Individual Paper Presentation Presider: Laura Peña-Telfer

Fri, January 07

Registration
2:00pm - 5:15pm in the Atrium Lobby
Format: General

Curriculum, Pedagogy, and Assessment
Fri, January 07

Exploring Pedagogies of Practice That Support Preservice Teachers in Learning How to Facilitate Argumentation-Focused Discussions
Meredith Park Rogers, Indiana University - Bloomington
Jamie N Mikeska, ETS; Pamela Lotterro-Perdue, Towson University; Heidi Masters, University of Wisconsin - La Crosse;
Ronald Hermann, Towson University; Laura Zangori, University of Missouri – Columbia; Dionne Cross Francis, University of North Carolina - Chapel Hill
2:00pm - 3:00pm in Crepe Myrtle
This session explores various activities teacher educators use with preservice teachers in preparation for, or debriefing about, the facilitation of argumentation-focused discussions. The online suite where this practice occurs includes digital games, avatar simulation, and virtual reality.
Format: Exploratory Session

Preservice Science Teacher Preparation-ELEMENTARY
Fri, January 07

Perceptions of Science: Identifying Influencing Variables Inearly Childhood Pre-Service Educators
Bridget T Miller, University of South Carolina
Benjamin Wiles, Clemson
2:00pm - 3:00pm in Dogwood - Session A
Views about science can influence how one teaches science. It is important for educators and teacher educators to reflect on their past experiences and decipher what experiences influence their overall perceptions about science. This is a mixed method study identifying influencing variables on pre-service teachers’ perceptions about science.
Format: Individual Paper Presentation Presider: Preethi Titu

Preservice Science Teacher Preparation-ELEMENTARY
Fri, January 07

Assessing Elementary Preservice Teachers’ Science Content Knowledge: Developing and Evaluating a Standards-Based Science Content Instrument
Suzanne M Nesmith, Baylor University
Grant Morgan, Baylor University
2:00pm - 3:00pm in Dogwood - Session B
This study explored the development, implementation, and evaluation of a science content instrument designed to assess elementary preservice teachers’ understanding of state science standards. Findings provide implications regarding the instrument components relative to exam science standards and science educator competencies.
Format: Individual Paper Presentation Presider: Preethi Titu
A Storyline Unit Anchored in Phenomenon for Elementary Preservice Teachers and an Evaluation of Their Pre / Post Pedagogical Views

Mason A Kuhn, University of Northern Iowa
Ron Rinehart, University of Northern Iowa; Mark McDermott, University of Iowa

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

In this presentation, we describe a learning experience created for elementary pre-service teachers where we gave them the opportunity to use science practices to learn content and reflect on how these lessons impacted their pedagogical views. We have lesson plans and assignments where students reflect on using the Science and Engineering Practices.

Format: Individual Paper Presentation  
Presider: Preethi Titu

High School Girl's System Thinking Skills About the Carbon Cycle

Younkyeong Nam, Pusan National University
Jinmong Shin, Busan Science High School

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

In this study, 157 high school girls’ systems thinking level was measured before and after the carbon cycle lesson unit. About 30% of the students’ systems thinking skills improved hierarchically to a level of understanding feedback loops. However, 60% of the students' systems thinking skill stayed at the level of understanding system interactions.

Format: Individual Paper Presentation  
Presider: Helen Meyer

How Preservice Science Teachers Use Self-Regulated Learning When Planning Questions

Hong H. Tran, University of Georgia
Daniel K. Capps, University of Georgia; Georgia W. Hodges, University of Georgia

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

This descriptive study investigated how preservice science teachers (PSTs) use key self-regulated learning (SRL) subprocesses (goal setting, metacognitive monitoring, self-evaluation) while planning classroom questions. The results show that the PSTs did not effectively use the SRL subprocesses to support planning their questions.

Format: Individual Paper Presentation  
Presider: Helen Meyer

Teacher Candidates' Ability to Plan and Enact Cognitively Demanding Science Lessons

Danielle E. Dani, Ohio University
Nicole Kirchner, Ohio University; Amal N. H. Alqhtani, Ohio University; Charles Tracy, Ohio University

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

Drawing on situated learning theory and the centrality of dialogic mentoring to the learning to teach process, authors use Tekkumru-Kisa’s Task Analysis Guide for Science (TAGS) to explore the outcomes of a mentored clinical experience on teacher candidates’ ability to plan and enact cognitively demanding inquiry-based science teaching.

Format: Individual Paper Presentation  
Presider: Helen Meyer

Reflective Narrative of a Veteran Teacher’s Transition to Science Methods

Lillian L Sims, University of Cincinnati

2:00pm - 3:00pm in Redbud A & B - Session B
This is a reflective study of my parallel roles as a veteran science teacher and science methods instructor. My audience is pre-service teacher educators and classroom practitioners who may benefit from my insight about serving in dual roles.

**Format:** Small Group Roundtables  
**Presider:** Sara Heredia

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### History, Philosophy, and Nature of Science
**Fri, January 07**

**Developing Preservice Secondary Science Teachers’ Conceptions of the Nature of Science: Lessons From a New Course Focused on Examining the Nature, History, and Philosophy of Science**

*Kelsey Beeghly, University of Central Florida  
Malcolm B Butler, University of Central Florida*

*2:00pm - 3:00pm in Redbud A & B - Session C*

An innovative new course, “Seminar on Secondary Science Education”, is being piloted at a large research-intensive university in the US. By design, this course examines the nature of science within the context of its major historical and philosophical developments as preservice secondary science teachers reflect on aspects of their own pedagogy.

**Format:** Small Group Roundtables  
**Presider:** Sara Heredia

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### Preservice Science Teacher Preparation-ELEMENTARY
**Fri, January 07**

**Examining the Science Teaching Beliefs and Self-Efficacy Belief of Elementary Pre-Service Teachers Enrolled in Science and Non-Science Emphasis**

*Cynthia C. Minchew Deaton, Clemson University  
Sunil Pokhrel, Clemson University*

*2:00pm - 3:00pm in Redbud C - Session A*

Given the same teaching environment and similar learning opportunities, the two cohorts, one specializing in elementary level Science and Mathematics and the second in Literacy, Culture, and Diversity (LCD) teaching, do not significantly differ in their science teaching and science teaching self-efficacy beliefs.

**Format:** Individual Paper Presentation  
**Presider:** Julie Contino

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**A Practice-Based Framework Analysis of Elementary Preservice Teachers’ Teaching Practices in Their Prior Knowledge of Science Instruction**

*Karthigeyan Subramaniam, University of North Texas  
Chris S Long, University of North Texas*

*2:00pm - 3:00pm in Redbud C - Session B*

The purpose of the study was to identify the prevalent teaching practices in prospective teachers’ prior knowledge of science instruction. The research question that framed this study was: What are the predominant teaching practices in prospective teachers’ prior knowledge of science instruction?

**Format:** Individual Paper Presentation  
**Presider:** Julie Contino

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**What Do Elementary Teachers Learn From College Science Coursework?: Preservice Teachers’ Subject Matter Knowledge and Knowledge Monitoring**

*Ryan S Nixon, Brigham Young University  
Alexandra Dorine Swain, Brigham Young University; Shirley Ang, Brigham Young University*

*2:00pm - 3:00pm in Redbud C - Session C*

The impact of college science coursework on elementary teachers has not been sufficiently explored. We explore the relationships among preservice teachers’ coursework, science subject matter knowledge, and knowledge monitoring ability. Neither participants’ coursework nor knowledge monitoring was related to their subject matter knowledge.

**Format:** Individual Paper Presentation  
**Presider:** Julie Contino
Exploring What First-Graders Communicate About Venus Flytrap Structure and Function in Drawing and Writing in a Multimodal Assessment

Rachel E Wilson, Appalachian State University
Leslie U Bradbury, Appalachian State University

2:00pm - 3:00pm in Regency G - Session A

Presenters worked with 4 first-grade teachers to design and implement a 6-day unit using multiple modes of representation and ELA skills to help students learn about plant structure and function. Results of the quantitative and qualitative analysis of student work will be shared with implications for how to assess young students in science.


An Assessment of Student and Faculty Perceptions of the Actual and Ideal States of Laboratory Instruction in Four Introductory Science Instructional Settings

William McComas, University of Arkansas
Kate Walker, University of Arkansas

2:00pm - 3:00pm in Regency G - Session B

This session features discussion of the results of a survey of students and instructors 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 teacher education will be provided.


Using a Wonder-Based Nature Study to Engage in Science Practices

Andrew Gilbert, George Mason University
Stephanie Dean, George Mason University

2:00pm - 3:00pm in Regency G - Session C

This study considered science practices within a wonder-framed nature study as one possible way for educators to support students as they take on the role of scientists during outdoor investigations.


Teaching and Learning Online: Science for Secondary Grade Levels

Jennifer E. Killham, University of La Verne
Franklin S. Allaire, University of Houston-Downtown

2:00pm - 3:00pm in Regency H - Session A

The expansion of online environments for education poses logistical and pedagogical challenges for secondary science teachers and learners. This themed paper set features five papers exploring the benefits and challenges of teaching secondary (middle and high school) science in online environments.

Format: Themed Paper Set
Students’ Perceptions of Scientists’ Scientific Practices From Draw a Scientist Test (DAST) Based on Gender

Melissa J Olson, Texas Tech University (TTU)
Jocelyn A Miller, Texas Tech University (TTU)Connor G Bryant, Texas Tech University (TTU)Rebecca L Hite, Texas Tech University (TTU)Gina M Childers, Texas Tech University (TTU)
2:00pm - 3:00pm in Studio 220 @ NOMA A - Session A

Practices scientists use to investigate phenomena are organized into three spaces: investigation, evaluation, and theoretical. Exploring students’ DAST descriptions, the perceived practices used by scientists were examined. Students overwhelmingly perceive scientists performing investigations, and with little emphasis on evaluation and theorizing.

Format: Individual Paper Presentation Presider: Richard Cox

Real-Time Prediction of Science Student Learning Outcomes Using Machine Learning Classification of Hemodynamics During Online Learning Sessions

Richard Lamb, East Carolina University
Knut Neumann, Leibniz Institute for Science and Mathematics Education
2:00pm - 3:00pm in Studio 220 @ NOMA A - Session B

The purpose of this study is to examine how hemodynamic response data may be used to develop student level answer predictions via machine learning algorithms as the student engages with an online learning management system in a science classroom.

Format: Individual Paper Presentation Presider: Richard Cox

Assessing Preservice Elementary Teachers’ Knowledge and Use of the Crosscutting Concepts

Soon C Lee, Kennesaw State University
Anna M Arias, Kennesaw State University
2:00pm - 3:00pm in Studio 220 @ NOMA A - Session C

3D learning involves the use of crosscutting concepts (CCCs) for sensemaking, yet information is needed on how to support and assess teachers’ knowledge and use of the CCCs in 3D instruction. This presentation describes analyses of two assessments of preservice elementary teachers’ knowledge of the CCCs in the context of 3D science learning.

Format: Individual Paper Presentation Presider: Richard Cox

Send Your Students' Brains on a Mission to Find Patterns in the World

ROBERT C. BARKMAN, Springfield College (retired professor emeritus)
2:00pm - 3:00pm in Studio 220 @ NOMA B & C

Pattern recognition is a cross-cutting concept that inspires questions about relationships and their causes. Hear the stories of leading scientists who credit pattern recognition for their discoveries. Learn through exercises how you can teach students to make discoveries inspired by patterns.

Format: Workshops
The Role of Equity in STEM Education: A Multidimensional Challenge

Stacey Britton, University of West Georgia
G. Nathan Carnes, University of South Carolina; Anne P. Gatling, Merrimack College; Rachel A. Gisewhite, University of Southern Mississippi; Sophia Jeong, The Ohio State University; Teresa Shume, North Dakota State University; David Steele, Alder Graduate School of Education; Bhaskar Upadhyay, University of Minnesota, Twin-Cities

2:00pm - 3:00pm in Teal Ballroom

What is the purpose of equitable STEM education? How can we define equity and social justice in our own contexts? How does knowledge of equity impact tour pre-service teachers? This round table discussion seeks to challenge science teacher educators and their pre-service teachers. Resources and a related support community will be provided.

Format: Exploratory Session

Mathematical Modeling to Promote Sensemaking in Biology

Desi, University of Minnesota
Cuc Vu, University of Minnesota; Gillian Roehrig, University of Minnesota; Anita Schuchardt, University of Minnesota

2:00pm - 3:00pm in Think Tank @ NOMA

Students often struggle to solve mathematical problems because they do not engage in sensemaking, making connections between equations and associated biological phenomena. Participants will take part in a sensemaking activity, developing a mathematical representation of a biological phenomenon.

Format: Workshops

Creating the Need to Read Through Science-Focused Interdisciplinary Projects

Wendy P. Ruchti, Idaho State University

2:30pm - 3:00pm in ASTE Zoom Room - Session A

This presentation will detail the process of one intermediate school (grades 3-5) implementing embedding compelling and worthy texts into interdisciplinary (STEM and literacy) projects.


Supporting Latinx Preservice Teachers’ Understanding of Nature of Science Through Culturally Relevant Workshop Designed Based on Their Autobiographies

Noushin Nouri, University of Texas-RGV
Vero G. Frady, University of Texas-RGV; Patricia Ramirez-Blondolillo, University of Texas-RGV; Yajaira Flores, University of Texas-RGV

2:30pm - 3:00pm in ASTE Zoom Room - Session B

We designed a culturally responsive nature of science workshop based on autobiographies of Latinx preservice teachers (LPTs) regarding their experience with science. The data showed LPTs had unique views about soci-cultural and subjective aspects of science. We conclude their answers should be analyzed with a cultural lens.

The Development of the Adolescent Curiosity Scale

Glenn Beaumont, Queensland Department of Education/UQ
Patricia D Morrell, The University of Queensland; Robyn Gillies, The University of Queensland
2:30pm - 3:00pm in ASTE Zoom Room - Session C

The development and use of the Adolescent Curiosity Scale for middle level students will be described. The impact of its use on the teaching of middle level science instruction and hence middle level science teacher preparation will be discussed.


Case Studies: Promoting STEM Teacher Candidates’ Understanding and Implementation of Differentiated Instruction

Mohammed Estaiteyeh, Western University, Canada
Isha DeCoito, Western University, Canada
3:05pm - 3:35pm in ASTE Zoom Room - Session A

This paper explores STEM teacher candidates’ (TCs') understanding and implementation of differentiated instruction (DI). It shows the positive impact of a DI-focused course assignment on TCs’ planning of equitable and inclusive teaching. It also shows how case studies of socio-scientific issues can be used as a teaching strategy to achieve this goal.

Format: Individual Paper Presentation  Presider: Christine Tippett

Preparation and Inspiration: Incorporating School Gardens in Environmental Education as Agents of Change

Mariam Takkouch, Western University, Canada
Isha DeCoito, Western University, Canada
3:05pm - 3:35pm in ASTE Zoom Room - Session B

This paper explores the role of school gardens in fostering environmental awareness of high school students from the point of view of teachers and a school principal. The positive impact of garden-based learning is highlighted in promoting biodiversity and sustainability consciousness through involving students in nature.

Format: Individual Paper Presentation  Presider: Christine Tippett

Science Teacher Educators and Inclusion: Perspectives and Practices

Christine D Tippett, University of Ottawa
Karen Goodnough, Memorial University; Saiqa Azam, Memorial University; Todd M Milford, University of Victoria
3:05pm - 3:35pm in ASTE Zoom Room - Session C

Increased student diversity in today’s K-12 classrooms requires all teachers be prepared to meet the needs of all students. Science teacher educators (STEs) play a critical role in preparing teacher candidates for inclusive science classrooms. We explore Canadian STEs’ views on inclusion and discuss factors that influence their inclusive practices.

Format: Individual Paper Presentation  Presider: Christine Tippett

Coffee, Cookies, and Committees

3:05pm - 4:05pm in Prefunction Area
- Membership/Participation Committee Meeting - Crepe Myrtle
- Awards Committee Meeting - Redbud A & B
- Professional Development Committee Meeting - Redbud C
- Elections Committee Meeting - Regency H
- Publications Committee Meeting - Studio 220 @ NOMA B & C
- Communications Committee Meeting - Think Tank @ NOMA
Navigating the Pandemic as an International Teaching Assistant in Science Education

Shukufe Rahman, Indiana University
Gayle Buck, Indiana University
3:35pm - 4:05pm in ASTE Zoom Room - Session A
International teaching assistants (ITAs) faced unique challenges and dilemmas coping with the education challenges brought about by the pandemic. This study used a self-study methodology to explore the linguistic, socio-cultural and contextual challenges that one ITA faced and provide evidence-based suggestions to consider in future disruptions.
Format: Individual Paper Presentation Presider: Farah Faruqi

An Integrated STEM Classroom: A Case Study of an Elementary Science Teacher Making Connections Between Science and Engineering

Farah Faruqi, University of Minnesota
Khomson Keratifhamkul, University of Minnesota; Gillian Roehrig, University of Minnesota
3:35pm - 4:05pm in ASTE Zoom Room - Session B
STEM education is becoming more prevalent in elementary schools as there are more calls for integration between the STEM disciplines. This single case study examines how an elementary teacher makes explicit and implicit connections between science and engineering during an integrated STEM unit implementation.
Format: Individual Paper Presentation Presider: Farah Faruqi

Curriculum and Pedagogy in STEM Education: Exploring Teacher Candidates' Preparation for Online Teaching

Isha DeCoito, Western University, Canada
Mohammed Estaiteyeh, Western University, Canada
4:15pm - 4:45pm in ASTE Zoom Room - Session B
This paper explores STEM teacher candidates' (TCs) preparation for online teaching. It highlights the positive impact of a digitally-enriched course on TCs' technological and pedagogical skills. The course was delivered online, incorporated many digital tools, and provided space for TCs to share expertise and resources in a community of practice.
Format: Individual Paper Presentation Presider: Corrine Lardy

Using a Toolkit to Support Coherence in Supervising Secondary Science Student Teachers

Corinne Lardy, California State University, Sacramento
Donna Ross, San Diego State University; Meredith Vaughn, San Diego State University
4:15pm - 4:45pm in ASTE Zoom Room - Session A
This multiple case study examines coherence in preservice science methods courses and field experiences at two campuses. Instructors and supervisors had NGSS materials, developed in our project. We studied the use of phenomena, SEPs and 3D planning. We provide insight into how supervision can help create a shared vision of science teaching.
Format: Individual Paper Presentation Presider: Corrine Lardy
The Efficacy of Online Games to Help Teach Ocean Literacy: Keeping Them Engaged at the End of the Day
Gwendolyn K Griffiths, St. Francis Xavier University
Katarin Macleod, St. Francis Xavier University
4:15pm - 4:45pm in ASTE Zoom Room - Session C
We investigated the use of online games to teach ocean literacy in Nova Scotia, Canada. Pre-service teachers were interviewed about students' responses to the games. Pre-service teachers found the game Salmon Cycle, which integrated the local aboriginal culture of the Mi'kmaw people, to be the most effective in educating students.

Format: Individual Paper Presentation
Presider: Corrine Lardy

Connect With Nature and Build Learning Communities Using Social Media Under Project-Based Learning
SuJin Choi, George Washington University
4:15pm - 5:15pm in Crepe Myrtle - Session A
Help science teachers make the learning process more collaborative using social media. We show how in a PBL course, preservice teachers are encouraged to create an Instagram community invested in learning about and preserving the Potomac River. This session is designed for science educators and preservice teacher preparatory programs.

Format: Syllabus Sharing
Presider: Meredith Park Rogers

Guided Exploring Rehearsals and Practice Teaching Within Elementary Science Methods Coursework
Stephen L Thompson, University of South Carolina
4:15pm - 5:15pm in Crepe Myrtle - Session B
The science methods course model presented here engaged preservice elementary teachers in guided rehearsals and practice teaching within authentic classroom settings and with elementary students. Related findings highlight how these approaches mitigate common constraints associated with current science teacher preparation approaches.

Format: Small Group Roundtables
Presider: Meredith Park Rogers

Syllabus for an Integrated Introduction to Science for Educators via the Science & Engineering Practices
Sarah J Reynolds, University of Indianapolis
4:15pm - 5:15pm in Crepe Myrtle - Session C
Our course, taken by incoming first-year preservice elementary educators, aims to build their scientific skills and their understanding of the nature of science (NOS) through reflective application of the NGSS science & engineering practices to interdisciplinary science topics.

Format: Syllabus Sharing
Presider: Meredith Park Rogers

From Pandemic Pivot to Community Outreach: Utilizing Homeschooled Students as Participants for Course-Based Field Placements
Ronald S. Hermann, Towson University
Maureen Honeychuck, Towson University
4:15pm - 5:15pm in Crepe Myrtle - Session D
One impact of the pandemic on teacher education programs was the inability to place PSTs in course-based field experiences. We share our experiences utilizing homeschooled students as participants in PST-developed and implemented task-based lessons aimed at orchestrating productive discussions.

**Preservice Science Teacher Preparation - ELEMENTARY**

**Fri, January 07**

**Use of Children's Literature in Planning Science Instruction**
*Iliana E. De La Cruz, Texas A&M University*
*Sara Raven, Texas A&M University; Sharon D. Matthews, Texas A&M University; Aaron Kidd, Texas A&M University*

4:15pm - 5:15pm in Dogwood - Session A

This study seeks to understand how preservice elementary teachers make decisions about integrating children's literature into science teaching. We will present a qualitative content analysis into preservice teachers' decision-making processes in selecting, and using books and their expressed value in integrating literature in science instruction.

**Format: Individual Paper Presentation  Presider: Stephen Burgin**

**Connections in the Schoolyard: Engaging in the Crosscutting Concepts Through Nature Journaling**
*Stephanie Hathcock, Oklahoma State University*
*Kelly Feille, University of Oklahoma; Heather Shaffery, University of Oklahoma; Sofia Alvarez-Briglie, University of Oklahoma; Amelia Cook, University of Oklahoma*

4:15pm - 5:15pm in Dogwood - Session B

To support science learning outdoors, nature journaling can be a tool to engage in natural phenomena in students' place. We use a framework of schoolyard pedagogy and nature journaling to engage learners in the crosscutting concepts of NGSS. This qualitative study identifies opportunities for nature journaling tasks to engage learners in the CCC.

**Format: Individual Paper Presentation  Presider: Stephen Burgin**

**Exploring How Pre-Service Elementary Teachers Apply Evolutionary Principles to Their Lives and Future Teaching Careers**
*Rachel A Sparks, University of Nebraska-Lincoln*
*Rebekka Darner, Illinois State University*

4:15pm - 5:15pm in Dogwood - Session C

Standards call upon elementary teachers to teach evolutionary concepts as early as third grade, after receiving little preparation to teach evolution, despite it being the unifying theory of biology. We share research on preservice teachers' transformative experiences related to evolutionary principles in an introductory biology course.

**Format: Individual Paper Presentation  Presider: Stephen Burgin**

**Humanizing Integrated STEAM Instruction Through Empathy**
*Kristin Cook, Bellarmine University*
*Richard B Cox, Jr., Winthrop University; Regina McCurdy, University of Central Florida*

4:15pm - 5:15pm in Magnolia - Session A

Research and practice in integrated STEAM education offers insights into empathy-driven experiences though teaching strategies such as design thinking. This session (1) shares existing literature on the use of empathy in education; (2) synthesizes key empathy findings from STEAM research; and (3) poses next steps for the field of STEAM education.

**Format: Individual Paper Presentation  Presider: Katie Laux**
Building a STEM Community Through Photovoice

*Katie Laux, Hillsborough County Public Schools*

4:15 pm - 5:15 pm in Magnolia - Session B

The purpose of this research is to explore how a professional learning community (PLC) focused on participatory action research (PAR) using photovoice can help a network of STEM schools address and overcome obstacles and inequities associated with STEM education while increasing collaboration and a sense of ownership of the network.

*Format:* Individual Paper Presentation *Presider:* Katie Laux

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Positioning STEM as an Avenue to Literacy and Numeracy

*Todd M Milford, University of Victoria*

*Mark McDermott, The University of Iowa; Christine D Tippett, University of Ottawa*

4:15 pm - 5:15 pm in Magnolia - Session C

Policy makers continue to cast science education as the ‘poor stepsister’ in relation to literacy and mathematics. We argue that a focus on multimodal science and STEM learning experiences can enhance student achievement in science as well as in literacy and mathematics.

*Format:* Individual Paper Presentation *Presider:* Katie Laux

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A Model for Micro-Credentialing in Secondary STEM Teacher Preparation

*Shelly R Rodriguez, The University of Texas, Austin*

*Jason R Harron, Kennesaw State University*

4:15 pm - 5:15 pm in Redbud A & B - Session A

Micro-credentials are being taken up in various higher education settings as an alternative credentialing model. UTeach Maker is an optional micro-credentialing program that is part of a nationally recognized STEM teacher preparation program. This session will unpack the program pillars and discuss how they can be adapted to other contexts.

*Format:* Small Group Roundtables *Presider:* Angela Webb

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An Analysis of Noyce Scholar Personal and Professional Self-Efficacy

*REGINA E TOOLIN, University of Vermont*

*Herman E Meyers, University of Vermont*

4:15 pm - 5:15 pm in Redbud A & B - Session B

This study examined themes of transition from pre-professional to professional self-efficacy for six NSF Robert Noyce Scholars enrolled in a MAT in Secondary Education Program. Findings included confirmation of the perception of professional growth among Scholars pertaining to teacher self-confidence and professional knowledge.

*Format:* Small Group Roundtables *Presider:* Angela Webb

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Investigating Preservice Science Teachers’ PCK at the Discipline, Domain, and Topic Levels

*Sarah Voss, Drake University*

*Jerrid Kruse, Drake University; Maryann Huey, Drake University*

4:15 pm - 5:15 pm in Redbud A & B - Session C

While PCK includes levels such as discipline (science), domain, (chemistry), and topic (gas laws), empirical research is lacking. This study investigated levels of PCK of preservice teachers. PCK at each level overlapped, but participants struggled to articulate general PCK. Implications for teacher education and future research will be discussed.

*Format:* Individual Paper Presentation *Presider:* Angela Webb
Exploration of Teacher-Student Neural Coupling Occurring During the Teaching and Learning of Science

Richard Lamb, East Carolina University Neurocognition Science Laboratory
David Fortus, Weizmann Institute of Science; Troy Sadler, University of North Carolina Chapel Hill; Knut Neumann, Leibniz Institute for Science and Mathematics Education; Amanda Kavner, East Carolina University Neurocognition Science Laboratory; Leonard Annetta, East Carolina University Neurocognition Science Laboratory; Douglas Hoston, East Carolina University Neurocognition Science Laboratory

4:15pm - 5:15pm in Redbud C - Session A

This study investigated and began to characterize the neurological basis for the talk between science teachers and students in terms of speaker-listener coupling in a naturalistic setting.

Format: Individual Paper Presentation Presider: Stephanie Philipp

Situated Cognition and Socio-Cultural Constructivism: Science Teacher Instructional Intentions and Science Learning by Emergent Multilingual Learner

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

4:15pm - 5:15pm in Redbud C - Session B

Using two social constructivist approaches to learning as a theoretical lens, this study examines the relationship between teacher instructional intentions and the learning of one emergent multilingual learner. Documentation of planning the inquiry-based, language-rich experience is compared to the entries in the student’s science journal.

Format: Individual Paper Presentation Presider: Stephanie Philipp

Elementary Student's Perception Changes About Their Creativity During Engineering Design Process

DongYoung Lee, Pusan National University
Younkyeong Nam, Pusan National University

4:15pm - 5:15pm in Redbud C - Session C

This study examines the change of creativity in the engineering design process. This study explores how learners’ reported creativity changes according to the stages of the engineering design process and why.

Format: Individual Paper Presentation Presider: Stephanie Philipp

The Development of Global Energy STEAM Program With the Focus of Democratic Citizen Literacy and Its Implication in Science Education

Young-Shin Park, Chosun University

4:15pm - 5:15pm in Regency G - Session A

This study showed how we included the perspective of democratic citizen literacy(DCL) into STEAM program with the focus of ‘Art’ and we will introduce DCL frame which is used to develop six energy topics of DCL.

Format: Individual Paper Presentation Presider: Alison Mercier
Approaches to STEM Program Development in Schools

Elizabeth Crotty, University of Wisconsin - Eau Claire
Gillian H Roehrig, University of Minnesota; Elizabeth A Whalen, St. Catherine University; Jeanna Wieselmann, Southern Methodist University

4:15pm - 5:15pm in Regency G - Session B

This study explores the different approaches taken by teacher leaders to develop STEM programming in schools. The various approaches to developing STEM programming are outlined and discussed noting limitations/affordances of each. The ways teacher leadership can be harnessed to drive STEM programming in public middle schools is presented.

Format: Individual Paper Presentation  Presider: Alison Mercier

Peer-to-Peer Collaborative Professional Learning Framework for Transferring STEM Teaching Practices

Leslie A. Suters, Tennessee Technological University
Kelly Moore, Tennessee Technological University; Jennifer Meadows, Tennessee Technological University

4:15pm - 5:15pm in Regency G - Session C

A collaborative professional learning (CPL) model was used between College of Engineering and Education faculty to help improve STEM education practices. Preliminary results include more opportunities for discourse and formative assessment used by engineering faculty. Both populations felt the benefits were worth the time invested.

Format: Individual Paper Presentation  Presider: Alison Mercier

Trust in Climate Science and Scientists: Secondary Science Teachers’ Climate Change Views and Teaching

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

4:15pm - 5:15pm in Regency H - Session A

This mixed methods study characterizes secondary teachers’ trust in climate scientists and scientists and explores how trust in climate science and scientists is approached in science classrooms.

Format: Individual Paper Presentation  Presider: Mark Andrew Bloom

Climate Change Misconceptions in Secondary Education: a Meta-Synthesis

Candace L Penrod, Utah State University
Kimberly H Lott, Utah State University

4:15pm - 5:15pm in Regency H - Session B

As scientists emphasize anthropogenic climate change, misconceptions persist, interfering with educating a climate-literate society. This meta-synthesis investigates current climate change misconceptions in secondary education, including the most prevalent misconceptions and the most promising strategies to mitigate climate change misconceptions.

Format: Individual Paper Presentation  Presider: Mark Andrew Bloom
K-8 Climate Change and Marine Science Professional Development: Successes and Plans for Future Modification

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

4:15pm - 5:15pm in Regency H - Session C

After identifying baseline K-8 teacher knowledge related to climate change, marine science, and the NGSS, we modified an existing curriculum, created plans for a PD initiative, and implemented the PD with one round of twelve preservice and practicing K-8 teachers. This presentation shares lessons learned and plans for future modification.

Format: Individual Paper Presentation Presider: Mark Andrew Bloom

Utilizing Expectancy-Value Theory to Interpret High School Teachers’ Implementation of Bioeconomy-Based Laboratories and Activities

Margaret R Blanchard, NC State University
Karen M Collier, North Carolina State University; Aparajita Rajwade, North Carolina State University; Katherine M McCance, North Carolina State University; Shana L McAlexander, Duke University; Richard A Venditti, North Carolina State University

4:15pm - 5:15pm in Studio 220 @ NOMA A - Session A

This qualitative study investigated the experiences of 16 rural high school teachers who were engaged in professional development to stimulate their students' interest in the bioeconomy. Teachers’ motivations underlying decisions to implement lessons/activities were analyzed using task value constructs from expectancy-value theory.

Format: Individual Paper Presentation Presider: Jennifer Bateman

Exploring High School Science Teachers’ Experiences With Professional Support That Form Their PCK in Teaching Students With Disabilities in an Inclusive Science Classroom

Sahrish P Anjwani, University of Georgia and Gwinnett County Public Schools

4:15pm - 5:15pm in Studio 220 @ NOMA A - Session B

This study explored the professional learning opportunities, resources, and other supports science teachers working with students with disabilities have had experience and/or access to that may have contributed to the development of their pedagogical content knowledge (PCK) specific to teaching science to students with disabilities.

Format: Individual Paper Presentation Presider: Jennifer Bateman

Exploring the Relationship Between Discipline-Specific Subject Matter Knowledge and Discipline-Specific Science Teaching Efficacy of Elementary Teachers

Doug Ball, Utah State University
Colby Tofel-Grehl, Utah State University; Brenda Bennett, Utah State University

4:15pm - 5:15pm in Studio 220 @ NOMA A - Session C

This study explicates findings from an exploratory study looking at potential relationships between discipline-specific science teaching efficacy and subject matter knowledge for in-service elementary teachers. In particular, differences between physical and life science disciplines are examined.

Format: Individual Paper Presentation Presider: Jennifer Bateman
Design and Delivery of a Secondary Methods Module That Will Transform Pre-Service Teachers Thinking

Michelle Tindall, Modeling in Michigan

William R. Thornburgh, American Modeling Teachers Association

4:15pm - 5:15pm in Studio 220 @ NOMA B & C

This workshop introduces a newly developed, two-week unit for secondary methods courses, which introduces Modeling Instruction through the lens of High-Leverage Teaching Practices, NGSS, and the NSTA Standards for Science Teacher Preparation. Workshop participants will experience an abbreviated Modeling Cycle and leave with a copy of the unit.

Format: Workshops

Science Teacher Preparation for the STEM Era: A Federal Strategic Plan

Jeff Weld, Iowa Governor's STEM Advisory Council

4:15pm - 5:15pm in Teal Ballroom

America’s Strategy for STEM Education, a Federal Strategic Plan for 2019-2023, brings immense implications for both the scholarly and teaching activities of science teacher educators. Expect a lively discussion on support, ambivalence, concern, threat, opportunity, excitement, and plugging in to America’s Strategy for STEM Education.

Format: Exploratory Session

Innovations in Culturally Relevant and Responsive Science Instruction

Julie C. Brown, University of Florida

Mark B. Pacheco, University of Florida; Angelina E. Castagno, Northern Arizona University; Darold Joseph, Northern Arizona University; Pradeep M. Dass, Northern Arizona University; Lama Jaber, Florida State University; Shannon G. Davidson, Florida State University; Diane J. Ketelhut, University of Maryland; Kristina A. Kramarczuk, University of Maryland; Ebony Terrell Shockley, University of Maryland; Brian C. Nelson, Arizona State University; Allison Metcalf, Florida State University

4:15pm - 5:15pm in Think Tank @ NOMA

This session features innovative models and tools at the frontier of culturally responsive and relevant instruction for diverse and underserved student populations. Researchers describe frameworks for equitable and responsive science teaching, models for developing responsive teaching practices, and tools for examining those practices.

Format: Themed Paper Set

Boundary Crossing During the Virtual Mentoring of the Peer Review Process: A Collaborative Self-Study

Joanne B Vakil, The Ohio State University

Linda Hobbs, Deakin University

4:45pm - 5:15pm in ASTE Zoom Room - Session A

Peer review mentoring for a science ed journal is examined through the lens of boundary crossing and self-study. Findings identify a coordination of boundary spanners, providing the mentee with a widened perspective to support future scholarly practices. Implications of an effective design for mentoring may interest grad students and journal editors.

Format: Small Group Roundtables Presider: Stephanie Arthur
Agriculture, Culturally Sustaining Pedagogy, and the Digital Divide

Lori Andersen, University of Hawaii at Manoa
Ming Wei Koh, Center for Getting Things Started

4:45pm - 5:15pm in ASTE Zoom Room - Session B

This innovative project developed culturally sustaining instructional materials for low-technology distance learning in response to the COVID-19 pandemic and 30% of students lacking internet access. We present the work of two researchers with 10 teachers in a rapid, participatory co-design process to develop instructional materials.


Continuum Model for Awareness, Advocacy, and Activism in Social Justice Centered Science Teaching

Stephanie A Arthur, University of South Florida

4:45pm - 5:15pm in ASTE Zoom Room - Session C

This research addresses teaching secondary science within a conceptual model for a continuum of awareness, advocacy, and activism for social justice. How can science teachers shift from being advocates to becoming activists for their science students through intentional investigation of identity and equity within their classrooms and beyond?

Format: Small Group Roundtables  Presider: Stephanie Arthur

JSTE Editor Reception - Synchronous (Invitation Only)

5:15pm - 6:15pm in ASTE Zoom Room & Regency F
Format: General

Mentor-Mentee Nexus

5:15pm - 6:00pm in Redbud A & B
Format: General

Six at Six Social Dinner Meet-Ups

6:00pm - 7:30pm in Lobby
Format: General

WISE Dinner

6:00pm - 8:00pm in Regency A & B
Format: General

Poster Breakout Discussions & Social Hour

7:30pm - 8:30pm in ASTE Zoom Room
Format: General

Graduate Student Social

8:00pm - 10:00pm in Lobby
Format: General
Saturday, January 8

Sat, January 08

Conference Office
7:00am - 8:00pm in Meeting Planner Office
Format: General

Sat, January 08

Continental Breakfast
7:00am - 8:30am in Regency A & B
Format: General

Sat, January 08

Birds of A Feather Discussions
Topics
• Anti-Racist Science Education
• Early Career Faculty
• Elementary Science Methods Online
• Practicum Experiences in a Pandemic
• Secondary Science Methods Online
• Using New Technologies in a Pandemic
• When I'm Not Teaching Science Teachers...
• Work-Life Balance
Format: General

Sat, January 08

Nature Walk With Matt
7:15am - 8:15am in Regency A & B
Format: General

Sat, January 08

Collaboration & Writing Space
7:00am - 10:30am in Regency F
Format: General

Sat, January 08

Conference Planning Committee Meeting
7:15am - 8:15am in Regency G
Format: General

Sat, January 08

Oversight Committee Meeting
7:15am - 8:15am in Studio 220 @ NOMA A
Format: General

Sat, January 08

Equity Committee Meeting
7:15am - 8:15am in Teal Ballroom
Format: General

Sat, January 08

Closing Social/Conference Reflections
8:00am - 9:00am in ASTE Zoom Room
Format: General
Content Knowledge for Teaching About Matter and Its Interactions: An Exploration of Educative Curriculum Materials and Assessments for Teacher Educators

Deborah L Hanuscin, Western Washington University
Josie Melton, Western Washington University; Emily J Borda, Western Washington University; Jamie N Mikeska, ETS

8:30 am - 9:30 am in Crepe Myrtle

Content knowledge for teaching (CKT) focuses on the professional knowledge that teachers draw upon while teaching. In this session, attendees will have an opportunity to explore sample assessment items and educative curriculum materials for teacher educators that can be used to develop elementary preservice teachers’ CKT about matter.

Format: Exploratory Session

Exploring Elementary Preservice Teachers’ Development of Naval STEM Lesson Plans

Jeffrey Radloff, SUNY Cortland
Dominick Fantacone, SUNY Cortland; Angela Pagano, SUNY Administration

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

This presentation explores elementary preservice teachers’ (PSTs) development of Naval STEM tasks in a senior science methods course. Results showed most PSTs adapted existing teaching materials, and how they integrated and contextualized engineering design varied. Implications and future directions for science teacher education are discussed.

Format: Individual Paper Presentation Presider: Anna Maria Arias

Exploring Elementary PSTs’ Self-Efficacy for Teaching Engineering: In What Aspects Do PSTs Feel Most and Least Confident?

Min Jung Lee, Old Dominion University
Kristie S. Gutierrez, Old Dominion University; Jennifer J. Kidd, Old Dominion University

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

Elementary PSTs’ self-efficacy significantly increased after teaching engineering with engineering student partners. To understand these changes, we examined the focus of their self-efficacy. Student reflections suggest PSTs felt most comfort related to instructional self-efficacy and the least comfort with their knowledge of engineering.

Format: Individual Paper Presentation Presider: Anna Maria Arias

Secondary Science Preservice Teachers: Technology Integration in Methods and Residency

Andrea C Burrows, University of Wyoming
Trina J Kilty, University of Wyoming

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

This study described how secondary science PSTs implemented technology in residency that they had planned in previous science methods courses. A collective case study was used to gain understanding of multiple perspectives across experience, gender, and content areas. Recommendations are given for science teacher educators to integrate technology.

Format: Individual Paper Presentation Presider: Karl Jung
The Space Between Anything and Everything: Exploring K-12 STEM Teachers’ Definitions of Technology

Amanda D. Tompkins, University of South Florida
Karl G. Jung, University of South Florida
8:30am - 9:30am in Magnolia - Session B

The term “technology” remains ill-defined and ambiguous. This presentation explores 46 STEM educators’ definition of technology, descriptions of how they are currently using technology, and their goals for future implementation. Using definitions to identify preconceptions can inform future technology workshops on how to support conceptual change.

Format: Individual Paper Presentation  Presider: Karl Jung

Adapting Repeated Teaching Experiences for Use in an Online Elementary Science Methods Course

Franklin S. Allaire, University of Houston-Downtown
8:30am - 9:30am in Redbud A & B - Session A

This presentation describes how repeated teaching experiences 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: Small Group Roundtables  Presider: Rachel Sparks

Applying the NSTA/ASTE Standards for Science Teacher Preparation to the Redesign of a Physical Science Course for Elementary Preservice Teachers

Stacy A Hootman, University of Indianapolis
Lori A Bolyard, University of Indianapolis; Sarah J Reynolds, University of Indianapolis
8:30am - 9:30am in Redbud A & B - Session B

University of Indianapolis faculty redesigned a physical science course for preservice teachers based on the 2020 NSTA/ASTE Standards for Science Teacher Preparation. Participants will see our semester guide to a physical science course, and hear instructor and student feedback on the course as well as plans for future iterations of the course.

Format: Small Group Roundtables  Presider: Rachel Sparks

Early Elementary Conceptions of Engineers: Themes From the Draw an Engineer Test (DAET)

Kimberly H Lott, Utah State University
Krista Ruggles, Utah Valley University
8:30am - 9:30am in Redbud C - Session A

This presentation will present the results of a study that used the Draw An Engineer Test (DAET) to assess early childhood conceptions of engineers before and after implementing a STEM unit as part of their classroom instruction.

Format: Individual Paper Presentation  Presider: Jacob Pleasants

Investigating Teacher Development of Self-Regulated Learning Skills in Secondary Science Students

Erin E Peters-Burton, George Mason University
Andrew N Porter, George Mason University
8:30am - 9:30am in Redbud C - Session C

Format: Small Group Roundtables  Presider: Rachel Sparks
This multiple case study examined how secondary science teachers supported their students' self-regulated learning development after an intensive, year-long, professional development. The results suggest that the teachers used the SRL coaching strategies but only for the early phases. Recommendations for professional development will be discussed.

**Format**: Individual Paper Presentation  
**Presider**: Jacob Pleasants

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**Curriculum, Pedagogy, and Assessment**  
Sat, January 08

**“Another Day Passed and I Still Haven't Used (Y=mx+b)”**: Understanding Versus Memorization  
*Renesha (R. L.) Hendrix*

8:30am - 9:30am in Regency G

In this study, the researcher used the lesson study method to improve their professional development and implement a curriculum guideline more accessible to K-12 scholars in the US. Scratch and Calq were used for scholars to comprehend the statement through illustrations in Scratch and then apply them to culturally relevant scenarios in Calq.

**Format**: Themed Paper Set

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**Ethnoscience and Environmental Education**  
Sat, January 08

**Digging Into School Gardens: A Systematic Review of the Research**  
*Kathy Cabe Trundle, Utah State University*  
*Rita Hagevik, UNC-Pembroke*

8:30am - 9:30am in Regency H - Session B

This study provides a comprehensive and systematic review of school garden-based learning (GBL) research spanning more than three decades (1989-2019), with a goal of summarizing the current knowledge base, identifying research trends over time, and providing guidance for future curriculum development and research.

**Format**: Individual Paper Presentation  
**Presider**: Stacey Britton

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**Ethnoscience and Environmental Education**  
Sat, January 08

**Building Capacity for Pre-Service Teachers to Conduct Meaningful Field Experiences in Future Classrooms**  
*Sarah Nuss, Virginia Institute of Marine Science*  
*Jennifer Maeng, University of Virginia*  
*Lisa Lawrence, Virginia Institute of Marine Science*  
*Elizabeth Edmondson, Virginia Commonwealth University*

8:30am - 9:30am in Regency H - Session C

This presentation discusses the implementation and year 1 outcomes of a program design to support pre-service teachers and education faculty in building capacity to teach and implement meaningful watershed educational experiences.

**Format**: Individual Paper Presentation  
**Presider**: Stacey Britton

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**Preservice Science Teacher Preparation-MIDDLE/SECONDARY**  
Sat, January 08

**An Examination of Culturally Responsive Teaching Self-Efficacy and Outcome Expectancy of 8 Cohorts of Preservice Teachers in an MT Secondary Science Program**  
*Elizabeth W Edmondson, Virginia Commonwealth University (VCU) - Richmond, VA*

8:30am - 9:30am in Studio 220 @ NOMA A - Session A

The impact of an MT secondary science program on the culturally responsive teaching (CRT) of its candidates was studied through an explanatory mixed methods (Creswell, 2009) approach using the CRTSE and CRTOE scales (Siwatu, 2007) and interviews of the candidates to examine participants' CRT self-efficacy and outcome expectancy.

**Format**: Individual Paper Presentation  
**Presider**: SuJin Choi
Secondary Science Preservice Teachers’ Self-Efficacy and Preparation for Linguistically Diverse Science Classrooms

*Alexis Rutt, University of Mary Washington*

8:30 am - 9:30 am in Studio 220 @ NOMA A - Session B

The study investigates secondary science preservice teachers’ feelings of preparation and self-efficacy for teaching science in linguistically diverse classrooms after participating in language- and literacy-integrated science methods courses. Results show increased feelings of preparation and efficacy with room to grow. Implications are discussed.

*Format*: Individual Paper Presentation  *Presider*: SuJin Choi

Intersection of Science, Second Language, and Literacy Acquisition (ISSLLA): An Innovative Collaboration Between Interdisciplinary Teacher Education Faculty During Year 1

*Su Gao, University of Central Florida*

Vassiliki (Vicky) I Zygouris-Coe, University of Central Florida; Joyce Nutta, University of Central Florida; Haiyan Bai, University of Central Florida; Kristina Brendel, University of Central Florida

8:30am - 9:30am in Studio 220 @ NOMA A - Session C

This proposal shares our first-year pilot of a secondary teacher education program funded by the NSF. We will share an innovative secondary science methods course’s development, implementation, outcome, and lessons learned through collaboration between science education, disciplinary literacy, and TESOL faculty.

*Format*: Individual Paper Presentation  *Presider*: SuJin Choi

Why Environmental Justice? Rethinking Science Educators’ Engagement in Environmental Education

*Holly M Plank, University of Pittsburgh*

Hillary Henry, University of Pittsburgh; Cassie F Quigley, University of Pittsburgh

8:30am - 9:30am in Studio 220 @ NOMA B & C

This workshop takes participants beyond understanding what environmental justice is and how to teach it. We also invite participants to think deeply about their own why environmental justice. Grounding our work in the why is the first step in navigating tensions and challenges in teaching environmental justice in today’s political climate.

*Format*: Workshops

Have We Answered the Call? a Systematic Review of the 5E Instructional Model

*Melissa Hulings, The University of Texas at Arlington*

Candace Joswick, The University of Texas at Arlington

8:30am - 9:30am in Think Tank @ NOMA - Session A

The 5E Instructional Model is widespread in K-20 science education and teacher preparation, yet the authors have called for empirical evidence of its validity. Through a systematic review, we explore existing literature to determine the effectiveness of the 5E Instructional Model. Findings and implications will be discussed.

*Format*: Individual Paper Presentation  *Presider*: Yamil Ruiz
Modeling Interdisciplinary Project-Based Learning Units in Order to Increase Global Competencies Among Pre-Service Teachers

Lisa N Pitot, University of Wisconsin La Crosse
Jennifer Kozia, University of Wisconsin La Crosse
8:30am - 9:30am in Think Tank @ NOMA - Session B

This study examined two pre-service teacher (PST) educator’s collaboration on a capstone unit plan project designed to increase PST’s globally responsive teaching competencies and abilities to develop authentic project-based curricular units. PBLWorks design templates, rubrics, project exemplars, and project analyses will be shared.

Format: Individual Paper Presentation Presider: Yamil Ruiz

3cScience Motivation: Introducing a Framework for Inspiring Science Learning

Bryan H Nichols, Florida Atlantic University
8:30am - 9:30am in Think Tank @ NOMA - Session C

This presentation will introduce 3cScience motivation, an open framework based on curiosity, connections, and compassion. The framework was developed using tools for conceptual analysis, and designed help illustrate and clarify some important, positive motivational pathways for learners, beyond grades and nebulous future jobs.

Format: Individual Paper Presentation Presider: Yamil Ruiz

Coffee Break & Fireside Chats

9:30am - 10:15am in Prefunction Area

Fireside Chat With JSTE Editors - ASTE Zoom Room
Fireside Chat With CITE Editors - Crepe Myrtle
Fireside Chat With Thread Coordinators - Dogwood
Fireside Chat With NSTA Student Chapter Advisors - Magnolia
Fireside Chat With Presidential Team - Redbud A & B
Fireside Chat With ASTE Awardees - Redbud C
Fireside Chat With Forum Leaders - Regency G
Fireside Chat With Elections Committee - Regency H
Fireside Chat With Innovations Editors - Teal Ballroom
Fireside Chat With Regional Leaders - Think Tank @ NOMA

Format: General

Meet the Food-Water-Energy Nexus: National Collaboration and Implications for Science Teacher Education

Rita Hagevik, The University of North Carolina at Pembroke
Sarah Haines, Towson University
10:30am - 11:30am in Crepe Myrtle

We will discuss the Food-Water-Energy Nexus and apply it to science teacher education through an analysis of the national standards focused on food and food production (NGSS, NHES, NAAEE, ANFR). Research on food and water; water and energy; and food and energy with resources on how to use these in science teacher education will be shared.

Format: Exploratory Session
Learning to Teach Science Remotely: A Pilot Practicum for Preservice Elementary School Teachers
Deena L. Gould, University of New Mexico
Waunita Zink, University of New Mexico; Kelli Williams-Page, University of New Mexico
10:30am - 11:30am in Dogwood - Session A
We report outcomes of a remote practicum that had a university-based microteaching component followed by a school-based teaching component. We report PSET’s perceived satisfaction and perceived teaching efficacy. We also report affordances of the practicum for “real” teaching roles, pedagogical agility, and bridging from university to school
Format: Individual Paper Presentation Presider: Alison Mercier

Pre-Service Teachers’ Engagement in Collaborative Inquiry Projects During Remote Instruction
Julie Robinson, University of North Dakota
Rebekah Hammack, Montana State University
10:30am - 11:30am in Dogwood - Session B
This study identifies impacts of a K-8 science methods project that engaged pre-service teachers (PSTs) in scientific inquiry through remote collaboration. We identified disconnects between PSTs’ involvement in the project and goals of collaborative learning and offer strategies for using remote collaborative inquiry in science methods courses.
Format: Individual Paper Presentation Presider: Alison Mercier

“I Am Capable of More Than What I Thought”: Exploring Preservice Teacher Perceptions of Action Research
Seema Rivera, Clarkson University
Preethi Titu, Kennesaw State University
10:30am - 11:30am in Dogwood - Session C
As Action research (AR) provides the opportunity for preservice teachers (PSTs) to engage in research in an effort to learn more about teaching and improve their own pedagogy, this single embedded case study was employed to understand the perceptions of PSTs toward AR as a way of support to develop their teaching skills.
Format: Individual Paper Presentation Presider: Alison Mercier

In-Service Elementary Teachers’ Beliefs About Scientists
Nicole L. Cook, UNC Charlotte
Ian C Binns, UNC Charlotte Daniel Alston, UNC Charlotte
10:30am - 11:30am in Magnolia - Session A
In this investigation, we looked at in-service elementary teachers’ beliefs and possibly held stereotypes of scientists using the E-DAST and follow-up interviews. We present implications for further research such as using the DAST and its variations as a means of sparking conversations and personal pedagogical reflections.
Format: Individual Paper Presentation Presider: Hong Tran

Using Video to Elicit the Professional Knowledge of a Teacher: A Pilot Study
Julie Luft, University of Georgia
10:30am - 11:30am in Magnolia - Session B
We report on our use of a protocol to evaluate teachers’ noticing of good science instruction as they view short videos of science teachers’ teaching. The protocol is focused on instruction and the noticing frame of the teacher.
Science Teacher Professional Development-ELEMENTARY
Sat, January 08

Preservice Elementary Teachers’ Field Experience at a Science Summer Program: Exploring the Connection Between Science Teaching Self-Efficacy and Understanding of Best Practices
Jacquelyn Duran, Teachers College, Columbia University
Alison Matthews, Teachers College, Columbia University; Min Jung Lee, Old Dominion University
10:30am - 11:30am in Magnolia - Session C
We explore the impact of an intensive field experience on PSTs’ science teaching self-efficacy and on their understanding of elements of good science teaching. Using a pre/post design, results from the STEBI-B are compared to survey and interview data using a rubric designed by the researchers to examine PST’s perceptions of good science teaching.

Preservice Science Teacher Preparation-MIDDLE/SECONDARY
Sat, January 08

Collaborative Teaching of a Secondary Science Methods Course: A Self-Study of Three Science Teacher Educators
Stephen R Burgin, University of Arkansas
Kate Walker, University of Arkansas; Peggy Ward, University of Arkansas
10:30am - 11:30am in Redbud A & B - Session A
In this presentation, the findings from a self-study of three science teacher educators who cotaught a secondary science methods course will be presented. Successes and challenges of the collaboration, recommendations for others, and the merits of self-study as a qualitative methodology will be discussed.

Preservice Science Teacher Preparation-MIDDLE/SECONDARY
Sat, January 08

Teacher Educator Preparation: Experiences in a Multi-Tiered Mentoring Program in Science Teacher Education
Lorna Otero, Teachers College
Emelia Pelliccio, Teachers College; Ibrahim Dincer, Teachers College; Jessica Riccio, Teachers College; Kristen Larson, Teachers College
10:30am - 11:30am in Redbud A & B - Session B
This self-study looks at our shared experiences as student teacher educators in a collaborative, embedded support system for a pre-service science student teaching course. Through a collaboration of near-peers, supervisors, and faculty we co-constructed a system where we, as mentors, built and refined our skills as aspiring teacher educators.

Preservice Science Teacher Preparation-ELEMENTARY
Sat, January 08

Tracing the Development of Preservice Teachers' Understandings About Sources of Energy for Trees
Rebecca M Krall, University of Kentucky
Moriah Peel, University of Kentucky; Amber Keene, University of Kentucky; Sagan Goodpaster, University of Kentucky
10:30am - 11:30am in Redbud A & B - Session C
This study explored preservice elementary teachers' understandings of photosynthesis from the macroview perspective of energy sources for trees across the seasons. A pictorial protocol was used to create situatedness in the interview. Findings will be presented in the form of concept maps illustrating changes in understanding across the interview.
A Multiple Case Study Comparison of Elementary Education and Engineering Majors’ Understanding of Community Engineering

Rebekah Hammack, Montana State University
Tina Vo, University of Nevada Las Vegas; Blake Wiehe, Montana State University; Miracle Moonga, Montana State University

10:30am - 11:30am in Redbud C - Session A

This research investigates and compares elementary education and engineering majors’ understanding of engineering within their communities. We found while there were some similarities across groups, engineering majors were more likely to acknowledge science concepts, and elementary education majors found a larger variety of engineering elements.

Format: Individual Paper Presentation  Presider: Rebekah Hammack

Characterization of Elementary Teachers’ Integration of Engineering

Jennifer L Maeng, University of Virginia
Amanda L Gonczi, Michigan Technological University; Whitney N McCoy, University of Virginia

10:30am - 11:30am in Redbud C - Session B

This study investigated 15 elementary teachers’ self-identified engineering lessons with the goal of understanding what they believe engineering to be and how this translates into instruction. Only 11 of 18 lessons were consistent with engineering, which suggests a need for teachers to better understand what engineering is.

Format: Individual Paper Presentation  Presider: Rebekah Hammack

Starting, Growing, and Sustaining an NSTA Student Chapter

Melanie Reap, Kimberly Staples, Nicole Glen, Sandra Yarema, Dominick Fantacone, Debi Hanuscin, Donna Governor,

10:30am - 11:30am in Regency F

Interested in starting, growing, or sustaining an NSTA student chapter at your institution? Wondering how to leverage doing that as part of your teaching/research/service? Come join the NSTA Preservice Division Director and Advisors of NSTA Student Chapters in a roundtable networking session!

Format: Workshops  Presider: Flavio Mendez

What Knowledge Gets Used When Reading About a Socioscientific Issue: Implications for Science Teacher Education

Lucas Menke, Drake University
Jerrid Kruse, Drake University; Kinsey Zacharski, Drake University

10:30am - 11:30am in Regency G - Session A

This study used a think-aloud protocol to analyze the knowledge bases that in-service secondary science teachers use when reading about socioscientific issues. Results indicate participants drew most heavily from their understanding of the nature of technology and media literacy. Implications for science teacher education will be discussed.

Format: Individual Paper Presentation  Presider: Ron Hermann

Instructional Planning Modifications to Meet Social Distancing Requirements

Trina J Kilty, University of Wyoming
Andrea C Burrows, University of Wyoming

10:30am - 11:30am in Regency G - Session B
Rapidly changing conditions of the COVID-19 pandemic compelled educators to rapidly redesign science courses to accommodate social distancing. In this study, a team of undergraduate college students planned and taught STEM outreach minilessons to a K-12 audience. The team faced challenges planning meaningful learning experiences in uncertain times.

**Format:** Individual Paper Presentation  
**Presider:** Ron Hermann

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**College and University Science Education**  
**Sat, January 08**

**Teleological Thinking About Evolution in Community College Biology**  
*Kathryn E Green, University of Georgia*  
*Cesar Delgado, North Carolina State University*  
*10:30am - 11:30am in Regency G - Session C*

This research focuses on teleological thinking about evolution in biology students. We include results of an intervention in which the instructor directly addresses teleological thinking in hopes of increasing understanding and acceptance of evolution. Preliminary results indicate that this method may assist some students but not all.  
**Format:** Individual Paper Presentation  
**Presider:** Ron Hermann

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**Educational Technology**  
**Sat, January 08**

**Teaching With Technology: Building Confidence**  
*Danielle J. Malone, Washington State University*  
*Judith Morrison, Washington State University; Jonah B. Firestone, Washington State University; Sarah Newcomer, Washington State University; Lindsay Lightner, Washington State University; Stassia Feltes, Washington State University*  
*10:30am - 11:30am in Regency H - Session A*

This study explores how teachers define technology use in their classrooms and their perceived confidence with technology integration. This exploration is the first step to understanding teachers’ professional development needs to support integrating technological tools within K-12 classrooms.  
**Format:** Individual Paper Presentation  
**Presider:** Amanda Tompkins

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**Educational Technology**  
**Sat, January 08**

**Documenting the Guitar Build: Using ePortfolios as an Evaluation Tool for Integrated STEM Professional Development**  
*Debbie A French, Wake Forest University*  
*Sean Hauze, San Diego State University; Sophia Dorsey, Wake Forest University*  
*10:30am - 11:30am in Regency H - Session B*

ePortfolios are used in collegiate STEM courses and preservice teacher training. These findings indicate ePortfolios are also an effective evaluation tool for integrated STEM Professional Development by documenting processes, skills learned, and integration. Analysis of survey data indicated teachers referenced ePortfolios during the school year.  
**Format:** Individual Paper Presentation  
**Presider:** Amanda Tompkins

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**Student Learning P-12**  
**Sat, January 08**

**Relationship-Based Teaching Conversations in a High School Classroom: A Teacher and Undergraduate Mentor Exemplify Effective Science Education**  
*Jennifer C. Parrish, University of Northern Colorado*  
*Zachary C. Romer, Northridge High School; Jose A. Calderon, Aims Community College; David A. Slykhuis, University of Northern Colorado*  
*10:30am - 11:30am in Studio 220 @ NOMA A - Session A*

A high school teacher and undergraduate mentor from a community college exemplify what constitutes effective relationship-based science education in the 21st century as they engage in conversation with students during beta testing of Make to Learn, a project-based digital arts curriculum which introduces computational thinking. NSF Grant XXXXXXX  
**Format:** Individual Paper Presentation  
**Presider:** Stephen Thompson
Results of a Discourse Analysis of Student-to-Student Conversations in a Secondary School Physical Science Laboratory Setting
Jennifer Faith Oramous, University of Arkansas
10:30am - 11:30am in Studio 220 @ NOMA A - Session B
This study focuses on the student-to-student (SS) “productive conversation” occurring within groups engaged in several activities in a physical science laboratory with a goal to identify aspects and patterns of such conversation. SSPT is defined and findings discussed.

Curriculum, Pedagogy, and Assessment
Sat, January 08

Teachers’ Calls for Support in Bridging Elementary Science and Literacy
Danielle R Scharen, North Carolina State University
Sarah J Carrier, North Carolina State University
10:30am - 11:30am in Studio 220 @ NOMA A - Session C
We share the beliefs and practices of science and literacy integration from the perspective of the true “experts” in elementary education: current elementary teachers. Our findings report teachers’ views about their comfort, time limitations, and needs for support integrating science and literacy.

Curriculum, Pedagogy, and Assessment
Sat, January 08

Engaging Elementary and Secondary Preservice and Inservice Science Teachers in Crosscutting Concepts: Strategies Across Multiple Institutions
Julie Contino, Richard Gilder Graduate School/American Museum of Natural History
Anna Maria Arias, Kennesaw State University; Amanda Benedict-Chambers, Missouri State University; Jeni Davis, Salisbury University; Patrick Enderle, Georgia State University; Sarah Fick, Washington State University; Deborah Hanuscin, Western Washington University; Morgan Presley, Ozarks Technical Community College; Carrie-Anne Sherwood, Southern Connecticut State University; Tina Vo, University of Nevada, Las Vegas
10:30am - 11:30am in Studio 220 @ NOMA B & C
Participants will engage in strategies for supporting K-12 preservice and inservice elementary and secondary science teachers with the Crosscutting Concepts (CCCs), guided by experienced teacher educators from eleven institutions across the country. Participants will be supported to discuss the adaptation of activities for different contexts.
Format: Exploratory Session

College and University Science Education
Sat, January 08

Qualitative Research Studies Pre and During a Global Pandemic: Methods, Research, and Products
Felicia M Mensah, Teachers College at Columbia University
Tasnim Aziz, Teachers College at Columbia University; Allison Bookbinder, Teachers College at Columbia University; Shane Coleman, Teachers College at Columbia University; Anna Ghurbanyan, Teachers College at Columbia University; Andrea Horowitz, Teachers College at Columbia University; John Lee, Teachers College at Columbia University; Lauren McGinty, Teachers College at Columbia University
10:30am - 11:30am in Teal Ballroom
This interactive session offers a new format for the conference. Sixteen research papers exhibiting different qualitative approaches are shared in this two-part symposium. Deliberate attention to graduate student preparation as emergent academic researchers begins with students conducting studies based upon interests and presenting their findings.
Format: Themed Paper Set
An Account of Cross-Cutting Concepts in the NGSS: Thorough Mixed Methods Analyses via Text Mining Approach

Tomoki Saito, Juntendo University

10:30am - 11:30am in Think Tank @ NOMA - Session A

In this study, the author analyzed the texts on the NGSS and identified several constructs described on the Cross-cutting Concepts and the Performance Expectations related to them. By examining lines on qualitative and quantitative analyses, the author found that the standards describe students’ performance of processes associated with each CCC.

Format: Individual Paper Presentation Presider: Jayme Simlin Del Mario

Exploring Ecological Levels in a Teacher Leader’s Reflections on Integrated Science Curricular Reform

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

10:30am - 11:30am in Think Tank @ NOMA - Session C

A directed content analysis explored the ecological levels within a teacher leader’s reflections on curricular reform integrating chemistry and Earth science. Findings show more reflections from a classroom perspective despite spending more time at the district-level. However, reflections drew from all levels illustrating myriad contextual factors.

Format: Individual Paper Presentation Presider: Jayme Simlin Del Mario

Collaboration & Writing Space

11:30am - 4:00pm in Regency F

Format: General

Awards Lunch

12:00pm - 1:30pm in Regency A & B

Format: General

Executive Committee Meeting

2:30pm - 4:30pm in Boardroom

Format: General

Greenville Food & Drink Tour

4:00pm - 7:00pm in Lobby

Format: General

Full Board of Directors Meeting #2

5:00pm - 8:00pm in Boardroom

Format: General

Executive Committee Meeting

8:00pm - 8:30pm in Boardroom

Format: General
Presiders

Franklin Allaire
Mark Andrew Bloom
Stephanie Arthur
Ellen Barnett
Jennifer Bateman
Stacey Britton
Stephen Burgin
SuJin Choi
Julie Contino
Kristin Cook
Richard Cox
Emily Dare
Elizabeth Edmondson
Farah Faruqi
Allan Feldman
Brent Giles
Lisa Gross
Rebekah Hammack
Stephanie Hathcock
Sara Heredia
Ben Herman
Ron Hermann
Sharfun Islam Nancy
Karl Jung
Meredith Kier
Richard Lamb
Corrine Lardy
Katie Laux
Pamela Lotero-Perdue
Heather Lucas
Lauren Madden
Anna Maria Arias
Flavio Mendez
Alison Mercier
Joi Merritt
Helen Meyer
Bridget Miller
Shannon Navy
Noushin Nouri
Jennifer Oramous
Meredith Park Rogers
Laura Peña-Telfer
Stephanie Philipp
Lisa Pitot
Jacob Pleasants
Catherine Quinlan
Emma Refvem
Matt Reynolds
Wendy Ruchti
Jayme Simlin Del Mario
Khushbu Singh
Rachel Sparks
Amy Tankersley
Stephen Thompson
William Thornburgh
Christine Tippett
Preethi Titu
Colby Tofel-Grehl
Amanda Tompkins
Hong Tran
William Veal
Kate Walker
Shelby Watson
Angela Webb
Rachel Wilson
Sandra Yarema
2023 ASTE Conference

2023 Salt Lake City ASTE Conference (2.0): Life Elevated!

The Conference Committee invites you to journey to Utah and join us at the 2023 ASTE conference in Salt Lake City. Pre-conference adventures begin on January 11th, and the conference continues until January 14th. Numerous hiking trails and ski slopes are accessible within a short drive from Salt Lake. Conference rate hotel rooms will be available from January 9th through January 16th so that you may fully explore all the many wonders Utah has to offer.

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!

Kathy Cabe Trundle and Rita Hagevik
Conference Co-Chairs