SCIENCE EDUCATION
for the REST OF US

Coming together to reflect on global science education reforms

Denver, Colorado – Sheraton Denver Downtown
We acknowledge Wiley and their work as publisher of the *Journal of Research in Science Teaching* – JRST.
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General Information

**Information about NARST**

NARST is a global organization for improving science teaching and learning through research. Since its inception in 1928, NARST has promoted research in science education and the communication of knowledge generated by the research. The ultimate goal of NARST is to help all learners achieve science literacy.

The Association is incorporated as a non-profit corporation in the State of Minnesota. The official publication is the *Journal of Research in Science Teaching (JRST)*. NARST encourages presentations of a wide variety of investigations in all aspects of science education, including action, historical, philosophical, ethnographic, experimental, and evaluative research studies. Reports of empirical research, critical reviews, and theoretical works are encouraged. In October 2010, to reflect the Association’s growing international focus and membership, the Board approved referring to the Association by its acronym only. At the April 2011 Board Meeting, the tagline for the Association was approved by the Board. Thus, the Association’s name and tagline is:

*NARST—A global organization for improving science education through research.*

Research areas of interest to NARST members include curriculum development and organization, assessment and evaluation, learning theory, teacher education, programs for exceptional students (special needs and talents), equity studies, policy, and methods of teaching.

**NARST Mission Statement**

NARST is a global organization of professionals committed to the improvement of science teaching and learning through research. Since its inception in 1928, NARST has promoted research in science education and the communication of knowledge generated by the research.

The ultimate goal of NARST is to help all learners achieve science literacy. NARST promotes this goal by: 1) encouraging and supporting the application of diverse research methods and theoretical perspectives from multiple disciplines to the investigation of teaching and learning in science; 2) communicating science education research findings to researchers, practitioners, and policy makers; and 3) cooperating with other educational and scientific societies to influence educational policies.

**Member Benefits**

- Ten issues of the Journal of Research in Science Teaching (JRST) are published each volume year. JRST has been ranked as one of the highest quality educational journals according to studies published by War, Holland and Schramm (American Educational Research Journal) and Guba and Clark (Educational Researcher) for the American Educational Research Association (AERA). These authors identified JRST as clearly the top research journal in science education.

- Website, Member Portal and Listserv, allowing access to further information about the Association. You may access this site at: http://www.narst.org. There is further information about subscribing to the listserv on this site.

- Opportunities to participate in monthly webinars.
Code of Ethical Conduct

The purpose of the National Association of Research in Science Teaching (NARST) Code of Ethical Conduct is to articulate a set of aspirational principles to guide and support members as they engage in professional activities—research, teaching, and service. NARST members are science education professionals who include researchers, practitioners, and graduate students from various cultures worldwide. These aspirational principles align with and support the mission of the organization to help all members achieve, develop, and contribute meaningfully to the improvement of science teaching and learning through research. NARST expects its members to adhere to the highest ethical standards. The Code of Ethical Conduct serves as a guide to the everyday professional conduct of science educators.

Unfamiliarity with NARST’s Code of Ethical Conduct is not a valid defense for engaging in or failing to challenge observed unethical behavior. We accomplish this through our Code of Ethical Conduct where there is:

A. Professional Competence
Science education professionals strive to maintain the highest levels of competence in their work; they recognize the limitations of their expertise; and they undertake only those tasks for which they are qualified by education, training, or experience. They recognize the need for ongoing education in order to remain professionally competent; and they utilize the appropriate scientific, scholarly, professional, technical, and administrative resources needed to ensure honesty and integrity. Science education professionals conduct research, teach, practice, and provide service only within the boundaries of their competence, based on their education, training, supervised experience, or appropriate professional experience. They consult with other professionals when necessary for the benefit of their students, research participants, and clients. They maintain awareness of current scientific, scholarly, and professional information in their fields of activity and undertake continuing efforts to maintain competence in the skills they use. Importantly, professional competence must also include a willingness to accept and integrate new information and experiences, regardless of the effect that process has on research outcomes.

B. Integrity
It is the social responsibility of science education professionals to maintain integrity in all conduct, publications, and forums, and give due credit to the contributions of others. Adhering to this standard means science education professionals do not fabricate, falsify, or plagiarize. Public comments on matters of importance that are relevant to science education must be made with care and accuracy. Adhering to this standard means science education professionals do not use deficit language, deceptive statements concerning research data, or otherwise knowingly make false, misleading or deceptive statements in practicing and presenting research. Comment and debate within the bounds of collegiality and professionalism that keep the organization moving forward and current with emergent issues and perspectives are encouraged. Adhering to this standard means science education professionals do not use dismissive remarks or gestures, restrict multiple voices, or use derogatory language. In short, science education professionals conduct their professional activities in ways that engender trust and confidence.

C. Professional and Scholarly Responsibility in Science Teaching, Learning, and Research
Science education professionals have a responsibility to use research practice and policy to advance NARST members’ understanding of the teaching and learning of science in all learning contexts—formal, informal, local, and global—through research, practice, and policy. They adhere to the highest scholarly and professional standards within their field of expertise and accept responsibility for adherence to those standards. Science education professionals should regard the tutelage of graduate students and early career faculty as a trust conferred by the organization for which they work, as well as NARST, for the promotion of these individuals’ learning and professional development.
Science education professionals understand that they form a community and show respect for other science education professionals even when they disagree on theoretical, methodological, or personal approaches to professional activities. In activities involving marginalized populations, it is essential that responsible science education professionals seek out the voices and experiences of members of these groups and treat them as critical to their scholarship. While always endeavoring to be collegial, science education professionals must never let the desire to be collegial outweigh their shared responsibility for ethical behavior. When appropriate, they consult with colleagues, NARST’s Equity and Ethics Committee, or organizational entities such as their institutional review board in order to prevent, avoid, or challenge unethical conduct.

D. Respect for People’s Rights, Dignity, and Diversity
Science education professionals respect the rights, dignity, and worth of all people in their professional activities. They treat other professionals, students, research participants, and members of the organization fairly, respectfully, and without exploitation or harassment. Science education professionals acknowledge the rights of others to hold values, attitudes, and opinions that differ from their own and take reasonable steps to avoid harm to others in the conduct of their work. They learn with others, share ideas honestly, give credit for others’ contributions, and encourage others to contribute their unique skills, knowledge, and interests in professional environments. Science education professionals are sensitive to cultural, individual, and role differences in teaching, studying, and providing service to groups of people with distinctive characteristics, as well as the power differential that might result from such differences.

Science education professionals carefully avoid discrimination and bias toward individuals and groups based on race, gender, age, religion, ethnicity, nationality, sexual orientation, gender expression, gender identity, presence of disabilities, educational background, socioeconomic status, or other personal attributes. They refrain from making biased assumptions about others and perpetuating demeaning attitudes and stereotypes. Science education professionals do not accept any forms of discrimination and actively challenge implicit and explicit forms of discrimination.

E. Social Responsibility
Science education professionals are aware of their scientific and professional responsibility to the communities and societies in which they live. This awareness extends to their involvement and service to an increasingly diverse and international NARST community. NARST members are guided by the values and standards that reflect the professional literature. They strive to promote equity and the public good by advancing scientific and scholarly knowledge. Science education professionals are aware of the differences in society and culture that impact scholarly knowledge and academic work. They value and embrace the public trust in research and teaching and are concerned about their ethical behavior and the behavior of other science education professionals that might compromise that trust. Science education professionals should reasonably expect of themselves and others to be guided by a code of ethics that supports efforts to resolve ethical dilemmas.

References


Research Interest Groups (RIGs)

Continental and Diasporic Africa in Science Education RIG (CADASE)
The purpose of CADASE RIG is to (a) encourage science educators to engage in research aimed at meeting the needs of people of African descent; and (b) provide intellectual, professional, and personal space for science educators engaged in such research. This RIG will provide opportunities for science education researchers to integrate the study of culture, ethnicity, gender, race, and social class as lenses for performing critical analyses and evaluations of prevailing theory and practice of science education on the lives of people of African descent. A variety of theoretical and methodological frameworks will be used to address issues in science curriculum, learning, teaching, assessment and evaluation, and policy issues in both K-14 formal and informal venues in different contexts.

Chair: Mary M. Atwater
atwater@uga.edu

Steering Committee Chair: Rona Robinson-Hill
rmrobinsonhi@bsu.edu

Secretary: Shari Earnest Watkins
shariear@yahoo.com

Treasurer: Brittany Gavin-Hudson
bagarvin@gmail.com

LATINO/A RIG (LARIG)
The Latino/a RIG supports social networks that further research agendas regarding Latino/a science learners. LARIG also serves as a support and mentoring alcoba (space) for Latin@s/Latino science educators and others interested in Latin@ science education.

Chair: Regina L. Suriel, Valdosta State University
rlsuriel@valdosta.edu

Contemporary Methods for Science Education Research
The broad purpose of this RIG is to advance the mission of NARST by maintaining the rigor of science education studies, as well as promoting more standardized research practices across the organization such that we are better able to learn from and synthesize each other’s work. The intent is that these outcomes will, in turn, allow us to keep advancing the field and maintain the relevance of our research to improving science teaching and learning.

Chair: Robert Talbot, University of Colorado - Denver
robert.talbot@ucdenver.edu

Co-Chair: Bina Vanmali, Arizona State University
bina@asu.edu

Engineering Education RIG (ENE-RIG)
The purpose of the RIG in Engineering Education is to synergize research in science and engineering education, promote rigorous research in engineering education, and provide a collaboration and discussion space supporting intellectual and professional exchange and networking.

Chair: Anne Emerson Leak, High Point University
aleak@highpoint.edu
Indigenous Science Knowledge Research Interest Group (ISK-RIG)
The ISK-RIG was set up to showcase and provide support to current and future research works of a growing number of Indigenous Knowledge Systems (IKS) researchers working within indigenous communities throughout the world who are members of NARST. This group includes active members from Africa and the African Diaspora, Alaska, Australia, Canada, Indigenous populations of the Americas, Asia and the Pacific, the Middle East, Thailand, Nordic Regions, New Zealand, Scandinavia, the West and East Indies, etc. The goal is to increase awareness of what indigenous knowledge systems can contribute to research.

Chair: Bhaskar Upadhyay, University of Minnesota bhaskar@umn.edu
Secretary: Cikigaq-Irasema Ortega, University of Alaska, Anchorage iortega2@uaa.alaska.edu
Treasurer: Sharon Nelson-Barber, WestEd snelson@wested.org

Research in Artificial Intelligence-Involved Science Education (RAISE)
This RAISE RIG aims at employing AI to extend the landscape of science education, increase the capacity of all participants in the venture to face worldwide challenges, and significantly address the equity and ethical problems in the world broadly. This RIG will (a) support cutting-edge innovations using AI to address learning, teaching, assessment, equity and policy issues in science education; (b) communicate the cutting-edge research involving AI to all researchers, practitioners, and policymakers; and (c) encourage junior scholars in the field to pursue AI innovations within science education research as it is broadly practiced.

Chair: Xiaoming Zhai, University of Georgia Xiaoming.zhai@uga.edu
Co-Chair: Kent J. Crippen, University of Florida kcrippen@coe.ufl.edu

Asian and Pacific Islander Science Education Research (APISER)
The APRSER RIG will promote diversity, equity, and inclusion in science education research using the lenses relevant to Asian and pacific islander cultures, ethnicities, gender, and class, as well as the intersections of these markers. It will also serve as an intellectual network to support and mentor current and future Asian and Pacific Islander scholars within and outside of the United States, including NARST members interested in API related research endeavors.

Dr. Ling Liang liang@lasalle.edu
Dr. Xiufeng Liu xliu5@buffalo.edu

Lesbian, Gay, Bisexual, Transgender, Queer, Plus Science Education Research Group (LGBTQ +)
This RIG provides opportunities for science education researchers to explore and discuss issues relevant to the LGBTQ+ community related to a wide range of topics including science curriculum, learning, teaching, assessment or evaluation, and policy issues in both K-16 formal and informal educational contexts. RIG members promote diversity, equity, and inclusion in science education and science education research. The LGBTQ+ RIG serves as a peer support, mentoring, and inclusive space for folks who identity as LGBTQ+. The LGBTQ+ RIG provides a formalized space inclusive of queer folk and queer research.

Dr. Colby Toefel-Grehl, Utah State University colby.tg@usu.edu
Dr. Sara Porter, University of North Carolina at Greensboro scheredi@uncg.edu
2023–2024 NARST Leadership Team

Officers and Board of Directors:

President
Jomo Mutegi (2025)
Old Dominion University

President-Elect
Jerome Shaw (2026)
University of California, Santa Cruz

Immediate Past President
Gillian Roehrig (2024)
University of Minnesota

Secretary-Treasurer
Brooke Whitworth (2026)
Clemson University

Executive Director
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California State University – Long Beach

Executive Board Members:

Malcolm Butler (2024)
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Patrick Enderle (2026)
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National Taiwan Normal University

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National Open University of Nigeria

Graduate Student Coordinator
Jennifer Bateman (2025)
Clemson University

NARST Liaison to NSTA
Michael G. Bowen (2024)
Mount Saint Vincent University

JRST Editors

Felicia Moore Mensah (2025)
Teachers College, Columbia University

Troy Sadler (2025)
The University of North Carolina at Chapel Hill
### Strand Key

<table>
<thead>
<tr>
<th>Strand</th>
<th>Title</th>
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<tbody>
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<td>Strand 1</td>
<td>Science Learning—Development of Student Understanding</td>
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<tr>
<td></td>
<td><strong>Xiaoming Zhai</strong> (2024) University of Georgia</td>
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<td><strong>Daniela Fiedler</strong> (2025) Leibniz Institute for S&amp;M Education</td>
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<td>Strand 2</td>
<td>Science Learning—Contexts, Characteristics, and Interactions</td>
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<td><strong>Patricia Patrick</strong> (2024) Columbus State University</td>
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<td><strong>Tara Nkrumah</strong> (2025) Arizona State University</td>
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<td><strong>Neta Shaby</strong> (2024) Ben Gurion University of the Negev</td>
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<td><strong>Rebecca Swanson</strong> (2025) University of Nebraska-Lincoln</td>
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<td><strong>Preethi Titu</strong> (2025) Kennesaw State University</td>
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### 2023-2024 Strand Coordinators

#### Strand 1: Science Learning—Development of Student Understanding

- **Xiaoming Zhai** (2024) University of Georgia
- **Daniela Fiedler** (2025) Leibniz Institute for S&M Education

#### Strand 2: Science Learning—Contexts, Characteristics, and Interactions

- **Patricia Patrick** (2024) Columbus State University
- **Anne Emerson Leak** (2025) University of California Santa Barbara

#### Strand 3: Science Teaching—Primary School (Grades PreK-6)

- **Karl Jung** (2024) University of South Florida
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#### Strand 4: Science Teaching—Middle and High School (Grades 5-12)

- **Elizabeth Lewis** (2024) University of Nebraska-Lincoln
- **Emily Adah Miller** (2025) University of Georgia

#### Strand 5: College Science Teaching and Learning (Grades 13-20)

- **Anita Schuchard** (2024) University of Minnesota
- **Tara Nkrumah** (2025) Arizona State University

#### Strand 6: Science Learning in Informal Contexts

- **Neta Shaby** (2024) Ben Gurion University of the Negev
- **Rebecca Swanson** (2025) University of Nebraska-Lincoln

#### Strand 7: Pre-service Science Teacher Education

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Strand 11: Cultural, Social, and Gender Issues

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Heba EL-Deghdayd
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Yuxi Huang
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Roberta Hunter
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Mohammed Ibrahim
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Paul Iwuanyanwu
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Katie Wade-Jaimes
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Benjamin Janney
## Program Proposal Reviewers

<table>
<thead>
<tr>
<th>Program Proposal Reviewers</th>
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<tbody>
<tr>
<td>Sophia Jeong</td>
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<td>Yao JianXin</td>
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### 2024 Distinguished Contributions to Science Education through Research Award

This award is presented at the Annual International Conference but is bestowed only when an outstanding candidate, or candidates, has been identified. It is given to recognize individuals who, through research over an extended period of time, have made outstanding and continuing contributions, provided notable leadership, and made a substantial impact in the area of science education.

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</tbody>
</table>
NARST Award Recipients

Outstanding Doctoral Research Award

This award is given annually for the Doctoral Research judged to have the greatest significance in the field of science education from among all theses and dissertations nominated this year for the award.

<table>
<thead>
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<th>Year</th>
<th>Awardee(s)</th>
<th>Advisor(s)</th>
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</thead>
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<tr>
<td>1992</td>
<td>Rene Stofflett</td>
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<td>Julie Gess-Newsome</td>
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<td>Carolyn W. Keys</td>
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<td>Jerome M. Shaw</td>
<td>Edward Haertel</td>
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<td>Christine M. Cunningham</td>
<td>William L. Carlsen</td>
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<td>Jane O. Larson</td>
<td>Ronald D. Anderson</td>
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<td>Kathleen Hogan</td>
<td>Bonnie K. Nastasi</td>
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<td>Fouad Abd-El-Khalick</td>
<td>Norman G. Lederman</td>
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<td>2000</td>
<td>Danielle Joan Ford</td>
<td>Annemarie S. Palinscar</td>
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<td>2001</td>
<td>Iris Tabak</td>
<td>Brian Reiser</td>
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<td>Hsin-Kai Wu</td>
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<td>Lori Fulton</td>
<td>Jian Wang</td>
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<td>2015</td>
<td>Allison Godwin</td>
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<td>Anna MacPherson</td>
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<td>Anita Schuchardt</td>
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<td>Katherine Wade-Jaines</td>
<td>Renée Schwartz</td>
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<td>Anita S. Tseng</td>
<td>Jonathan F. Osborne</td>
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<td>Orit Ben Zvi-Assaraf</td>
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<td>2021</td>
<td>Eben Witherspoon</td>
<td>Christian D. Schunn</td>
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<td>Won Jung Kim</td>
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<td>Gary William Wright III</td>
<td>Cesar Delgado</td>
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<td>2024</td>
<td>Grace P. Carroll</td>
<td>Soonhye Park</td>
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<td>K. &quot;Ren&quot; Rende Mendoza</td>
<td>Carla Johnson</td>
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## NARST Award Recipients

### Early Career Research Award

The Early Career Research Award is given annually to the early researcher who demonstrates the greatest potential to make outstanding and continuing contributions to research in science education. The recipient will have received his/her Doctoral degree within five years of receiving the award.

<table>
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<th>Awardee(s)</th>
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<td>Bryan A. Brown</td>
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<td>Doug Lombardi</td>
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<td>Hosun Kang</td>
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<td>Eve Manz</td>
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<td>Terrell R. Morton</td>
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### NARST Fellows Award

The NARST Fellow Program is an award program that honors and recognize excellence in science education research and service. This program promotes and advances the NARST mission in science education, and the role of science education in the local and global community, by designating NARST members as Fellows.

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<td>Ron Blonder</td>
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<td>Elizabeth Mavhunga</td>
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### Excellence in Mentoring Award

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### Future NARST Meeting Dates

**2025**
March 22-25 | Washington, D.C.

**2026**
April 18-21 | Seattle, WA

**2027**
March 14-17 | Boston, MA
The Journal of Research in Science Teaching (JRST) Award

The JRST Award was awarded annually to the author or authors of the Journal of Research in Science Teaching article judged to be the most significant publication for the Volume year. It was awarded annually between 1974 and 2015.

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<td>Donald E. Riechard, Robert C. Olson</td>
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<td>1976</td>
<td>Marcia C. Linn, Herbert C. Thier</td>
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<td>1977</td>
<td>Anton E. Lawson, Warren T. Wollman</td>
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<td>1978</td>
<td>Dorothy L. Gabel, J. Dudley Herron</td>
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<tr>
<td>1979</td>
<td>Janice K. Johnson, Ann C. Howe</td>
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<tr>
<td>1980</td>
<td>John R. Staver*, Dorothy L. Gabel*, Linda R. DeTure</td>
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<tr>
<td>1982</td>
<td>Robert G. Good*, Harold J. Fletcher*, F. David Boulanger</td>
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<td>1983</td>
<td>Jack A. Easley, Jr.</td>
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<tr>
<td>1984</td>
<td>Marcia C. Linn, Cathy Clement, Stephen Pulos</td>
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<td>1985</td>
<td>Julie P. Sanford</td>
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<td>1986</td>
<td>Anton E. Lawson</td>
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<td>1987</td>
<td>Russell H. Yeany, Kueh Chin Yap, Michael J. Padilla</td>
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<td>1988</td>
<td>Kenneth G. Tobin, James J. Gallagher</td>
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<td>1989</td>
<td>Glen S. Aikenhead</td>
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<td>1990</td>
<td>Richard A. Duschl, Emmett L. Wright</td>
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<td>1991</td>
<td>E. P. Hart, I. M. Robottom</td>
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<td>1993</td>
<td>Nancy R. Romance, Michael R. Vitale</td>
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<td>1994</td>
<td>E. David Wong</td>
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<td>1995</td>
<td>Stephen P. Norris, Linda M. Phillips</td>
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<td>David F. Jackson, Elizabeth C. Doster, Lee Meadows, Teresa Wood</td>
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<td>1999</td>
<td>Phillip M. Sadler</td>
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<td>Allan G. Harrison, J. Grayson, David F. Treadgust</td>
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<td>Fouad Abd-El-Khalick, Norman G. Lederman</td>
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<td>Andrew Gibert, Randy Yerrick</td>
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<td>Sofia Kesidou, Jo Ellen Roseman</td>
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<td>Jonathan Osborne, Sue Collins, Mary Ratcliffe, Robin Millar, Richard Duschl</td>
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<td>2005</td>
<td>Jonathan Osborne, Sibel Erduran, Shirley Simon</td>
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<td>2006</td>
<td>Troy D. Sadler, Dana L. Zeidler</td>
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<td>2007</td>
<td>Jerome Pine, Pamela Aschbacher, Ellen Roth, Melanie Jones, Cameron McPhee, Catherine Martin, Scott Phelps, Tara Kyle, Brian Foley</td>
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<td>2008</td>
<td>Christine Chin</td>
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<td>2009</td>
<td>Kihyun Ryoo, Bryan Brown</td>
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<td>2010</td>
<td>Helen Patrick, Panayota Mantzicopoulos, Ala Samarapungavan</td>
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<td>Daphne Minner, Jeanne Century, Abigail Jurist Levy</td>
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<td>2013</td>
<td>Edys S. Quellmalz, Michael J. Timms, Matt D. Silbergliet, Barbara C. Buckley</td>
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<td>2014</td>
<td>Joseph Taylor, Susan Kowalski, Christopher Wilson, Stephen Getty, Janet Carlson</td>
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<td>Matthew Kloser</td>
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*Tie
# NARST Award Recipients

## The NARST Outstanding Paper Award

The NARST Outstanding Paper Award was awarded annually for the paper or research report presented at the NARST Annual International Conference that was judged to have the greatest significance and potential in the field of science education. It was awarded annually between 1975 and 2015.

<table>
<thead>
<tr>
<th>Year</th>
<th>Awardee(s)</th>
<th>Year</th>
<th>Awardee(s)</th>
<th>Year</th>
<th>Awardee(s)</th>
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<td>John J. Koran</td>
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<td>James J. Gallagher Armando Contreras</td>
<td>2004</td>
<td>Joanne K. Olson* Sharon J. Lynch*</td>
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<td>1987</td>
<td>Robert D. Sherwood</td>
<td>2001</td>
<td>Allan G. Harrison</td>
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*Tie
General Information

NARST Award Recipients

Outstanding Masters Thesis Award
This award was established in 1995 to be given annually for the Master’s Thesis judged to have the greatest significance in the field of science education. It was last awarded in 2002.

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<td>C. Theresa Forsythe</td>
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<td>Renee D. Boyce</td>
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<td>Andrew Gilbert</td>
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<td>Laura Elizabeth Slocum</td>
<td>Marcy Hamby Towns</td>
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Classroom Applications Award
The Classroom Applications Award was established in 1979. The award was given annually to authors whose papers were presented at the previous NARST Annual International Conference and judged to be outstanding in terms of emphasizing classroom application of research in science education. The award was last presented in 1991.

<table>
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<td>Livingston S. Schneider</td>
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<td>Mary Westerback</td>
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## NARST Standing Committees

### Awards Committee

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<tr>
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<td>Amelia Wenk Gotwals</td>
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### Outstanding Doctoral Research Award

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<td>David C. Owens (Co-Chair)</td>
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# NARST Standing Committees

## Awards Committee (cont.)

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</table>
| 2024       | Xiufeng Liu (Chair)     | Valarie Akerson  
             | University of Buffalo | Indiana University |
| 2025       | Mei-Hung Chiu (Co-Chair) | Dana Zeidler  
             | National Taiwan University | University of South Florida |
|            |                         | Mei-Hung Chiu  
             | National Taiwan University | University of South Florida |
| 2025       |                         | Justin Dillon  
             | Exeter University, UK | University of South Florida |
| 2025       |                         | Kathy Trundle  
             | Utah State University | University of South Florida |
| 2026       |                         | Saouma BouJaoude  
             | American University of Beirut, Lebanon | University of South Florida |
| 2026       |                         | Carla Johnson  
             | NC State University | University of South Florida |
| 2026       |                         | Gail Jones  
             | NC State University | University of South Florida |

## NARST Fellow Award

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</table>
| 2024       | Lama Jaber (Chair)     | Julie Luft  
             | Florida State University | University of Georgia |
| 2025       | Enrique Suarez (Co-Chair) | Senay Purzer  
             | University of Massachusetts, Amherst | Purdue University |
|            |                         | Lezly Taylor  
             | Virginia Polytechnic Institute and State University | University of South Florida |
| 2026       |                         | Helena Aptyka  
             | Institute for Biology Education | University of South Florida |
| 2026       |                         | Laura B. Schneider  
             | Great Mills High School | University of South Florida |

## NARST Fellow Award (cont.)

<table>
<thead>
<tr>
<th>Final Year</th>
<th>Representative from Ethics and Equity Committee</th>
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</table>
| 2025       | Regina McCurdy  
             | Georgia Southern University | Holly Kennedy Amerman  
             | University of Georgia | University of Georgia |
| 2024       | Me-Hung Chiu  
             | National Taiwan University | Lucía Vázquez-Ben  
             | Universidad de Coruña, Spain | University of Georgia |
| 2026       | David Crowther (Chair)  
             | University of Nevada, Reno | David Crowther  
             | University of Nevada, Reno | University of Nevada, Reno |
| 2025       | Nazan U. Bautista (Co-Chair)  
             | Miami University | Nazan U. Bautista  
             | Miami University | Miami University |
| 2024       | Enrique Suarez  
             | Universidad de Coruña, Spain | Enrique Suarez  
             | Universidad de Coruña, Spain | Universidad de Coruña, Spain |
| 2026       | Carina Rebello  
             | Purdue University-Main Campus | Carina Rebello  
             | Purdue University-Main Campus | Purdue University-Main Campus |
| 2025       | Angela Chapman  
             | University of Texas Rio Grande Valley | Angela Chapman  
             | University of Texas Rio Grande Valley | University of Texas Rio Grande Valley |
| 2026       | Tim Klavon  
             | Black Hills State University | Tim Klavon  
             | Black Hills State University | Black Hills State University |

## Board Member Liaison

| Final Year | Scott McDonald  
             | Penn State University | Scott McDonald  
             | Penn State University | Penn State University |
## NARST Standing Committees

### Equity and Ethics Committee

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<tr>
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<td><strong>Justice T. Walker</strong> (Chair) University of Texas at El Paso</td>
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<td>2025</td>
<td><strong>Regina McCurdy</strong> (Co-Chair) Georgia Southern University</td>
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### External Policy and Relations Committee

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<td><strong>Durdane Bayram-Jacobs</strong> (Chair) Eindhoven University of Technology</td>
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<td>2025</td>
<td><strong>Ellen Granger</strong> (Co-Chair) Florida State University</td>
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### Graduate Student Committee

The Graduate Student Committee is composed of graduate student members appointed by the President-elect. The committee is chaired by the Graduate Student Representative, a non-voting (ex-officio) liaison to the NARST Board. A Board Director is appointed to serve as an ex officio advisor to the committee.

<table>
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<tr>
<th>Final Year</th>
<th>Graduate Student Coordinator</th>
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<tr>
<td>2026</td>
<td><strong>Jennifer Bateman</strong> (Chair) Clemson University</td>
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97th NARST International Conference  | March 17–20, 2024  | 25
### NARST Standing Committees

#### International Committee

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<td><strong>Hayat Hokayem</strong> (Co-Chair)</td>
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<td><strong>Lucía Vázquez Ben</strong></td>
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<td><strong>Irene Drymiotou</strong></td>
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<td><strong>Lee Kenneth Jones</strong></td>
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<td><strong>Stefan Sorge</strong></td>
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<td><strong>Claudia Vergara</strong></td>
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<td><strong>Jose Pavez</strong></td>
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<td><strong>Imran Tufail</strong></td>
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<td><strong>Estelle Blanquet</strong></td>
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<td>2026</td>
<td><strong>Arif Rachmatullah</strong></td>
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#### Membership Committee

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<td>Recep Tayyip Erdogan University</td>
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<td><strong>Harini Krishnan</strong></td>
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<td><strong>Grant Gardner</strong></td>
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## NARST Standing Committees

### Program Committee

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<td><strong>Jomo Mutegi</strong> (Chair) Old Dominion University</td>
<td>2024 <strong>Julie Bianchini</strong> University of California, Santa Barbara</td>
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<td>2025</td>
<td><strong>Jerome Shaw</strong> (Co-Chair) University of California, Santa Cruz</td>
<td>2024 <strong>Tejaswini Dalvi</strong> University of Massachusetts, Boston</td>
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<td>2024 <strong>Amal Ibourk</strong> Florida State University</td>
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<td>2024 <strong>Kathryn Kirchgasler</strong> University of Wisconsin-Madison</td>
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<td>2024 <strong>Richard Lamb</strong> East Carolina University</td>
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<td>2024 <strong>Jacob Pleasants</strong> Oklahoma University</td>
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<td>2024 <strong>Neta Shaby</strong> Ben Gurion University of the Negev</td>
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<td>2024 <strong>Xiaoming Zhai</strong> University of Georgia</td>
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<td>2025 <strong>Allison Antink-Meyer</strong> Illinois State University</td>
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<td>2025 <strong>Quentin Biddy</strong> University of Colorado</td>
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<td>2025 <strong>Narendra Dadarao Deshmukh</strong> Horni Bhabha Centre for Science Education</td>
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<td>2025 <strong>Daniela Fiedler</strong> Leibniz Institute for S&amp;M Education</td>
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<td>2025 <strong>Peng He</strong> Michigan State University</td>
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<td>2025 <strong>Sophia Jeong</strong> University of Georgia</td>
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<td>2025 <strong>Anne Emerson Leak</strong> University of California, Santa Barbara</td>
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<td>2025 <strong>Jing Lin</strong> Beijing Normal University</td>
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<td>2025 <strong>Rebecca Swanson</strong> University of Nebraska-Lincoln</td>
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<td>2025 <strong>Preethi Titu</strong> Kennesaw State University</td>
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<td>2025 <strong>Yang Yang</strong> Qingdao University</td>
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## NARST Standing Committees

### General Information

- **NARST Standing Committees**

#### Publications Advisory Committee

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<th>Members</th>
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<tr>
<td>2024</td>
<td><strong>Lindsay Lightner</strong> (Chair)</td>
<td><strong>Jana Bouwma-Gearhart</strong> Oregon State University</td>
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<td></td>
<td><strong>Tina Vo</strong> (Co-Chair)</td>
<td><strong>Kent Crippen</strong> University of Florida</td>
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<td><strong>Emily Dare</strong> Florida International University</td>
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<td><strong>Hui Jin</strong> Educational Testing Service</td>
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<td><strong>Carla Johnson</strong> North Carolina State University</td>
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<td>2025</td>
<td><strong>Cesar Delgado</strong> North Carolina State University</td>
<td><strong>Li Ke</strong> University of North Carolina Chapel Hill</td>
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<td><strong>Linda Morell</strong> UC Berkeley</td>
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<td><strong>Mohammad Azzam</strong> Western University</td>
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<td><strong>Midhat Noor Kiyani</strong> McGill University</td>
<td><strong>Eli Tucker-Raymond</strong> Boston University</td>
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<td><strong>Shiang-Yao Liu</strong> National Taiwan Normal University</td>
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#### Research Committee

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<th>Final Year</th>
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<tr>
<td>2024</td>
<td><strong>Natalie King</strong> (Chair)</td>
<td><strong>Jana Bouwma-Gearhart</strong> Oregon State University</td>
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<td>2025</td>
<td><strong>Bryan H. Nichols</strong> (Co-Chair)</td>
<td><strong>Jessica Karch</strong> Tufts University</td>
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<td><strong>Mi’Kayla Newell</strong> Georgia State University (Grad Student)</td>
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<td><strong>Peter Wulff</strong> University of Potsdam, Germany</td>
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<td><strong>Liam Guilfoyle</strong> University of Oxford</td>
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<td><strong>James Nyachwaya</strong> North Dakota State University</td>
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<td><strong>Mina Sedaghatjou</strong> Rowan University</td>
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<td><strong>Karen Woodruff</strong> Kean University</td>
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<td><strong>Ezgi Yesilyurt</strong> Weber State University</td>
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<td><strong>Alexander Bohn</strong> Northern Virginia Community College</td>
<td><strong>Saramma Chandy</strong> Mumbai University</td>
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<td><strong>Michael Giamellaro</strong> Oregon State University</td>
<td><strong>Colby Tofel-Grehl</strong> Utah State University</td>
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<td><strong>Carrie-Anne Sherwood</strong> Southern Connecticut State University</td>
<td><strong>Stephen B. Witzig</strong> University of Massachusetts Dartmouth</td>
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<td><strong>Malcolm Butler</strong> University of North Carolina, Charlotte</td>
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## NARST Standing Committees

### Social Media, Website and Communications Committee

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<td>2024</td>
<td>Ryan Cain (Chair) Weber State University</td>
<td>Stanton Belford University of Tennessee Southern</td>
<td>2026 Patrick Enderle Georgia State University</td>
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<td>Gary Weiser (Co-Chair) Teacher College, Columbia University</td>
<td>Amy Voss Farris Penn State University</td>
<td>2026 Suzanne Poole Patzelt Montclair State University</td>
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<td>Mark Newton East Carolina University</td>
<td>2026 Steven Worker University of California, Agriculture and Natural Resources</td>
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<td>Stephanie Teeter North Carolina State University</td>
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<td>2025 Anna Maria Arias Kennesaw State University</td>
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### Our Approach to Integrated STEM

Throughout the PreK-12 pathway, every student engages in rich STEM experiences. Looking to implement integrated STEM in your district for all students? Let’s connect!

stem@ctacusa.com

prek12stem.com
Sponsorship Program for Graduate Student Memberships

NARST members gave generously to sponsor graduate student memberships this year through the Graduate Student Sponsorship Program initiative. This program was started in response to needs of our graduate student community. Because graduate students may sometimes obtain assistance from their universities to attend the NARST conference, their NARST membership is usually not covered. While $60 may not sound like a lot of money, to a graduate student on an extremely limited budget, $60 is a lot.

Aligned with NARST’s commitment to support the graduate student community, through donations to the GSSP, NARST was able to offer partial or full financial assistance toward joining the organization.

Last year (2022), with the $1,200 donated since the start of the program, we were able to provide financial assistance (partial or full) to 26 graduate students to become NARST members.

NARST Recognizes and Thanks this Year’s Graduate Student Sponsors:

- Meg Blanchard
- Kathryn Hayes
- Lisa Martin-Hansen
- Felicia Mensah
- Jonathan Osborne
- Brian Reiser
- Christina Schwarz
- Shannon Taylor
- Brooke Whitworth

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Visit the PhET Booth and Join our workshop
Monday 5:30 - 6:15 pm in Governor’s Square 11
AI-Powered Video Platform for Research & Teacher Coaching

What is Vosaic AI?
Vosaic AI is an innovative new tool that enhances teacher coaching and improves video analysis for academic research. It utilizes one of the most robust Large Language Models (LLMs) on the market to analyze videos and give time-stamped feedback based on custom prompts.

What are the benefits of Vosaic AI

INSTANT FEEDBACK
Vosaic AI analyzes video transcripts using a variety of pre-set or custom prompts, giving you immediate, time-stamped feedback you can use to adjust your practice in real time.

FAST ANALYSIS
Whether you want a general summary of a video or time-stamps of specific behaviors, Vosaic AI can provide both before you even hit “play.”

SUPER EASY TO USE
Vosaic AI follows the popular prompt-and-response pattern that many users are already familiar with from ChatGPT, Google, and other popular tools.

How it works?
Vosaic automatically transcribes videos and identifies different speakers—giving you an instant talk analysis.

From there, you can prompt Vosaic AI to give you feedback by asking questions like, “Which domains of Danielson’s framework for teaching are used?” and Vosaic AI will respond with clickable time-stamped comments for you to review.

Beyond AI
Vosaic is the only cloud-based platform that helps you code videos using moments with duration, so you’re only a click away from reviewing clips of practice and not just freeze frames with comments.

ADDITIONAL BENEFITS INCLUDE:
- Simple video recording & uploading
- Secure access & sharing
- Free user seats for blind coding
- Custom video coding
- Automated transcribing
- LMS integration (Canvas, Brightspace, etc.)
- IRR analysis and reporting
- World class support via chat, email, or phone
OA books at Springer Nature

Springer Nature publishes open access (OA) books and chapters under its SpringerOpen and Palgrave Macmillan imprints. We helped to pioneer OA book publishing, first piloting OA publication for books in 2011. We publish OA books across a wide range of areas in:

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Average chapter downloads per open access book: 58.7K

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- Author retains copyright
- Rigorous peer review
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- Free for readers (PDF, ePub, HTML, MOBI)
- Various formats accepted: monographs, edited volumes/collections, proceedings, protocols, short-form books (SpringerBriefs, Palgrave Pivots), chapters.

Contact Claudia Acuna
Editor, Science Education
claudia.acuna@springer.com
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Live Observation | Virtual Live Observation | From Video | From Audio

Learn About A Cutting-Edge Teacher Observation Tool
Visit us at the SeeMeTeach table and learn how this tool can be used for graduate student or faculty research, grant evaluation, or for teacher observation and feedback.

OR

Join us at the NARST Workshop on Tuesday March 19th from 4:15 — 5:00 PM
Workshop attendees will receive a Free account and an in-depth look at this research or teacher observation tool!

OR

Contact Us To Chat
Use the QR Code to set up a time to chat with a member of the SeeMeTeach team, either at the conference, or post-conference.
In Praise of Science Teachers: 
Essential Partners in Researching, Reframing, and Reforming Science Learning

The year 2025 brings NARST’s 98th Annual International Conference. With our 100th anniversary rapidly approaching, now is an opportune time to reflect on a critical component of our organizational identity: science teachers. Many of us recall the historical genesis of the acronym NARST as standing for the National Association for Research in Science Teaching. There is no science teaching without science teachers.

For this conference, let us centralize, emphasize, and praise the work science teachers do that enables and inspires our efforts as science education researchers. Inherent in this theme is an inclusive understanding of the terms science teaching, science teachers, and science education researchers. Science teaching is taken to include engineering education and the diverse ways in which we as humans engage in and contribute to both disciplines. Likewise, science teaching is not limited to formal brick-and-mortar or digital settings. In addition to professional educators, science teachers include parents, families, and other community members. Many of these same folks can and should play integral roles in the research process.

When we gather in the greater Washington, DC area, let us give voice to the myriad ways in which science teachers (writ large) contribute to researching, reframing, and reforming science teaching and learning. Bearing in mind throughout NARST’s ultimate goal of helping all learners achieve science literacy.

**NCSE:** Safeguarding Sound Science for Over 40 Years

The National Center for Science Education ensures students get the accurate and effective science education they deserve.

**Supporting Teachers**
We provide professional learning to help teachers resolve common misconceptions their students may have about climate change, evolution, and the nature of science.

**Catalyzing Action**
We vigilantly monitor efforts to interfere with the accurate teaching of science and mobilize local communities and educators to respond effectively when problems arise.

**Investigating Science Education**
We produce high-quality research relevant to understanding and improving science education, especially with regard to socially but not scientifically controversial topics.

**Did you know?** NCSE is available to help PIs develop and implement outreach as part of the broader impacts portion of grant projects. For more information, email: media@ncse.ngo.

**Become a Graduate Student Sponsor!**

If you didn’t hear about the opportunity, or if you find that you can donate now, for just $60, you can pay the NARST membership of a graduate student.

To become a sponsor, please go to [https://members.narst.org/donations/](https://members.narst.org/donations/)
In Praise of Science Teachers: Essential Partners in Researching, Reframing, and Reforming Science Learning
Take your career to the next level and explore our rigorous graduate programs designed for working professionals. Join us as we combine research, education, and industry to push boundaries and reach new heights.

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Take your career to the next level and explore our rigorous graduate programs designed for working professionals. Join us as we combine research, education, and industry to push boundaries and reach new heights.
8 MARCH 2024
Virtual Conference Day

Plenary Session
Presidential Welcome to the Virtual Conference Day
8-Mar-24, 7:00 AM-7:20 AM
Location: Zoom A

Social Event
Meet and Greet
8-Mar-24, 7:20 AM-7:40 AM
Location: Zoom A

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Related Paper Set
Developing Critically Caring Science Classrooms
8-Mar-24, 7:45 AM-8:45 AM
Location: Zoom A

"It Makes You Feel Like You’ve Actually Been, Like, Heard": Care in Collective Sensemaking
Jason Buell*, Northwestern University, USA
Yang Zhang, Northwestern University, USA
Chris Griesemer, University of California Davis, USA
Jessica Alzen, University of Colorado Boulder, USA
Kelsey Edwards, Northwestern University, USA
Cindy Passmore, University of California Davis, USA
William Penuel, University of Colorado Boulder, USA
Brian Reiser, Northwestern University, USA

A Systematic Review of Theories of Caring in Science Education
Christina Krist, University of Illinois Urbana-Champaign, USA
Enrique Suarez*, University of Massachusetts Amherst, USA

Care and Risk in a Fifth-Grade Science Classroom
Annabel Stoler*, Boston University, USA
Eve Manz, Boston University, USA

"It’s Difficult to Separate My Feelings": Exploring a Preservice Teacher’s Wrestling with Relationality
Allison Metcalf*, Florida State University, USA
Lama Jaber, Florida State University, USA
Shannon Davidson, University of Alabama, USA

Multi-Strand Stand-Alone Paper Set 1
8-Mar-24, 7:45 AM-8:45 AM
Location: Zoom B

Strand 12: Technology for Teaching, Learning, and Research
A Theoretical Framework to Evaluate AI-Based Information Technologies for Critical Engagement With Science: A Proposition
Inbal Klein-Avraham*, Technion - Israel Institute of Technology, Israel
Esther Greussing*, Technische Universität Braunschweig, Germany
Monika Taddicken, Technische Universität Braunschweig, Germany
Ayelet Baram-Tsabari, Technion - Israel Institute of Technology, Israel
Strand 11: Cultural, Social, and Gender Issues
Reframing Equitable Physics Education from the Lens of Marginalized Family: An Ethnographic Study
Izzah Mardhiya Mohammad Isa*, Universiti Teknologi Malaysia, Malaysia
Muhammad Abd Hadi Bunyamin, Universiti Teknologi Malaysia, Malaysia
Fatin Aliah Phang, Universiti Teknologi Malaysia, Malaysia

Strand 7: Pre-service Science Teacher Education
Effects of Opportunities to Learn on Pre-Service Science Teacher Knowledge and Beliefs
David Letloenyane*, University of the Free State, South Africa
Loyiso Jita, University of the Free State, South Africa

Strand 8: In-service Science Teacher Education
Examining a Boundary-Spanning Case Study Within a School-University Partnership That Supports Science Teacher Professional Development
Maiza de Albuquerque Trigo*, University of Luxembourg, Luxembourg
Christina Siry, University of Luxembourg, Luxembourg
Thierry Frentz, Ministry of Education, Luxembourg

Roundtable Discussions
8-Mar-24, 9:00 AM-10:00 AM
Location: Zoom A Breakout Rooms

Strand 11: Cultural, Social, and Gender Issues
Impostor Phenomenon and Belongingness Among Science Faculty: An Exploratory Study
Devasmita Chakraverty*, Indian Institute of Management Ahmedabad, India

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
A Qualitative Exploration of Latina Professors’ Impostor Phenomenon in STEM
Devasmita Chakraverty*, Indian Institute of Management Ahmedabad, India

Strand 1: Science Learning: Development of student understanding
Work-in-progress Roundtable
Understanding Obstacles to Conceptualizing, Transforming, and Analyzing Multidimensional Datasets
A Lynn Stephens*, The Concord Consortium, USA
Natalya St. Clair, The Concord Consortium, USA
Daniel Damelin*, The Concord Consortium, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Work-in-progress Roundtable
The Emotional Impact of Science Textbook Images: Creating an Affective Science Image Dataset
Isabella DeRegis*, Towson University, USA
Brian Miller, Towson University, USA
Strand 14: Environmental Education and Sustainability
Work-in-progress Roundtable
Engaging in Socioscientific Issues with Scientists’ Disagreement: The Case of Nuclear Wastewater Release Controversy
Won Jung Kim*, Santa Clara University, USA
Junhwan Ahn*, Santa Clara High School, USA

Strand 14: Environmental Education and Sustainability
Roundtable
High School Science Students’ Visions of Mobilization of Their TechnoSocial Values
J. Lawrence Bencze*, OISE, University of Toronto, Canada
Dave Del Gobbo, Peel District School Board, Canada
Majd Zouda, OISE, University of Toronto, Canada
Sarah El Halwany, Université de l’Ontario français, Canada
Sheliza Khan, University of Toronto, Canada
Gonzalo Guerrero, IOE, University College London, United Kingdom

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Factors Affecting Science Academic Achievement among ESLs: A Meta-Synthesis of the Literature
Thalia Juarez*, University of Texas Rio Grande Valley, USA
Brian Gabryscho*, University of Texas Rio Grande Valley, USA

Strand 6: Science Learning in Informal Contexts
Bringing Middle School Students and Scientist Together: Perceived Value of Science Communication Meetings
Melike Hanedar, Bogazici University, Turkey
Ipek Paksoy, Bogazici University, Turkey
Gaye Ceyhan*, Bogazici University, Turkey

Multi-Strand Stand-Alone Paper Set 2
8-Mar-24, 9:00 AM-10:00 AM
Location: Zoom B

Strand 8: In-service Science Teacher Education
Physics Teachers’ Belief System: Beliefs of Knowledge, Teaching, Learning, and Science
Ozden Sengul*, Bogazici University, Turkey

Strand 8: In-service Science Teacher Education
Supporting Science Teachers in the Design and Enactment of Socioscientific Issues and Model-Based Learning
Benzegul Durak*, Düzce University, Turkey
Mustafa Topçu*, Yildiz Technical University, Turkey

Poster Session
8-Mar-24, 10:15 AM-11:15 AM
Location: Zoom A Breakout Rooms

Colorado Science Education Research
Reliability Analysis of Psychological Measures related to STEM Persistence in Undergraduate Students
Rena Kirkland*, Adams State University, USA
Aaron Montoya, Adams State University, USA
Marlene Garcia Araiza, Adams State University, USA
Strand 11: Cultural, Social, and Gender Issues
School-Level Earth Science Enrollment as a Mediator of Demographic Predictors of Earth Science Performance
Christine Schlendorf*, Farmingdale State College, USA
Angela Kelly, Stony Brook University, USA
Robert Krakehl, Stony Brook University, USA

Strand 14: Environmental Education and Sustainability
K-12 Science Teachers’ Awareness and Use Regarding Climate Change Educational Resources From U.S. National Parks
Breanna Beaver, Youngstown State University, USA
Lisa Borgerding*, Kent State University, USA
Shannon Navy, Kent State University, USA
Edward Bolden, Kent State University, USA

Strand 6: Science Learning in Informal Contexts
Comunidad de Ciencia: Latina Girls’ Interactions with their Parents during Family Problem-Based Learning Science Activities
Katherine Short-Meyerson*, University of Wisconsin Oshkosh, USA
Peter Rillero*, Arizona State University, USA
Margarita Jimenez-Silva, University of California Davis, USA
Cameron Bilardello, University of Wisconsin-Madison, USA

Strand 8: In-service Science Teacher Education
How Autonomy and Support Impact the Implementation of New STEM Frameworks and Teacher Retention Intentions
Jenna Zietowski*, Saint Joseph’s University, USA

Strand 11: Cultural, Social, and Gender Issues
Ultra-orthodox women’s choice of STEM studies and career
Ruth Edri, Technion - Israel Institute of Technology, Israel
Shani Goldstein*, Technion - Israel Institute of Technology, Israel
Shahaf Yoel, Technion - Israel Institute of Technology, Israel
Yehudit Dori, Technion - Israel Institute of Technology, Israel

Strand 12: Technology for Teaching, Learning, and Research
Orchestrating Learning Communities Across Three Social Planes with Learning Community Technologies
Dana Gnesdilow*, University of Wisconsin, USA
Michael Tissenbaum, University of Illinois Urbana-Champaign, USA
Xuesong Cang, University of Wisconsin, USA
Litong Zeng, University of Illinois Urbana-Champaign, USA
Shafagh Hadinezhad, University of Illinois Urbana-Champaign, USA
Samantha Baker, University of Wisconsin, USA
Diane Gengler, University of Wisconsin, USA
Sadhana Puntambekar, University of Wisconsin, USA

Strand 12: Technology for Teaching, Learning, and Research
Physics Experiments Using Self-Made Applications for Smartphone and the Philosophical Significance
Akira Adachi*, Osaka Institute of Technology, Japan
Strand 3: Science Teaching — Primary School (Grades preK-6):
Characteristics and Strategies
Analysis of Primary Science Education in the United States Through the Lens of Practitioner Literature
Farnaz Avarzamani*, Arizona State University, USA
Samira Golshani, Islamic Azad University, Iran, Islamic Republic of
Ying-Chih Chen, Arizona State University, USA

Strand 1: Science Learning:
Development of student understanding
Identifying Student Idea Trajectories in a Science-Based Social Justice Unit
Troy Wilson*, University of California, Berkeley, USA
Allison Bradford, University of California, Berkeley, USA
Libby Gerard, University of California, Berkeley, USA
Marcia Linn, University of California, Berkeley, USA

Strand 14: Environmental Education and Sustainability
Secondary School Science Students’ Visions of Growing Personal Dispositifs
J. Lawrence Bencze*, OISE, University of Toronto, Canada
Dave Del Gobbo, Peel District School Board, Canada

Strand 8: In-service Science Teacher Education
A Design-based Course for STEM Teaching and Learning in Pakistan
Tasneem Anwar*, Aga Khan University, Pakistan

Multi-Strand Stand-Alone Paper Set 9
8-Mar-24, 10:15 AM-11:15 AM
Location: Zoom B

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Attitudes Toward Science among Grades 5 through 12 Students: Response Profiles, Background, and Future Intentions
Siqi Shen*, Shanghai Jiao Tong University, China
Ryan Summers*, University of North Dakota, USA
Shuai Wang*, Shanghai Jiao Tong University, China

Strand 10: Curriculum and Assessment
Developing an Evaluation Rubric for Planning and Assessing SSI-Based STEAM Programs in Science Classrooms
Ha My Anna Mang*, Macquarie, Australia
Hye-Eun Chu*, Macquarie, Australia
Sonya Martin, Seoul National University, Republic of Korea
Chan-Jong Kim, Seoul National University, Republic of Korea

Strand 7: Pre-service Science Teacher Education
Effect of Adaptive Expertise in Math/Science Teaching on Preservice Teachers’ Attitudes Toward iSTEM Teaching
Mounir Saleh*, University of Bahrain, Bahrain
Bashirah Ibrahim, University of Bahrain, Bahrain
Ernest Afari, University of Bahrain, Bahrain
Strand 7: Pre-service Science Teacher Education
Effectiveness of Online Science Laboratory Course on Pre-Service Science Teachers’ Efficacy Beliefs and Epistemological Beliefs
Ozgul Yilmaz-Tuzun, Middle East Technical University, Turkey
Cansu Basak Uygun*, Middle East Technical University, Turkey
Ceren Baser-Kanbak, Middle East Technical University, Turkey
Coskun Aykut, Middle East Technical University, Turkey

MID-DAY BREAK
8-Mar-24, 11:15 AM-12:15 PM
Location: Zoom A

Multi-Strand Stand-Alone Paper Set 3
8-Mar-24, 12:15 PM-1:15 PM
Location: Zoom A

Strand 8: In-service Science Teacher Education
Focused on Our Children’s Future: Supporting and Studying Socially Responsible Science Education Through Professional Development
Travis Fuchs*, Crofton House School, Canada
Yuen Sze Tan, University of British Columbia, Canada

Strand 6: Science Learning in Informal Contexts
Evaluating the Credibility of Online Sources: The Case of Climate Change Misinformation in Three Languages
Shakked Dabran-Zivan*, Faculty of Education in Science and Technology, Technion – Israel Institute of Technology, Israel
Ayelet Baram-Tsabari, Faculty of Education in Science and Technology, Technion – Israel Institute of Technology, Israel
Rebecca Kunze, Institute of Science Education, Leibniz University, Germany
Soraya Kresin, Institute of Science Education, Leibniz University, Germany
Alexander Büßing, Institute of Science Education, Leibniz University, Germany

Strand 8: In-service Science Teacher Education
Effects of Meta-Strategic Training Program for Relational Reasoning Skills on In-Service Biology Teachers’ Expertise Level
Vered Alboher Agmon*, Alexandru Ioan Cuza, University of IAŞI, Romania

Multi-Strand Stand-Alone Paper Set 4
8-Mar-24, 12:15 PM-1:15 PM
Location: Zoom B
Strand 7: Pre-service Science Teacher Education
Negotiating Dilemmatic Spaces: Preservice Teachers’ Challenges as They Learn to Assess Science Learning
Frances Edwards*, University of Waikato, New Zealand

Strand 8: In-service Science Teacher Education
Facilitating Science Discourse and Argumentation: Teacher Participation and Learning in Professional Development
Florence Gomez Zaccarelli*, Pontificia Universidad Catolica de Chile, Chile
Victoria Arriagada Jofre, Pontificia Universidad Catolica de Chile, Chile
Jocelyn Gaete-Cornejo, Pontificia Universidad Catolica de Chile, Chile

Strand 10: Curriculum and Assessment
Development and Validation of Biology Test for Senior High School STEM Students
Glen Mirabete*, De La Salle University, Philippines

Strand 3: Science Teaching — Primary School (Grades preK-6):
Characteristics and Strategies
Demystifying the Myths of Early Childhood Teachers’ Engagement with Sustainability Practices
Lacey Peters*, Hunter College, CUNY, USA
Janette Habashi*, University of Oklahoma, USA
Victoria Damjanovic*, Northern Arizona University, USA
Ingrid Anderson, Portland State University, USA

Multi-Strand Stand-Alone Paper Set 5
8-Mar-24, 1:30 PM-2:30 PM
Location: Zoom A

Strand 8: In-service Science Teacher Education
CT+CRT+Science: Pathways to Integration in Elementary Teachers’ Lesson Plans
Jeremy Bernier*, Arizona State University, USA
Kristina Kramarczuk, University of Maryland, USA
Ebony Terrell Shockley, University of Maryland, USA
Francheska Figueroa, Arizona State University, USA
Lin Yan, Arizona State University, USA
Yue Xin, University of Maryland, USA
Janice Mak, Arizona State University, USA
Man Su, Universitat des Saarlandes, Germany
Diane Ketelhut, University of Maryland, USA
Brian Nelson, Arizona State University, USA

Strand 8: In-service Science Teacher Education
Science Teachers’ Sensemaking of and Approaches to Artificial Intelligence Integrated Science Teaching
Won Jung Kim*, Santa Clara University, USA
Arif Rachmatullah*, Stanford Research Institute, USA

Strand 11: Cultural, Social, and Gender Issues
Views on STEM (Education) in an Elite School: A ‘Platonic Legacy’
Majd Zouda*, University of Toronto, Canada
Strand 7: Pre-service Science Teacher Education
Promoting Science Preservice Teachers’ Competencies through Phenomenon-Based Science Instruction: The Lotus Effect Activity
Noushin Nouri*, The University of Texas Rio Grande Valley, USA
Maryam Saberi, Ministry of education, Islamic Republic of Iran
Samira Bahrami, Farhangian University, Islamic Republic of Iran
Somayeh Samari, Ministry of education, Islamic Republic of Iran

Multi-Strand Stand-Alone Paper Set 6
8-Mar-24, 1:30 PM-2:30 PM
Location: Zoom B

Strand 5: College Science Teaching and Learning (Grades 13-20)
Role of Diagrams in Simultaneous Synthesis Physics Problem-Solving
Bashirah Ibrahim*, Bahrain Teachers College, University of Bahrain, Bahrain
Lin Ding, The Ohio State University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Fostering Scientific Argumentation Through Tablet-based Interactive Technological Engagement
Yingzhi Zhang*, Capital Normal University, China
Pengcheng Shan, Capital Normal University, China

Strand 7: Pre-service Science Teacher Education
Investigation of Pre-Service Teachers’ Knowledge of Atmosphere Related Environmental Problems and their Systems Thinking Skills
Aylin Çam*, Muğla Sıtıkı Koçman University, Muğla, Turkey
Harika Arslan, Düzce University, Turkey

Multi-Strand Stand-Alone Paper Set 7
8-Mar-24, 2:45 PM-3:45 PM
Location: Zoom A

Strand 11: Cultural, Social, and Gender Issues
Difficulty Gap in Students’ Achievement, Creativity and Anxiety in ICT: Can CTCA Be a Bridge?
Henry Okorie*, Lagos State University, Nigeria
Peter Okebukola, Lagos State University, Nigeria
Adekunle Oladejo, Lagos State University, Nigeria
Juma Shabani, Doctoral School, University of Burundi, Burundi
Deborah Agbanimu, Lagos State University, Nigeria

Strand 12: Technology for Teaching, Learning, and Research
Adopting a Human-In-The-Loop Approach to Detect Persistence Types in a Guided Science Inquiry Environment
Shuo Feng*, School of Education, Shanghai Jiao Tong University, China
Maohua Wang, Shanghai Municipal Education Commission, China
Shuai Wang, School of Education, Shanghai Jiao Tong University, China
Siqi Shen, School of Education, Shanghai Jiao Tong University, China
Strand 14: Environmental Education and Sustainability  
Disaster Risk Reduction Education  
Literature Review and Proposed Research Agenda  
Douglas Lownsbery*, Independent Researcher, USA

Strand 15: Policy, Reform, and Program Evaluation  
Physical Science Enrollment and Performance as Predictors of Graduation and Mediators of Socioeconomic Status  
Jon Hatzfeld*, Stony Brook University, USA  
Robert Krakehl, Stony Brook University, USA  
Angela Kelly, Stony Brook University, USA

Multi-Strand Stand-Alone Paper Set 8  
8-Mar-24, 2:45 PM-3:45 PM  
Location: Zoom B

Strand 15: Policy, Reform, and Program Evaluation  
Embracing Mortality: Integrating Death Education into the K-12 Science Curriculum for Holistic Science Literacy  
Rachel Ruggirello*, Washington University in St. Louis, USA  
Sonya Martin*, Seoul National University, Democratic People's Republic of Korea

Strand 5: College Science Teaching and Learning (Grades 13-20)  
Shaping Perspectives: Contrasting Student Framing in Evolutionary Research Between Computer-based Labs and Wet Labs  
Dhanya Attipetty*, University of Minnesota, USA  
Lily Dodge, University of Minnesota, USA  
Anita Schuchardt, University of Minnesota, USA

Catherine Kirkpatrick, University of Minnesota, USA

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies  
Implementing Computer Science in Elementary Science Classrooms: An Elementary Teacher’s Perceptions Over Four Years  
Sarah Lilly*, University of Virginia, USA  
Eric Bredder, University of Virginia, USA  
Anne McAlister, University of Virginia, USA  
Jennifer Chiu, University of Virginia, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science  
Exploring the Nature of Science Conceptions of University Science Professors Using the Family Resemblance Framework  
Rana Baddour*, American University of Beirut, Lebanon  
Saouma BouJaoude, American University of Beirut, Lebanon

Plenary Session  
Wrapping up!  
8-Mar-24, 3:45 PM-4:20 PM  
Location: Zoom A
17 MARCH 2024

Research Committee
Pre-Conference Workshop
Uncovering the Hidden Curriculum of DRK-12 Awards: Tips and Tools for Writing Successful NSF Grant Proposals
17-Mar-24, 8:00 AM-11:45 AM
Location: Governor’s Square 10

Uncovering the Hidden Curriculum of DRK-12 Awards: Tips and Tools for Writing Successful NSF Grant Proposals

ORGANIZERS
Terrell Morton, University of Illinois Chicago, USA
Lani Horn, Vanderbilt University, USA

Equity And Ethics Committee
Pre-Conference Workshop
Re-emphasizing the Roles of “Social” and “Cultural” in Science Learning
17-Mar-24, 8:00 AM-11:45 AM
Location: Governor’s Square 11

Re-emphasizing the Roles of “Social” and “Cultural” in Science Learning

ORGANIZERS
David Steele, Alder Graduate School of Education, USA

PANELISTS
David Steele, Alder Graduate School of Education, USA
Gary Wright, University of Missouri, USA
Justice Walker, University of Texas at El Paso, USA

Indigenous Science Knowledge (ISK-RIG)
Pre-Conference Workshop
Indigenous STEM Education: Perspectives from the Pacific Islands, the Americas and Asia
17-Mar-24, 8:00 AM-11:45 AM
Location: Governor’s Square 12

Indigenous STEM Education: Perspectives from the Pacific Islands, the Americas and Asia

ORGANIZERS
Sharon Nelson-Barber, WestEd, USA

PANELISTS
Jerry Lipka, University of Alaska, Fairbanks, USA
Dora Andrew-Ihrke, University of Alaska, Fairbanks, USA
Bhaskar Upadhyay, University of Minnesota, USA
David Zandvliet, Simon Fraser University, Canada
Janice Mak, Arizona State University, USA
Paichi Shein, National Sun Yat-sen University, Taiwan
Peresang Sukinarhimi, National Sun Yat-sen University, Taiwan

Julie Bianchini, University of California-Santa Barbara, USA
Alejandra Frausto Aceves, Northwestern University, USA
Daniel Morales-Doyle, University of Illinois-Chicago, USA
Bridget Mulvey, Kent State University, USA
Catherine Quinlan, Howard University, USA
Troy Sadler, University of North Carolina, USA
Dana Zeidler, University of South Florida, USA
2024 NARST Annual International Conference, Denver

**Membership Committee**
**Sponsored Session**
**Mentor/Mentee Nexus**
17-Mar-24, 8:00 AM-9:00 AM
Location: Governor’s Square 15

**Research Committee**
**Pre-Conference Workshop**
**Conducting High-Quality Education Research in Science for the Rest of Us**
17-Mar-24, 8:00 AM-11:45 AM
Location: Governor’s Square 16

**Membership Committee**
**Sponsored Session**
**Early Career Forum**
17-Mar-24, 9:10 AM-10:10 AM
Location: Governor’s Square 15

**Membership Committee**
**Sponsored Session**
**Welcome Session**
17-Mar-24, 10:20 AM-11:20 AM
Location: Governor’s Square 15

**PANELISTS**

**Lenora Crabtree**, University of North Carolina, Charlotte, USA
**Pauline Chinn**, University of Hawai‘i, Mānoa, USA

**Robert Bennett**, Georgia State University, USA
**Mihwa Park**, Texas Tech University, USA

**Melanie Kinskey**, Sam Houston State University, USA
**Robert Bennett**, Georgia State University, USA
**Mihwa Park**, Texas Tech University, Texas, USA

**Harini Krishnan**, Genetic Science Learning Center, University of Utah, USA
**Grant Gardner**, Middle Tennessee State University, USA

**Joi Merritt**, James Madison University, USA
**Harleen Singh**, California State University Stanislaus, USA

**Leigh Ann DeLyser**, CSforALL, USA
**Isabella Gransbury**, North Carolina State University, USA
**Monica McGill**, CSEdResearch.org, USA
**Jennifer Rosato**, National Center for Computer Science Education, USA

**Melanie Kinskey**, Sam Houston State University, USA
Research Committee  
Pre-Conference Workshop  
*Using the Science and Engineering Practices Observation Protocol (SciEPOP) to Identify Children’s Engagement with Science and Engineering in Early Learning Environments*  
17-Mar-24, 8:00 AM-11:45 AM  
Location: Governor’s Square 17

Using the Science and Engineering Practices Observation Protocol (SciEPOP) to Identify Children’s Engagement with Science and Engineering in Early Learning Environments

ORGANIZERS
Alison Miller, Bowdoin College, Brunswick, ME, USA

PANELISTS
Alison Miller, Bowdoin College, USA  
Laura Saenz, Bowdoin College, USA  
Hildah Makori, Bowdoin College, USA  
Katahdin Cook, Maine Mathematics and Science Alliance, USA  
Lisa Kenyon, Maine Mathematics and Science Alliance, USA  
Rachel Larimore, Samara Early Learning, USA

Committee Meeting

NARST Board of Directors Meeting  
17-Mar-24, 8:00 AM-11:45 AM  
Location: Directors Row E

Research Committee  
Pre-Conference Workshop  
*Integrating ChatGPT in Science Teacher Education and Science Education Research: Improving Curriculum, Pedagogy, Research and Equity in Science*  
17-Mar-24, 8:00 AM-11:45 AM  
Location: Plaza Court 1

Integrating ChatGPT in Science Teacher Education and Science Education Research: Improving Curriculum, Pedagogy, Research and Equity in Science

ORGANIZERS
Mehmet Aydeniz, The University of Tennessee, Knoxville, USA  
Michael Stone, Public Education Foundation, Chattanooga, TN, USA

PANELISTS
Mehmet Aydeniz, The University of Tennessee, Knoxville, USA  
Michael Stone, Public Education Foundation, Chattanooga, TN, USA

Research Committee  
Pre-Conference Workshop  
*Using Network Analysis to Analyze Scientific Knowledge Structures and Transition Data*  
17-Mar-24, 8:00 AM-11:45 AM  
Location: Plaza Court 3

Using Network Analysis to Analyze Scientific Knowledge Structures and Transition Data

ORGANIZER
Jennifer Cromley, University of Illinois, USA
Research Committee
Pre-Conference Workshop
Broader Impacts-Driven Dissemination: Benefiting Society Beyond Presentations and Publications
17-Mar-24, 8:00 AM-11:45 AM
Location: Plaza Court 4

Broader Impacts-Driven Dissemination: Benefiting Society Beyond Presentations and Publications

ORGANIZERS
Deborah Hanuscin, Western Washington University, USA
Natalie King, Georgia State University, USA
G. Michael Bowen, Mount St Vincent University, Canada

Research Committee
Pre-Conference Workshop
Using Novel Instructional Materials to Improve Students’ Mis/disinformation Detection and Socioscientific Decision-making
17-Mar-24, 8:00 AM-11:45 AM
Location: Plaza Court 5

Using Novel Instructional Materials to Improve Students’ Mis/disinformation Detection and Socioscientific Decision-making

ORGANIZERS
Benjamin Herman, Texas A&M University, USA

PANELISTS
Benjamin Herman, Texas A&M University, USA

Research Committee
Pre-Conference Workshop
How to Use AI and Center People in Science Education Research
17-Mar-24, 8:00 AM-11:45 AM
Location: Plaza Court 6

How to Use AI and Center People in Science Education Research

ORGANIZERS
Marcus Kubsch, Freie Universität Berlin, Germany

PANELISTS
Marcus Kubsch, Freie Universität Berlin, Germany
Kristina Krist, University of Illinois Urbana-Champaign, USA
Peter Wulff, Heidelberg University of Education, Germany
Joshua Rosenberg, University of Tennessee, Knoxville, USA
Kevin Hall, University of Illinois Urbana-Champaign, USA
Eugene Cox, University of Illinois Urbana-Champaign, USA
Chris Palaguachi, University of Illinois Urbana-Champaign, USA
Paul Tschisgale, IPN – Leibniz Institute for Science and Mathematics Education, Germany

Michael Clough, Texas A&M University, USA
Sarah Poor, Texas A&M University, USA
Ben Janney, Texas A&M University, USA
Asha Rao, Texas A&M University, USA
Tamara Powers, Texas A&M University, USA
Joanna Goodey Pellois, Texas A&M University, USA
International Journal of Science Education
Pre-Conference Workshop
Publishing in Science Education Journals and Tips to Help You Succeed
17-Mar-24, 10:00 AM-11:45 AM
Location: Plaza Court 2

Publishing in Science Education Journals and Tips to Help You Succeed

ORGANIZERS
Ron Blonder, Weizman Institute, Israel
M. Gail Jones, North Carolina State University, USA

PANELISTS
Ron Blonder, Weizman Institute, Israel
M. Gail Jones, North Carolina State University, USA
Vanessa Kind, University of Leeds, United Kingdom

Strand 1: Science Learning: Development of student understanding
SC-Organized Paper Set
Learning Progression and Disciplinary Core Ideas
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 2

Learning Progression of Students’ Reasoning about Life Cycles
Hayat Hokayem*, Texas Christian University, USA
Ihsan Ghazal*, Texas Christian University, USA
Savannah Graham*, University of Houston, USA

Students’ Ideas About Air Pollution: A Learning Progression for the Primary and Secondary School
Èlia Tena*, Universitat Autònoma de Barcelona (UAB), Spain
Caterina Solé, Universitat Autònoma de Barcelona (UAB), Spain
Digna Couso, Universitat Autònoma de Barcelona (UAB), Spain

Extracting Student Mastery of Force and Motion Attributes Using Cognitive Diagnosis Model
Maria Veronica Torralba*, De La Salle University, Philippines
Talaue T., De La Salle University, Philippines

Developing a Three-Dimensional Learning Progression for the Thermal Energy at Middle School Science
Mao-Ren Zeng*, Michigan State University CREATE for STEM Institute, USA
He Peng*, Michigan State University CREATE for STEM Institute, USA
Mingchun Huang, Michigan State University CREATE for STEM Institute, USA
Namsoo Shin, Michigan State University CREATE for STEM Institute, USA
Jonathan Bowers, Michigan State University, USA
Joseph Krajcik, Michigan State University CREATE for STEM Institute, USA

Promoting Meaningful Learning of Programming Language: Should we trust CTCA?
Esther Peter*, Lagos State University, Nigeria
Peter Okebukola, Lagos State University, Nigeria
Juma Shabani, Université du Burundi, Burundi
David Peter, Lagos State University, Nigeria
Deborah Agbanimu, Lagos State University, Nigeria

STEM Activities Integrated with Computational Thinking (CT): Early Childhood Children’ CT Skills
Nazli Ulker Hançer, Sinop University, Turkey
Mustafa Topçu*, Yıldız Teknik University, Turkey

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set
Elementary STEM Integration
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 3

Integrated STEM in Elementary Schools: Critical Aspects to Consider
Carol Waters*, University of Houston-Clear Lake, USA

“This is My Best STEM Class”: Practicing STEM from Educators with Different Professional Experiences
Qiu Zhong*, Indiana University Bloomington, USA
Conghui Liu*, Indiana University Bloomington, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Technology: Programming and Computational Thinking
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 4

Current Research Trends of Computational Thinking in the Context of STEM Education
Yurdagül Bogar*, Oslo Metropolitan University, Norway
Jari Lavonen, University of Helsinki, Finland

“Current Research Trends of Computational Thinking in the Context of STEM Education”
Yurdagül Bogar*, Oslo Metropolitan University, Norway
Jari Lavonen, University of Helsinki, Finland

Promoting Meaningful Learning of Programming Language: Should we trust CTCA?
Esther Peter*, Lagos State University, Nigeria
Peter Okebukola, Lagos State University, Nigeria
Juma Shabani, Université du Burundi, Burundi
David Peter, Lagos State University, Nigeria
Deborah Agbanimu, Lagos State University, Nigeria

STEM Activities Integrated with Computational Thinking (CT): Early Childhood Children’ CT Skills
Nazli Ulker Hançer, Sinop University, Turkey
Mustafa Topçu*, Yıldız Teknik University, Turkey

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set
Elementary STEM Integration
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 3

Integrated STEM in Elementary Schools: Critical Aspects to Consider
Carol Waters*, University of Houston-Clear Lake, USA

“This is My Best STEM Class”: Practicing STEM from Educators with Different Professional Experiences
Qiu Zhong*, Indiana University Bloomington, USA
Conghui Liu*, Indiana University Bloomington, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Technology: Programming and Computational Thinking
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 4

Current Research Trends of Computational Thinking in the Context of STEM Education
Yurdagül Bogar*, Oslo Metropolitan University, Norway
Jari Lavonen, University of Helsinki, Finland

Promoting Meaningful Learning of Programming Language: Should we trust CTCA?
Esther Peter*, Lagos State University, Nigeria
Peter Okebukola, Lagos State University, Nigeria
Juma Shabani, Université du Burundi, Burundi
David Peter, Lagos State University, Nigeria
Deborah Agbanimu, Lagos State University, Nigeria

STEM Activities Integrated with Computational Thinking (CT): Early Childhood Children’ CT Skills
Nazli Ulker Hançer, Sinop University, Turkey
Mustafa Topçu*, Yıldız Teknik University, Turkey

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set
Elementary STEM Integration
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 3

Integrated STEM in Elementary Schools: Critical Aspects to Consider
Carol Waters*, University of Houston-Clear Lake, USA

“This is My Best STEM Class”: Practicing STEM from Educators with Different Professional Experiences
Qiu Zhong*, Indiana University Bloomington, USA
Conghui Liu*, Indiana University Bloomington, USA
Adam Maltese, Indiana University
Bloomington, USA

Community-Based Engineering Education in Elementary Schools: A Multi-Case Study in Rural Communities
Tugba Boz*, Purdue University, USA
Rebekah Hammack*, Purdue University, USA
Nicholas Lux, Montana State University, USA
Paul Cannon, Montana State University, USA

Community-Based Engineering Education in Elementary Schools: A Multi-Case Study in Rural Communities
Tugba Boz*, Purdue University, USA
Rebekah Hammack*, Purdue University, USA
Nicholas Lux, Montana State University, USA
Paul Cannon, Montana State University, USA

Discourse and Creativity in Early Childhood Engineering
Mia Williams*, University of Wyoming, USA
Alison Mercier*, University of Wyoming, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12):
Characteristics and Strategies
SC-Organized Paper Set
Modelling Curriculum for Learning
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 5

“Fail Faster”: How a Teacher Supported Students With Testing and Debugging Computational Models
Jonathan Bowers*, Michigan State University, USA
Emil Eidin, Michigan State University, USA

How Can Science Teacher’s Discourse Be Like?: Discursive Strategies in a Modelling-Based Classroom
Camilo Vergara-Sandoval*, Universidad de O’Higgins, Chile
Víctor López*, Universitat Autònoma de Barcelona, Spain
Digna Couso*, Universitat Autònoma de Barcelona, Spain

Integrating a New Computational Modeling Curriculum Into High School Science Classrooms
Jacqueline DeLisi*, Education Development Center, USA
Beatriz Perret, Education Development Center, USA
Suhina Minocha, Education Development Center, USA
Irene Lee, Education Development Center, USA
Kirsten Peterson, Education Development Center, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Graduate Students in STEM Education
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 6

International Graduate Students as STEM Role Models for High School Students
Ana-Maria Topliceanu*, North Carolina State University, USA
Katherine McCance, University of Texas at San Antonio, USA
Jennifer Sollinger, North Carolina State University, USA
Margaret Blanchard, North Carolina State University, USA

The Impact of Teaching Professional Development on STEM Graduate Student Teaching Outcomes: A Meta-Analysis
Grant Gardner*, Middle Tennessee State University, USA
Alyssa Freeman, Middle Tennessee State University, USA
Chelsea Rolle, Middle Tennessee State University, USA
Kadence Riggs, Middle Tennessee State University, USA

The Relationship of Graduate Teaching Assistants’ Perceived Autonomy with Their Pedagogical Discontentment, Self-Efficacy, and Practices

Alyssa Freeman*, Middle Tennessee State University, USA

Empowering Graduate Teaching Assistants in STEM: Role of Collaborative Action Research in Professional Agency Development

Abdul Rauf*, University of Illinois Chicago, USA

Minjung Ryu, University of Illinois Chicago, USA

Strand 6: Science Learning in Informal Contexts

Engaging Rural and Tribal Communities in Culturally Responsive Research and Evaluation on Informal Science Learning

17-Mar-24, 3:00 PM-4:30 PM
Location: Governor’s Square 10

Indigenous Logic Model Development: Fostering Collaborative Engagement and Cultural Relevance

Anne Gold*, University of Colorado, USA

Colorado Science Education Research

Water Meaning Maps: Diving Deeper Into Rural Library Visitors’ Connections With Water in the Southwest

Christine Okochi*, CIRES, University of Colorado Boulder, USA

Megan Littrell, CIRES, University of Colorado Boulder, USA
Kathryn Boyd, CIRES, University of Colorado Boulder, USA  
Anne Gold, CIRES, University of Colorado Boulder, USA  

Engaging Communities and Adapting Informal Learning Research and Evaluation Methods to Rural Library Settings  
Kathryn Boyd*, Cooperative Institute for Research in Environmental Sciences Education & Outreach, USA  
Megan Littrell, Cooperative Institute for Research in Environmental Sciences Education & Outreach, USA  
Christine Okochi, Cooperative Institute for Research in Environmental Sciences Education & Outreach, USA  
Jill Stein, Reimagine Research Group, USA  
Shelly Valdez, Native Pathways, USA  
Anne Gold, Cooperative Institute for Research in Environmental Sciences Education & Outreach, USA  
Brigitta Rongstad Strong, Cooperative Institute for Research in Environmental Sciences Education & Outreach, USA  
Annamarie Schaecher, Cooperative Institute for Research in Environmental Sciences Education & Outreach, USA  
Tamara Grybko, Reimagine Research Group, USA  

Todd Campbell*, University of Connecticut, USA  
Ron Gray, Northern Arizona University, USA  
Yue Bai*, University of Connecticut, USA  
Stefani Chase*, Northern Arizona University, USA  

Pre-Service Science Teachers’ Perception of Mathematical Equations as Scientific Models Across Scientific Disciplines  
FangFang Zhao*, Beijing Normal University, China  
Jie Yang, Beijing Normal University, China  

Modeling the Interplay Between Creativity and Knowledge through Pre-Service Science Teachers’ Creative Instructional Design Practices  
Alper Durukan*, Van Yuzuncu Yil University, Turkey  
Jale Cakiroglu, Middle East Technical University, Turkey  
Sevgi Aydin Gunbatar, Van Yuzuncu Yil University, Turkey  

Examining Changes in Representations in Prospective Elementary Teachers’ Explanatory Models in a Content-Focused Course  
Alexandria Call*, Northern Arizona University, USA  
Martha Canipe*, Northern Arizona University, USA  

Strand 7: Pre-service Science Teacher Education  
SC-Organized Paper Set  
Understanding the Use of Models and Representations in Science Learning and Teaching  
17-Mar-24, 3:00 PM-4:30 PM  
Location: Governor’s Square 16  

The Iterative Design of a Model-Based Inquiry Planning Tool for Preservice Science Teachers  

Strand 8: In-service Science Teacher Education  
SC-Organized Paper Set  
Teacher Sensemaking in Professional Development Contexts  
17-Mar-24, 3:00 PM-4:30 PM  
Location: Directors Row H
Sensemaking of District Provided Curriculum: How Teachers Adapt Resources in their Own Context  
Joe DeLuca*, University of Georgia, USA  
Julie Luft, University of Georgia, USA  
Ella Yonai, University of Georgia, USA

Professional Learning to Support Elementary Teachers’ Systems Thinking  
Jennifer Maeng, University of Virginia, USA  
Amanda Gonci*, Michigan Technological University, USA  
Ruohan Liu, University of Virginia, USA  
Robert Handler, Michigan Technological University, USA

“Taking Action to Make Change”: Capturing Science Teachers’ Conceptions of Content Critique  
Matthew Wilsey*, Stanford University, USA  
Monica Sircar*, Stanford University, USA

Moments of Dissonance in a Professional Learning Community Toward Culturally and Linguistically Sustaining Science Teaching  
Victor Leos*, University of Colorado Boulder, USA  
Melissa Braaten, University of Colorado Boulder, USA  
Loraine Glidewell, University of Colorado Boulder, USA

Partnering With Teachers to Localize a Climate Learning Experience for Students  
Lindsey Mohan*, BSCS Science Learning, USA  
Emily Harris, BSCS Science Learning, USA  
Candice Guy-Gaytan, BSCS Science Learning, USA  
Audrey Mohan, BSCS Science Learning, USA  
Betty Stennett, BSCS Science Learning, USA

Supporting Teachers in the Selection of Meaningful Phenomena for Assessment Design  
Sara Cooper*, University of Colorado, USA  
Abraham Lo, BSCS Science Learning, USA

Examining Teachers’ Multimodal Customizations to Support Multilingual Students’ Equitable Sensemaking  
Samuel Lee*, Boston College, USA  
Katherine McNeill, Boston College, USA

Examining What Phenomena Matter to Students in a Customizable Unit  
Candice Guy-Gaytán*, BSCS Science Learning, USA  
Awais Syed, BSCS Science Learning, USA  
Emily Harris, BSCS Science Learning, USA  
Lindsey Mohan, BSCS Science Learning, USA

Strand 10: Curriculum and Assessment  
Related Paper Set  
Partnering with Teachers to Customize Curriculum and Assessment for Meaningful Student Learning  
17-Mar-24, 3:00 PM-4:30 PM  
Location: Directors Row J
Understanding the Conceptualisations of Coherence in Science Instruction and Teacher Education – A Systematic Literature Review

Mathias Ropohl, University of Duisburg-Essen, Germany
Stefan Sorge*, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Ibrahim Delen, Usak University, Turkey
Robert Evans, University of Copenhagen, Denmark
Kalle Juuti, University of Helsinki, Finland
Jari Lavonen, University of Helsinki, Finland
Pernilla Nilsson, Halmstad University, Sweden
Dustin Schiering, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Matthias Stadler, University of Bergen, Norway
Jeffrey Nordine, University of Iowa, USA

Understanding Estonian Science Teachers’ Beliefs About Teaching and Assessment of Scientific Competences

Triin Rosin*, University of Tartu, Estonia
Katrin Vaino, University of Tartu, Estonia
Regina Soobard, University of Tartu, Estonia
Miia Rannikmäe, University of Tartu, Estonia

A Case Study of Biology Teachers’ Persistence to Implement Reform Curriculum

Elizabeth de los Santos*, University of Nevada, Reno, USA
Kathleen Stynen*, Washoe County School District, USA
Faith Osgard*, Washoe County School District, USA
Suzanne Lewis*, University of Nevada, Reno, USA

Sylvia Scoggin*, Washoe County School District, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set

Critical Race Theories: Recovering Counterstories and Grappling with Slow Violence Across STEM and Teacher Education
17-Mar-24, 3:00 PM-4:30 PM
Location: Governor’s Square 14

We Missed A Step: Recovering Black Participation in Science Education

Tiffany Butler*, George Mason University, USA

Whiteness, Slow Violence and the Enclosure of STEM Pathways

Jennifer Adams*, University of Calgary, Canada
Preeti Gupta, The American Museum of Natural History, USA
Rachel Chaffe, The American Museum of Natural History, USA
Mahmoud Abouelkheir, The American Museum of Natural History, USA
Jahneal Francis, Northeastern University, USA

Educating Preservice Teachers While Black and White: Science as White Property in Teacher Education

Jonathan McCausland*, New Mexico Highlands University, USA
Jennifer Jackson*, Pennsylvania State University, USA
**Race in Teacher Educator Preparation:**
The Black Doll White Doll Experiment Becomes Personal
**Felicia Mensah**, Teachers College, Columbia University, USA

**Strand 11: Cultural, Social, and Gender Issues**
**SC-Organized Paper Set**

**Transforming Science Education:**
LGBTQIA+ Perspectives, Queer Theories, and Gender-Inclusive Approaches
17-Mar-24, 3:00 PM-4:30 PM
Location: Governor’s Square 12

“**You’re a girl**: Queer Students and Teachers, Violence, and Science Education after COVID-19
**Matthew Weinstein**, University of Washington - Tacoma, USA
**Alysa Schafer**, Tacoma School District, USA

The Science Classroom as a Gendered Space and the Consequences for Learning Science
**Gry Thorsen**, University of Copenhagen, Denmark
**Henriette Holmegaard**, University of Copenhagen, Denmark
**Lene Madsen**, University of Copenhagen, Denmark

Affirming Queerness in Biology: Teaching Diversity Not Cisheteronormativity
**Aramati Casper**, Colorado State University, USA
**Beth Wittmann**, Colorado State University, USA
**Ollie Turner**, Colorado State University, USA
**Elliot Batta**, Colorado State University, USA
**Kelly Lane**, University of Minnesota - Twin Cities, USA

**Sarah Eddy**, University of Minnesota - Twin Cities, USA

(TRANS)forming LGBTQ- and Gender-Inclusive Science Education
**Ren Rende**, University of Nebraska at Omaha, USA
**Carla Johnson**, North Carolina State University, USA

**Strand 12: Technology for Teaching, Learning, and Research**
**Related Paper Set**

Challenges of Using AI for Evaluation of Knowledge-in-use Assessments
17-Mar-24, 3:00 PM-4:30 PM
Location: Governor’s Square 15

Rubric Development for AI Scoring of NGSS Learning Progression-Based Scientific Models To Support Individual Opportunity To Learn
**Leonora Kaldaras**, University of Colorado Boulder, USA
**Tingting Li**, Michigan State University, USA
**Kevin Haudek**, Michigan State University, USA
**Joseph Krajcik**, Michigan State University, USA

Utilizing Deep Learning AI to Evaluate Scientific Models: Overcoming the Challenges
**Tingting Li**, Michigan State University, USA
**Leonora Kaldaras**, University of Colorado Boulder, USA
**Kevin Haudek**, Michigan State University, USA
**Joseph Krajcik**, Michigan State University, USA
Improving Machine Scoring Performance with Unbalanced Training Dataset
Xinyu He*, University of Georgia, USA
Xiaoming Zhai, University of Georgia, USA
Peng He, Michigan State University, USA
Ehsan Latif, University of Georgia, USA

Using Generative AI to Automatically Identify Students’ Three-Dimensional Understanding in an NGSS-Aligned Learning Progression
Peng He*, Michigan State University

Creating a Contextual Questionnaire to Investigate Middle Students’ View on the Nature of Science
Jie Yang*, Beijing Normal University, China
Sisi Han, Capital Normal University, China
Fangfang Zhao, Beijing Normal University, China

How do Science Teachers Transform their Understanding of Scientific Methods to their Teaching?
Busra Aksoz*, Bogazici University, Turkey
Ebru Kaya, Bogazici University, Turkey

Experiences that Teachers Attribute to the Development of their Epistemic Beliefs about Science Knowledge
Ellen Watson*, Brandon University, Canada
Sarah Ragoub*, University of Manitoba, Canada

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set
K-12 Teaching and Learning
17-Mar-24, 3:00 PM-4:30 PM
Location: Plaza Court 1

Student-Led Participatory Science Curriculum Encourages Science Identity Development in High School Students
Charlie Blake*, Southern Illinois University Edwardsville, USA
Andreai Dexheimer*, Southern Illinois University Edwardsville, USA
Carol Colanlno, Emory University, USA
Candice Johnson, Southern Illinois University Edwardsville, USA
Adriana Martinez, Southern Illinois University Edwardsville, USA
Benjamin Greenfield, University of Southern Maine, USA
Sharon Locke, Southern Illinois University Edwardsville, USA
Georgia Bracey, Southern Illinois University Edwardsville, USA

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set
Place-Base Education
17-Mar-24, 3:00 PM-4:30 PM
Location: Governor’s Square 11

Environmental Education: Solutions-Based Pedagogy to Avoid SuperDoom
Brandl Rayelynn*, Montana Technological University, USA
Chris Pavlovich*, Montana Technological University, USA

Place-Based Education in Diverse Urban Communities: The Case of Israel
Miri Yemini*, Technion, Israel

Promoting Scientific Literacy and Nature of Science in International Communities through Place-Based Socioscientific Issues Context
Daniel De Jesús*, Texas A&M University, USA
Benjamin Herman*, Texas A&M University, USA
Kira Delmore, Texas A&M University, USA

Impact of Interdisciplinary Integrated STEAM Garden-Based Curriculum on Students’ Knowledge, Self-Efficacy, and Attitudes
Katherine Vela*, Utah State University, USA
Douglas Weber, Utah State University, USA
Rita Hagevik, University of North Carolina-Pembroke, USA
Michelle Parslow*, Utah State University, USA
Kathy Cabe Trundle, Utah State University, USA
Laura Wheeler, Brigham Young University, USA

Strand 15: Policy, Reform, and Program Evaluation
SC-Organized Paper Set
Examining Teacher and Student Outcomes in STEM Learning Contexts
17-Mar-24, 3:00 PM-4:30 PM
Location: Directors Row I

Examining Advanced STEM Course Enrollment and Performance Trends in New Jersey Across District Factor Groups
Brian Baldwin*, Kean University, USA
Brandon Barbieri, Kean University, USA

Does Attending a Selective STEM High School Influence College Outcomes?
Jamie Elsner*, University of North Carolina at Chapel Hill, USA
William Zahran, University of North Carolina at Chapel Hill, USA

Isai García-Baza, University of North Carolina at Chapel Hill, USA
Daniel Klasik, University of North Carolina at Chapel Hill, USA
Krissi Hewitt, North Carolina School of Science and Mathematics, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA

A Comparison of Retained vs. Non-Retained Novice Science Teachers in Four U.S. States From 2007-2018
Douglas Larkin*, Montclair State University, USA
Khadjia Ahmed, Montclair State University, USA
Suzanne Patzelt, Touro University, USA
Mayra Muñoz, Montclair State University, USA

Colorado Science Education Research
Supporting Three-Dimensional Curriculum, Instruction, and Assessment Through a Ten-Year Research-Practice Partnership
Erin Furtak*, University of Colorado, USA
Samantha Duwe, Aurora Public Schools, USA

Colorado Science Education Research Symposium
BSCS Then and Now: Advancing High Quality Science Education for All Learners
17-Mar-24, 4:45 PM-6:15 PM
Location: Governor’s Square 10

BSCS Then and Now: Advancing High Quality Science Education for All Learners
Chris Wilson*, BSCS Science Learning, USA
Cari Herrmann Abell*, BSCS Science Learning, USA
Jody Bintz, BSCS Science Learning, USA
Abraham Lo, BSCS Science Learning, USA
Lindsey Mohan, BSCS Science Learning, USA
Jean Flanagan, BSCS Science Learning, USA
Candice Guy-Gaytán, BSCS Science Learning, USA
Diego Rojas, BSCS Science Learning, USA
Jeffrey Snowden, BSCS Science Learning, USA
Betty Stennett, BSCS Science Learning, USA
Sherry Hsi, BSCS Science Learning, USA

Engineering Education (ENE-RIG)
Sponsored Session
Applying an Engineering Education Lens to Today’s Socio-Scientific/Socio-Technical Realities: Public Health, Socioeconomic Inequality, Climate Change, Artificial Intelligence and Beyond
17-Mar-24, 4:45 PM-6:15 PM
Location: Governor’s Square 16

Applying an Engineering Education Lens to Today’s Socio-Scientific/Socio-Technical Realities: Public Health, Socioeconomic Inequality, Climate Change, Artificial Intelligence and Beyond

ORGANIZERS
Monica Cardella, Florida International University, USA
Pamela Lottero-Perdue, Towson University, USA

PANELISTS
John Settlage, University of Connecticut, USA
Christopher Wright, Drexel University, USA
Greses Pérez, Tufts University, USA
Senay Purzer, Purdue University, USA

ESERA
Sponsored Session
Re-imagining Science Education in Post-Pandemic Worlds & Uncertain Futures
17-Mar-24, 4:45 PM-6:15 PM
Location: Governor’s Square 17

Re-imagining Science Education in Post-Pandemic Worlds & Uncertain Futures

ORGANIZERS
Giulia Tasquier, University of Bologna, Italy
Lucy Avraamidou, University of Groningen, Netherlands

PANELISTS
Mauricio Pietrocola, University of Sao Paulo, Brazil
Olivia Levrini, University of Bologna, Italy
Digna Couso, Universitat Autònoma de Barcelona, Spain

Strand 1: Science Learning:
Development of student understanding
Symposium
Learning Progression Analytics:
Analyzing student learning for the individualized development of competence
17-Mar-24, 4:45 PM-6:15 PM
Location: Plaza Court 2

Learning Progression Analytics: Analyzing student learning for the individualized development of competence
Marcus Kubsch*, Freie Universität, Germany
Berrit Czinczel*, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Jannik Lossjew*, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Tobias Wyrwich*, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Ute Harms, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Daniela Fiedler, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Nikol Rummel, Ruhr-Universität Bochum, Germany
Hendrik Drachsler, DIPF, Germany
Ulrike Cress, IWM, Germany
Knut Neumann, IPN – Leibniz Institute for Science and Mathematics Education, Germany

The Role of Knowledge and Perspective-taking in Students’ Performance of Socio-scientific Argumentation
Shih-Yeh Chen*, National Taichung University of Education, Taiwan
Shiang-Yao Liu, National Taiwan Normal University, Taiwan

Middle School Students’ Informal Reasoning Quality, Attitudes Toward Socioscientific Issues and Motivation to Learn Science
Büşra Manay, Science Teacher, Turkey
Özgül Yılmaz Tüzün*, Middle East Technical University, Turkey

Exploring and Expanding the Frontiers of Socioscientific Issues
Dana Zeidler*, University of South Florida, USA
Troy Sadler*, University of North Carolina at Chapel Hill, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Socioscientific Issues
17-Mar-24, 4:45 PM-6:15 PM
Location: Plaza Court 4

Students’ Socio-scientific Systems Thinking: The Role of Systems Mapping, Causal Reasoning, and Content Knowledge
Nannan Fan*, University of North Carolina at Chapel Hill, USA
Eric Kirk, University of North Carolina at Chapel Hill, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA
Heewoo Lee, University of North Carolina at Chapel Hill, USA
Linyu Yu, University of North Carolina at Chapel Hill, USA

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set
Early Childhood Science Practices
17-Mar-24, 4:45 PM-6:15 PM
Location: Plaza Court 3

Playing in Science: Exploring Play-Based Science Learning Across Different Preschool Models
Kathleen Mahoney*, University of Massachusetts, USA
Jeanne Brunner*, University of Massachusetts, USA
Rethinking Early Years Environmental Science Education, Pedagogy, and Approaches in Response to Climate Change
Peter Oyewole*, Kent State University, USA

Head Start Teachers’ Understanding of Science and How it Relates to Classroom Science Practices
Arianna Pikus*, Texas A&M, USA
Hope Gerde, Texas A&M, USA
Christina Schwarz, Michigan State University, USA
Kyung Sook Lee, University of Alaska Fairbanks, USA
Laurie Van Egeren, Michigan State University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set
Discourse-based Learning
17-Mar-24, 4:45 PM-6:15 PM
Location: Plaza Court 5

What Kinds of Argumentation Dialog Types are Useful?
Shuang Xu, East China Normal University, China
Xiao huang*, Zhejiang Normal University, College of Education, China
Sibel Erduran, University of Oxford, United Kingdom
Mengzhuang Zheng, Zhejiang Normal University, China

Learning the Ropes: How Do Mentors Support Students Through the Scientific Publication Process?
Tanya Bhagatwala, Emory University, USA
Trisha Minocha, Emory University, USA
Sarah Fankhauser*, Oxford College of Emory University, USA

Using Questions to Reach Across Disciplines in a Middle School Integrated STEM Investigation
Lori Klukowski*, Middle Tennessee State University, USA
Ryan Jones, Middle Tennessee State University, USA
Fonya Scott, Middle Tennessee State University, USA

Investigating Teacher Questioning During Scaffolded Lessons for Evaluating Alternative Scientific Explanations
Janelle Bailey*, Temple University, USA
Lorraine Ramirez Villarin, University of North Georgia, USA
Donna Governor, University of North Georgia, USA

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set
Pedagogy in Science Museums
17-Mar-24, 4:45 PM-6:15 PM
Location: Plaza Court 6

When Science Museums Re-Imagined Their Communication and Educational Roles: Responses to the Covid-19 Pandemic
Ana Maria Navas Iannini*, Simon Fraser University, Faculty of Education, Canada
Erminia Pedretti, University of Toronto, Ontario Institute for Studies in Education (OISE), Canada

Learning Talk and Museum Signage at an Informal Science Exhibit
Jefferson Ramsey*, UNC Chapel Hill, USA
Leah Metcalf*, UNC Chapel Hill, USA
Slki Lim, UNC Chapel Hill, USA
Mengyi Mao, UNC Chapel Hill, USA
Janice Anderson, UNC Chapel Hill, USA
Jill Hamm, UNC Chapel Hill, USA
Dual Role Science Museum Educators: Fun = Engagement = Learning
Patricia Patrick*, Columbus State University, USA
Monique Lester, Columbus State University, USA

Revisiting Distance Learning in Museums Three Years After Covid-19 Closures
Megan Ennes*, University of Florida, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Approaches of Preservice Teachers Developing Self-efficacy for STEM Learning and Teaching
17-Mar-24, 4:45 PM-6:15 PM
Location: Governor's Square 16

Exploring Preservice Teachers’ Computational Thinking (CT) and Self-Efficacy through Scaffolding Plugged and Unplugged CT Activities
Jeffrey Radloff*, SUNY Cortland, USA
Bridget Miller, University of South Carolina, USA

Development of Integrated STEM Teaching Self-Efficacy Among Elementary Preservice Teachers
Jeanna Wieselmann*, Southern Methodist University, USA
Deepika Menon, University of Nebraska - Lincoln, USA
Sarah Haines, Towson University, USA
Sumreen Asim, Indiana University Southeast, USA
Amanda Koch, Independent Contractor, USA
Derek Cox, University of Nebraska - Lincoln, USA

Investigating Preservice Elementary Teachers’ STEM Teaching Self-Efficacy and Goal Orientation
Derek Cox*, University of Nebraska-Lincoln, USA
Deepika Menon, University of Nebraska-Lincoln, USA
Jeanna Wieselmann, Southern Methodist University, USA

Assessing Preservice Teachers Understanding of Computational Thinking using Science Lesson Plans
Line Saint-Hilaire*, Queens College, CUNY, USA
Anna Malyukova, Queens College, CUNY, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
Science Teachers’ Identity Development
17-Mar-24, 4:45 PM-6:15 PM
Location: Directors Row J

Science Teacher Identity Research: A Scoping Literature Review
Xiufeng Liu*, University at Buffalo, State University of New York, USA
Yanfang Zhai, Capital Normal University, China

Examining the Role of Instructional Coaching on Elementary Teachers’ Science Teacher Identity Development
Dionne Cross Francis*, University of North Carolina, USA
Andrea Phillips*, Indiana University, USA
Anina Mahmud*, University of North Carolina, USA
Meredith Park Rogers*, Indiana University, USA
**Being Science Teachers: Co-Constructing Identities In Science Instructional Coaching Conversations**  
*Catherine Bhathena*, Indianapolis Public Schools, USA

**Exploring Elementary Teaching Efficacy Differences Between Life and Physical Science**  
*Doug Ball*, Utah State University, USA  
*Colby Tofel-Grehl*, Utah State University, USA

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**Strand 8: In-service Science Teacher Education**  
SC-Organized Paper Set  
*Teachers’ Content and Pedagogical Content Knowledge*  
17-Mar-24, 4:45 PM-6:15 PM  
Location: Directors Row H

*Unraveling Empirically Supported Factors Contributing to Pedagogical Content Knowledge Development: A Systematic Analysis of Literature*  
*Soonhye Park*, North Carolina State University, USA  
*Kennedy Chan*, The University of Hong Kong, Hong Kong

*A model for developing teachers' Contemporary Content Knowledge (CCK)*  
*Ron Blonder*, Weizmann Institute of Science, Israel

*Mapping the Development and Deployment of Teachers' PCK and Instructional Practices After Modeling Instruction PD*  
*Matt Reynolds*, North Carolina State University, USA

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**Strand 11: Cultural, Social, and Gender Issues**  
Related Paper Set  
*Families Matter: Family Learning as a Central Component to Equity in STEM Education*  
17-Mar-24, 4:45 PM-6:15 PM  
Location: Governor's Square 14

*Recognizing Black Family Members as Partners in STEM Education*  
*DeLean Tolbert Smith*, University of Michigan-Dearborn, USA
Monica Cardella*, Florida International University, USA

Considering the Family-Centric STEM Identity Development Model to Support Inclusivity in Designing STEM Learning Experiences

Remy Dou*, Florida International University, USA

Heidi Cian, MMSA, USA

Agentic Interest Pathways: Understanding How Families Shape Their Own Interest Development to Inform STEM Equity

Scott Pattison*, TERC, USA

Smirla Ramos Montañez*, TERC, USA

Viviana López Burgos, TERC, USA

Gina Svarovsky, University of Notre Dame, USA

Annie Douglass, Oregon Museum of Science and Industry, USA

Julie Allen, Mt. Hood Community College Head Start, USA

Catherine Wagner, University of Notre Dame, USA

STEM Fam: Fostering Rightful Familial Presence in Middle School STEM

Angela Calabrese Barton*, University of Michigan, USA

Edna Tan, University of North Carolina at Greensboro, USA

Wisam Sidawi, University of Michigan, USA

Francisco Para Camacho, University of Michigan, USA

Virginia Swindell, University of North Carolina at Greensboro, USA

Strand 11: Cultural, Social, and Gender Issues

SC-Organized Paper Set

Identity and Gender: Student Portraiture, Teacher Perspectives, and Pursuing Equity

17-Mar-24, 4:45 PM-6:15 PM
Location: Governor’s Square 12

Meaningful Classroom Engagement for Cultivating STEM Identity: Exploring High School Student Perceptions Through Portraiture

Elizabeth Saville*, UBC Okanagan, Canada

Using Storied Identities to Uncover Science Teachers’ Identities in Science After an RET

Suzanne Patzelt*, Touro University, USA

Gender Difference in the Attitude of Students to Computer Studies: Can CTCA Bridge the Gap?

Chinyere Ikpah*, Lagos State University-ACEITSE, Nigeria

Rasheed Sanni, Lagos State University-ACEITSE, Nigeria

Peter Okebukola, Lagos State University-ACEITSE, Nigeria

Deborah Agbanimu, National Open University of Nigeria, Nigeria

Franklin Onowugbeda, Lagos State University-ACEITSE, Nigeria

Towards Gender Equity in Science Learning and Achievement: Measuring the Catalytic Effects of Culturo-Techno-Contextual Approach

Adekunle Oladeje*, Lagos State University, Nigeria

Peter Okebukola, Lagos State University, Nigeria

Juma Shabani, University of Burundi, Burundi

Ibiyinka Ogunlade, Ekiti State University, Ado-Ekiti, Nigeria
Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set
Concerns of Using Technology in Science Education
17-Mar-24, 4:45 PM-6:15 PM
Location: Governor’s Square 15

The Use of Educational Technology in Inquiry-based Elementary Science Education: A Systematic Review
Minji Yun*, University of Florida, USA
Kent Crippen, University of Florida, USA

Tess Bernhard*, University of Pennsylvania, USA

Towards Integrating Computational Agent-based Modeling Practices with Three-dimensional NGSS Learning
Aditi Wagh*, MIT, USA
Luke Conlin, Salem State University, USA
Daniel Wendel, MIT, USA
Emma Anderson, MIT, USA
Ilana Schoenfeld, MIT, USA

Supporting AI literacy in K-12 Science Education: Raising Critical Consciousness towards Ethical AI
Selin Akgun*, Michigan State University, USA
Hee Rin Lee, Michigan State University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set
Knowledge Into Practice
17-Mar-24, 4:45 PM-6:15 PM
Location: Plaza Court 1

Specifying the Refined Consensus Model: An Argument for Biology-Specific Collective Pedagogical Content Knowledge
Sophie-Luise Müller*, Freie Universität, Germany
Daniela Mahler, Freie Universität, Germany

PCK of NOS: Approach to the Collective PCK of Expert Biology Teachers in NOS Teaching
Paola Nuñez*, Pontificia Universidad Católica de Valparaiso, Chile
Claudia Vergara, Universidad Alberto Hurtado, Chile
Carolina Parraguez, Pontificia Universidad Católica de Valparaíso, Chile
David Santibañez, Universidad Finnis Terrae, Chile
Hernan Cofre, Pontificia Universidad Católica de Valparaíso, Chile

Pedagogy of Practice Approach to Teaching Nature of Science to In-Service Teachers
Anna Pshenichny-Mamo*, Technion – Israel Institute of Technology, Israel
Haya Ben Simon, Technion – Israel Institute of Technology, Israel
Dina Tsybulsky*, Technion – Israel Institute of Technology, Israel
Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set
Climate Change Education
17-Mar-24, 4:45 PM-6:15 PM
Location: Governor’s Square

Psychological Distance to Climate Change: Science Teachers’ and Scientists’ Use of Visual Representations
M. Gail Jones*, NCSU, USA
Julianna Nieuwsma, NCSU, USA
Rebecca Ward, NCSU, USA
Madeline Stallard, NCSU, USA
Kathleen Bordewieck, NCSU, USA
Amber Meeks, NCSU, USA
Tanzimul Ferdous, NCSU, USA
Kimberly Ideus, NCSU, USA

Children’s Understanding of Climate Change
Mijung Kim*, University of Alberta, Canada
Qingna Jin*, Cape Breton University, Canada

Climate Superheroes: Impact of a STEAM Camp on Preschool Children’s Ideas about Climate-Friendly Actions
Lisa Borgerding*, Kent State University, USA
Breanna Beaver, Youngstown State University, USA

Developing a Model of Climate Change Literacy Based on the Systematic Literature Review
Helin Semilarski*, University of Tartu, Estonia
Helen Semilarski, University of Tartu, Estonia

Pre-Service Biology Teacher Beliefs about Climate Change Education
Veronika Winter*, University of Vienna, Austria
Andrea Moeller, University of Vienna, Austria
Alexander Buessing, Leibniz University Hannover, Germany
Niklas Gericke, Karlstad University, Sweden

Social Event
Early Career Faculty Institute Meet-up
17-Mar-24, 6:15 PM-7:00 PM
Location: Directors Row I

Early Career Faculty Institute Meet-up

ORGANIZERS
Julie Luft, University of Georgia, USA
Angela Calabrese Barton, University of Michigan, USA

Social Event
Presidential Welcome Reception and Dance
17-Mar-24, 7:00 PM-10:00 PM
Location: Plaza Ballroom ABC/DEF
18 MARCH 2024

Social Event
Mind & Sole Denver! "5280 - Let's Run Mile High!"
18-Mar-24, 6:30 AM-8:00 AM
Location: Off Site

ORGANIZER
Angela Calabrese Barton, University of Michigan, USA

RIG Business Meeting
Asian and Pacific Islander Science Education Research [APISER] Business Meeting
18-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 17

RIG Business Meeting
Latino/a RIG [LARIG] Business Meeting
18-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 1

RIG Business Meeting
Contemporary Methods for Science Education Research Business Meeting
18-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 2

RIG Business Meeting
Engineering Education [ENE-RIG] Business Meeting
18-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 3

RIG Business Meeting
Indigenous Science Knowledge [ISK-RIG] Business Meeting
18-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 4

RIG Business Meeting
Research in Artificial Intelligence-involved Science Education [RAISE] Business Meeting
18-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 5

RIG Business Meeting
LGBTQ+ RIG Business Meeting
18-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 6

RIG Business Meeting
Continental and Diasporic Africa in Science Education [CADASE] Business Meeting
18-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 7
RIG Business Meeting
 Interested in forming a Computational Thinking in Science Education RIG?
 18-Mar-24, 7:00 AM-8:00 AM
 Location: Plaza Court 8

Roundtables Session 1
 18-Mar-24, 8:15 AM-9:45 AM
 Location: Plaza Ballroom ABC/DEF

Colorado Science Education Research Roundtable
 Supporting Computationally-Rich Science Instruction: Conceptual Models for CT-Integrated Science Curriculum and Professional Learning
 Gregory Benedis-Grab*, CU Boulder, USA
 Quentin Biddy, CU Boulder, USA
 Srinjita Bhaduri, CU Boulder, USA
 Jennifer Jacobs, CU Boulder, USA
 Alexandra Gendreau Chakarov, CU Boulder, USA
 Jeffrey Bush, CU Boulder, USA
 Tamara Sumner, CU Boulder, USA

Strand 3: Science Teaching — Primary School (Grades preK-6):
 Characteristics and Strategies Roundtable
 Elementary Science Teaching: Toward the Goal of Scientific Literacy
 Valarie Akerson*, Indiana University, USA
 Selina Bartels*, Valparaiso University, USA

Strand 11: Cultural, Social, and Gender Issues Roundtable
 Civic Science: Developing Scientific Literacy for Marginalized Students through Community Engagement
 E. Woo*, Michigan State University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science Roundtable
 Citizen Science as Means to Support Understanding of Cultural Heritage.
 Zoubeida Dagher*, University of Delaware, USA

Strand 14: Environmental Education and Sustainability Work-in-progress Roundtable
 Role of Basic Sciences in Creating Awareness among School Students & Student-Teachers about Single Use Plastics
 Narendra Deshmukh*, Homi Bhabha Centre for Science Education, TIFR, India

Strand 2: Science Learning: Contexts, Characteristics and Interactions Roundtable
 Dissecting Dialogue: A Proposed Integrated Framework for Analyzing Student Discourse in Science Classrooms
 Benny Mart Hiwatig, University of Minnesota, USA
 Abdi Warfa*, University of Minnesota, USA
Anica Miller-Rushing*, University of Maine, USA
Jennifer Haddad Lingle, University of North Carolina at Greensboro, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Work-in-progress Roundtable
Writing for Identity? Exploring the Motivation of Pre-College Students to Participate in Science Publication.
Sarah Fankhauser*, Oxford College, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Work-in-progress Roundtable
Influence of Summer Research Experiences on High School Students Science Identity
Nidaa Makki*, The University of Akron, USA
Katrina Halasa*, Akron Public Schools, USA
Kristin Koskey*, Drexel University, USA

Strand 3: Science Teaching — Primary School (Grades preK-6):
Characteristics and Strategies
Roundtable
Exposing a Hidden Reality, What Middle School Students Said About Their Lived Elementary Science Experiences.
Tryna Knox*, SMU, USA

Strand 3: Science Teaching — Primary School (Grades preK-6):
Characteristics and Strategies
Roundtable
Reading for Science: The Use of Scientific Literary Materials in Primary Schools
Fay Lewis*, University of the West of England, United Kingdom
Jane Carter*, University of the West of England, United Kingdom
Juliet Edmonds, University of the West of England, United Kingdom

Ann Alston, University of the West of England, United Kingdom
Stephanie Sargeant, University of the West of England, United Kingdom

Strand 3: Science Teaching — Primary School (Grades preK-6):
Characteristics and Strategies
Roundtable
Using Teaching Debriefs to Explore the Emerging Science Teaching Identity of a Veteran Elementary Teacher
Terrance Burgess*, Michigan State University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Work-in-progress Roundtable
Data-Informed Teaching: An Examination of Faculty Use of Student Data Dashboards for Classroom Instruction
Veronika Rozhenkova*, University of California Irvine, USA
Maryam Eslami, University of California Irvine, USA
Celine Crooks, University of California Irvine, USA
Brian Sato, University of California Irvine, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12):
Characteristics and Strategies
Roundtable
Situational Interest and Perceived Relevance in Physics Learning Modules
Rauno Neito*, University of Tartu, Estonia
Elisa Vilhunen, University of Helsinki, Finland
Jari Lavonen, University of Helsinki, Finland
Kaido Reivelt, University of Tartu, Estonia
Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies Roundtable
Interdisciplinary Assessment of Student Thinking About Variability Across Mathematics and Science Classes in Middle School
Fonya Scott*, Middle Tennessee State University, USA
Ryan Jones, Middle Tennessee State University, USA
Lori Klukowski, Middle Tennessee State University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies Work-in-progress Roundtable
Assessing Pedagogical Content Knowledge for Data Fluency for Middle School STEM Teachers
Rasha Elsayed*, WestEd, USA
Nicole Wong*, WestEd, USA
Leticia Perez*, WestEd, USA
Kirsten Daehler*, WestEd, USA
Pai-rou Chen, WestEd, USA
Corynn Del Core, WestEd, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies Roundtable
Case Study - Training STEM High School Teachers to Integrate Engineering through Gamification
Leslie Brown*, Utah State University, USA
Marissa Tsugawa, Utah State University, USA

Strand 14: Environmental Education and Sustainability Roundtable
The Woolly Bully: Increasing Students’ Science Identities by Tracking the Hemlock Woolly Adelgid
Tara Goodhue*, University of Massachusetts, Lowell, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies Roundtable
Intersectionality of Race and STEM Contents in Two High School Biology Teachers’ Classrooms
Bhaskar Upadhyay*, University of Minnesota, USA
Patricia Avery, University of Minnesota, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies Work-in-progress Roundtable
In Search of a New Perspective in Exploration of the Persistent P-12 STEM Achievement Gap
Wardell Powell*, Framingham State University, USA
Angela Chapman*, University of Texas Rio Grande Valley, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies Roundtable
Student Motivation to Learn and Pursue Careers in Science
Erica Meyers, Kasson- Mantorville Public Schools ISD 204, USA
Bonnie Boyd*, Independent School District 196, USA
Felicia Leammukda, Saint Cloud State University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
Work-in-progress Roundtable
Exploring A Promising Path Forward: Teacher Engagement with “Civic Science Education”
Maggie Demarse*, Michigan State University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
Work-in-progress Roundtable
How Do Teachers in Rural Alaska Make Space for Community Cultural Wealth in the Classroom?
Ginger Shultz*, University of Michigan, USA
Jeffrey Spencer, University of Michigan, USA
Archer Harrold, University of Michigan, USA
Safron Milne, University of Michigan, USA
Danielle Maxwell, University of Michigan, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Roundtable
A Scientific Laboratory-Based Course Aimed at Improving the Scientific Attitudes and Skills of Non-Science Majors
Brian Rempel, University of Alberta, Canada
Sheryl Gares, University of Alberta, Canada
Ellen Watson*, Brandon University, Canada

Strand 5: College Science Teaching and Learning (Grades 13-20)
Roundtable
Interactions within Cohorts of STEM Majors from Minoritized Groups: The Potential for Changing STEM Climate
Stacy Olitsky*, Saint Joseph's University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Work-in-progress Roundtable
Investigating the Role of Representational Competence and Spatial Ability in Learning With Chemical Representations
Sebastian Nickel*, FAU Erlangen-Nürnberg, Germany
Steffen Brockmüller, FAU Erlangen-Nürnberg, Germany
Sebastian Habig, FAU Erlangen-Nürnberg, Germany

Strand 5: College Science Teaching and Learning (Grades 13-20)
Work-in-progress Roundtable
Implementing and Evaluating Professional Development for Science Faculty that Impacts Student Learning of Science
Peter Cormas*, Pennsylvania Western University, USA
Louise Nicholson*, Pennsylvania Western University, USA
Min Li, Pennsylvania Western University, USA
Elizabeth Steiner, RAND Corporation, USA
Sy Doan, RAND Corporation, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Work-in-progress Roundtable
Assessing Metacognitive Monitoring in Evolution Understanding
Rahmi Aini*, Middle Tennessee State University, USA
M. Elizabeth Barnes, Middle Tennessee State University, USA

**Strand 5: College Science Teaching and Learning (Grades 13-20)**

**Work-in-progress Roundtable**

STEM Undergraduate Research Students’ Self-Efficacy and Their Learning Practices Within a Multi-Institutional Collaborative Research Community

Hyoung Joon Park*, Oregon State University, USA
Jana Bouwma-Gearhart, Oregon State University, USA

**Strand 8: In-service Science Teacher Education**

**Work-in-progress Roundtable**

Professional Development Design and Implementation to Foster Planning for Culturally Responsive Engineering Experiences

Christopher Irwin*, Florida International University, USA
Darryl Dickerson*, Florida International University, USA
Joshua Ellis*, Louisiana State University, USA
Daniel Adeniranye, Florida International University, USA
Bruk Berhane, Florida International University, USA
Andrew Green, Florida International University, USA
Berry Lamy, Florida International University, USA
Nicholas Oehm, Florida International University, USA

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**Equity and Ethics Committee**

**Sponsored Session**

**Jhumki Basu Scholars Symposium**

18-Mar-24, 8:15 AM-9:45 AM

Location: Governor’s Square 10

**Jhumki Basu Scholars Symposium**

**ORGANIZERS**

Regina McCurdy, Georgia Southern University, USA
Alexandria Muller, University of California-Santa Barbara, USA
David Steele, Alder Graduate School of Education, USA
Marsha Simon, University of West Georgia, USA

**PANELISTS**

Sule Aksoy, City University of New York, USA
Roshni Bano, University of Illinois, Chicago, USA
Haider Ali Bhatti, University of California, Berkeley, USA
Henriette Burns, Southern Illinois University Edwardsville, USA
Alia Hamdan, University of Arizona, USA
Mwenda Kudumu, North Carolina State University, USA
Gozde Tosun, Penn State University, USA
Alexandria Muller, University of California, Santa Barbara, USA
Ren Rende, University of Nebraska at Omaha, USA
Jenny Tilsen, University of Minnesota, USA
Hamza Malik, University of Massachusetts, Dartmouth, USA
Teresa Massey, Georgia State University, USA
Khanh Tran, Purdue University, USA
Carol Waters, University of Houston-Clear Lake, USA
Strand 1: Science Learning: Development of student understanding
SC-Organized Paper Set
Models and (Computational) Modeling
18-Mar-24, 8:15 AM-9:45 AM
Location: Governor’s Square 17

Interconnecting Modeling, System Thinking, and Disciplinary Core Ideas Using Computational System Modeling.
Emil Eidin*, University of Wyoming, USA
Jonathan Bowers, Michigan State University, USA

A Microanalytic Knowledge Analysis of Middle Schoolers’ Ideas About Modeling
Eric Kirk*, University of North Carolina at Chapel Hill, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA
Zhen Xu, University of North Carolina at Chapel Hill, USA
Jamie Elsner, University of North Carolina at Chapel Hill, USA
Li Ke, University of Nevada Reno, USA
Laura Zangori, University of Missouri Columbia, USA

Metamodeling Knowledge and Engagement in Modeling Practices: The Role of Content Knowledge
Paul Engelschalt*, Humboldt-Universität zu Berlin, Germany
David Fortus, The Weizmann Institute of Science, Israel
Dirk Krüger*, Freie Universität Berlin, Germany
Annette Upmeier zu Belzen, Humboldt-Universität zu Berlin, Germany

Mechanistic Reasoning in Group Drawing: The Case of Collaborative Gestures.
Vanessa De Andrade*, Universidade de Lisboa, Portugal
Yael Shwartz, Weizmann Institute of Science, Israel
Sofia Freire, Universidade de Lisboa, Portugal
Monica Baptista, Universidade de Lisboa, Portugal

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
COVID-19, Viruses, and Vaccines
18-Mar-24, 8:15 AM-9:45 AM
Location: Directors Row E

An Exploratory Study of Students’ Prior Experiences and Concepts of Viruses and Vaccines
Madeline Stallard*, NC State University, USA
Gail Jones*, NC State University, USA
Julianna Nieuwsma, NC State University, USA
Kathleen Bordewieck, NC State University, USA

Teaching During the COVID Pandemic: K-12 Science Teachers Tell Their Stories
Lauren Harper*, Horizon Research, Inc., USA
Peggy Trygstad*, Horizon Research, Inc., USA
Anna Bruce, Horizon Research, Inc., USA
Patrick Smith, Horizon Research, Inc., USA

The Impacts of the COVID Pandemic on Science Teachers and their Teaching
Peggy Trygstad*, Horizon Research, Inc., USA
Laura Craven, Horizon Research, Inc., USA
2024 NARST Annual International Conference, Denver

**Patrick Smith**, Horizon Research, Inc., USA

*Exploring the State of Creativity in an Online Physics Learning Environment During the Covid-19 Pandemic*

**Fredyrose Ivan Pinar**, De La Salle University, Philippines

*Motivating Science Learning When Shifting from Face-to-Face to Distance Learning: Comparing Teachers’ and Students’ Perspectives*

**Shira Passentin**, Weizmann Institute of Science, Israel

**David Fortus**, Weizmann Institute of Science, Israel

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**Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies**

SC-Organized Paper Set

*Inquiry-based Science Teaching*

18-Mar-24, 8:15 AM-9:45 AM

Location: Plaza Court 1

The *Science Education Research Trends in Indonesian Secondary Schools: A Systematic Review and Bibliometrics Study*

**M Muchson**, Western Michigan University, USA

**William Cobern**, Western Michigan University, USA

**Muhammad Saefi**, Universitas Islam Maulana Malik Ibrahim Malang, Indonesia

Leveraging Classroom Community to Encourage a Collective Enterprise of Building Science Ideas

**Jessica Alzen**, University of Colorado Boulder, USA

**Kelsey Edwards**, Northwestern University, USA

**Jason Buell**, Northwestern University, USA

**Chris Griesemer**, University of California Davis, USA

**Cynthia Passmore**, University of California Davis, USA

**William Penuel**, University of Colorado Boulder, USA

**Brian Reiser**, Northwestern University, USA

*Enhancing High-School Student’s Scientific Competency in Evaluating and Designing Scientific Inquiry Through Peer-Reviewed Guided Inquiry*

**Yu-Jan Tseng**, National Sun Yat-sen University, Taiwan

**Huann-shyang Lin**, National Sun Yat-sen University, Taiwan

*Instructional Approaches in AP and Introductory High School Science Courses & Their Relations to PCK*

**Robin Bulleri**, North Carolina State University, USA

**Soonhye Park**, North Carolina State University, USA

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**Strand 5: College Science Teaching and Learning (Grades 13-20)**

SC-Organized Paper Set

*Educator Development and STEM Teaching*

18-Mar-24, 8:15 AM-9:45 AM

Location: Plaza Court 6

*Developing Educator Identity in Engineering: A Pilot Case Study with Graduate Teaching Assistants (GTA)*

**Qingna Jin**, Cape Breton University, Canada

**Gokce Akcayir**, University of Alberta, Canada
Kristian Basaraba*, University of Alberta, Canada
Duncan Buchanan*, University of Alberta, Canada
Marnie Jamieson*, University of Alberta, Canada
Mijung Kim*, University of Alberta, Canada
Janelle McFeeters, University of Alberta, Canada
Kerry Rose*, University of Alberta, Canada

STEM Faculty Professional Development: Measuring the impact on College Student STEM Course Grades
Lynn Tashiro, Sacramento State, USA
Mary McCarthy Hintz*, Sacramento State, USA
Sabrina Solanki, University of California Irvine, USA
Judith Kusnick, Sacramento State, USA
De-Laine Cyrenne*, Sacramento State, USA

Physics Professors’ Pedagogical Decisions and Adoption of Research-Based Instructional Strategies
Christy Metzger*, University of Delaware, USA

Investigating Faculty Engagement in Developing Citizen/community Science Course Projects Utilizing a Socioscientific Issues-Based Approach
Stephen Witzig*, University of Massachusetts Dartmouth, USA
Hamza Malik, University of Massachusetts Dartmouth, USA
Rachel Stronach, University of Massachusetts Dartmouth, USA
Kathryn Kavanagh, University of Massachusetts Dartmouth, USA
Robert Gegear, University of Massachusetts Dartmouth, USA

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set
Learning in Science Museums
18-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 4

Promoting Inclusive Visits using Virtual Reality to a Museum of Natural History for Autistic Families
Darby Drageset, University of Florida, USA
Yu-Chia (Irene) Kao, University of Florida, USA
Nigel Newbutt, University of Florida, USA
Kent Crippen*, University of Florida, USA

Creating Science Learning Spaces: Lessons Learned from a Museum Science Program
Jacqueline Horgan*, Teachers College Columbia University, USA
Felicia Mensah, Teachers College Columbia University, USA

Students’ Conceptual Knowledge, but Not Their Interest, Help Make Use of a Socio-Scientific Museum Exhibition
Melanie Keller*, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Sarah Kellberg, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Jeffrey Nordine, University of Iowa, USA
Doris Lewalter, LMU Ludwig Maximilians Universität, Germany

A Hopeful Future: Knowledge and Ideological Resources for Learning at an Innovative Museum Exhibit
Lynne Zummo*, University of Utah, USA
Benjamin Janney, University of Utah, USA
Carrie Schultz, University of Utah, USA
Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Approaches to Assessments across STEM Disciplines
18-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 2

Research Strategies and Assessments of Online Source Credibility by Pre-Service Chemistry Teachers
Dennis Dietz*, Freie Universität Berlin, Germany
Arne Petter, Freie Universität Berlin, Germany
Claus Bolte, Freie Universität Berlin, Germany

Reflection on Physics Teaching – a Comparison of a Performance Assessment and a Multiple-Choice Assessment
Anna Weißbach*, University Bremen, Germany
Christoph Kulgemeyer, University Bremen, Germany

Considering Multiple Sources of Validity Evidence to Address Challenges in Developing PCK Multiple-Choice Items
Tobias Lieberei*, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Leroy Großmann*, Freie Universität Berlin, Germany
Virginia Welter, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Dirk Krüger, Freie Universität Berlin, Germany
Moritz Krell, IPN - Leibniz Institute for Science and Mathematics Education, Germany

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Research and Insights on Approaches About Preservice Science Teacher Education Frameworks
18-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 3

Establishing Common Ground in Empirical Research on Science Teachers’ Lesson Planning: A Scoping Review
Leroy Großmann*, Freie Universität Berlin, Germany
Maren Koberstein-Schwarz, Universität Hildesheim, Germany
Daniel Scholl, Universität Siegen, Germany
Dirk Krüger, Freie Universität Berlin, Germany
Anke Meisert, Universität Hildesheim, Germany

Making Beyond the University Classroom: Lessons from Preservice Teachers Participating in a Mobile Making Program
Myunghwan Shin*, California State University, Fresno, USA
Alexandria Hansen*, California State University, Fresno, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
Connections Between Teachers’ Epistemic Beliefs and Instruction
18-Mar-24, 8:15 AM-9:45 AM
Location: Governor’s Square 12

Science Teachers’ Beliefs About Teaching and Learning Science Contents and Scientific Practices
Verena Petermann*, Justus Liebig
University Giessen, Germany
Andreas Vorholzer, Technical University of Munich, Germany
Claudia von Aufschnaiter, Justus Liebig
University Giessen, Germany

Shifting Epistemic Authority in Science Education: Understanding Teacher Transitions in Knowledge Generation Environments
Jale Ercan-Dursun*, The University of Alabama, USA
Jee Suh, The University of Alabama, USA
Ercin Sahin, The University of Iowa, USA
Brian Hand, The University of Iowa, USA
Gavin Fulmer, The University of Iowa, USA

Exploring Relationships Among Science Teachers’ Pedagogical Content Knowledge, Epistemic Orientations, and Implementation of Model-Based Teaching
Grace Carroll*, North Carolina State University, USA
Soonhye Park, North Carolina State University, USA
Matt Reynolds, North Carolina State University, USA
Amanda Hall, North Carolina State University, USA
Laura Chalfant, North Carolina State University, USA
Scott Ragan, North Carolina State University, USA
Jason Painter, North Carolina State University, USA

Tackling the Epistemic and Dialogic Aspects of Interdisciplinary Argumentation Among Science Teachers
David Perl-Nussbaum*, Weizmann Institute of Science, Israel
Baruch Schwarz, The Hebrew University of Jerusalem, Israel

Edit Yerushalmi, Weizmann Institute of Science, Israel

Strand 8: In-service Science Teacher Education
Related Paper Set
Curriculum-Based Professional Learning: Multiple Approaches to Working with Teachers of Diverse Student Groups
18-Mar-24, 8:15 AM-9:45 AM
Location: Governor’s Square 14

Professional Learning Design to Enhance Elementary Teacher’s Pedagogical Design Capacity to Adapt Curriculum Materials
Katahdin (Kate) Cook Whitt*, Maine Mathematics and Science Alliance, USA
Lisa Kenyon, Maine Mathematics and Science Alliance, USA

Curriculum-Based Professional Development for Integrating Science and Language with Multilingual Learners
Alison Haas, New York University, USA
Okhee Lee*, New York University, USA
Abigail Schwenger, New York University, USA
Scott Grapin, University of Miami, USA
Sustained Professional Learning to Promote Teaching Elementary Science in Large Urban Schools
Cory Susanne Miller*, Michigan State University, USA
Joseph Krajcik*, Michigan State University, USA

Professional Learning to Support Teachers Customization of Middle School Science Curriculum to Support Equitable Sensemaking
Katherine McNell*, Boston College, USA
Renee Affolter, Boston College, USA
Strand 10: Curriculum and Assessment & Colorado Science Education Research
Related Paper Set
Building from Strengths and Attending to Context: Supporting Rural Science Teachers’ Learning
18-Mar-24, 8:15 AM-9:45 AM
Location: Directors Row H

Lessons Learned from Designing 5D Professional Learning for Rural Science Teachers
Abraham Lo*, BSCS Science Learning, USA
Annie Allen, University of Colorado, Boulder, USA
Kevin Cherbow, BSCS Science Learning, USA
Sara Cooper, University of Colorado, Boulder, USA
Lorraine Glidewell, University of Colorado, Boulder, USA
Cari Herrmann Abell*, BSCS Science Learning, USA
Keelin O’Connor, University of Colorado, Boulder, USA
William Penuel, University of Colorado, Boulder, USA

Opportunities and Challenges in Designing Phenomena-Based Tasks Rooted in Student-Identified Community Issues
Keelin O’Connor*, University of Colorado, Boulder, USA
William Penuel, University of Colorado, Boulder, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set
Moving Towards Equity and Racial Justice
18-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 5

Colorado Science Education Research
Moving Genetics Education Beyond Mendel Can Reduce Racial Prejudice
Brian Donovan, BSCS Science Learning, USA
Monica Weindling*, BSCS Science Learning, USA
Dennis Lee, BSCS Science Learning, USA
Awais Syed, BSCS Science Learning, USA

Developing Measures of Scientific Self-Perceptions and Interest in Elementary Students Historically Underrepresented in STEM
Kristin Gagnier*, AnLar, USA
Steven Holochwost, Lehman College, the City University of New York, USA
Melissa Ceren, The Graduate Center, the City University of New York, USA
Kelly Fisher, AnLar, USA

An Analysis of Socially Relevant, Justice-Oriented Approaches in Highly-Rated NGSS-Designed Science Curriculum Materials
Monica Sircar*, Stanford University, USA

Pre-Service Teachers’ Misconceptions of Culturally Relevant Pedagogy Assessed Via Q-Methodology
Eboney Maxey*, University of Georgia, USA
Mary Atwater, University of Georgia, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
Reflecting on Tensions in Centering Community Knowledge and Desettling Onto-Epistemic Hierarchies
18-Mar-24, 8:15 AM-9:45 AM
Location: Governor’s Square 11

Building on Curiosity to Support Youth Science Identity Development Through Caregiver-Child Conversations
Nicole Villa*, Florida International University, USA

Remy Dou, Florida International University, USA
Heidi Cian, MMSA, USA
Amy Padolf, Fairchild Tropical Botanic Garden, USA
Kavita Mitapalli, MN Associates, Inc., USA

Transition Into Upper Secondary Science and Mathematics as a Young Muslim Woman With Immigrant Background
Emilie Gertz*, Department of Science Education, Denmark

Fostering STEM Interest and Identity in the “STEM in our Lives” Project
Cory Buxton*, Oregon State University, USA
Diana Crespo Camacho, Oregon State University, USA
Barbara Ettenauer, Oregon State University, USA
Karla Hale, Western Oregon University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
‘Whose Knowledge Counts?’: Reflections on Participatory Design Principles to Enable Transformative Learning in Science Education.
Deborah Dutta*, Institute of Rural Management Anand, India
Geetanjali Date, Maharashtra State Faculty Development Academy, India
Sugat Dabholkar*, Rutgers University, USA
Kilo: A Model of Community Centered Integrated Science and Data Science Learning.

**Colby Tofel-Grehl**, Utah State University, USA

**Tyler Hansen**, Utah State University, USA

Exploring the Potential of Indigenous Science Knowledge for a Culturally Enriched Elementary Climate Education Curriculum

**Mohd Syafiq Aiman Mat Noor**, University of Leeds, United Kingdom

**Roslinawati Roslan**, Universiti Brunei Darussalam, Brunei Darussalam

**Hardimah Said**, Universiti Brunei Darussalam, Brunei Darussalam

**Marlizayati Johari**, Universiti Brunei Darussalam, Brunei Darussalam

Navigating Intersections of Westernized STEM Education and Indigenous Perspectives in Oceania

**Tobias Irish**, University of Hawaii at Hilo, USA

**Joseph Genz**, University of Hawaii at Hilo, USA

**Monique Storie**, University of Guam, USA

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**Strand 11: Cultural, Social, and Gender Issues Symposium**

The Arts’ Roles in Centering Equity, Justice, and Liberation Vis-À-Vis Science Knowledge and Identity Construction

18-Mar-24, 8:15 AM-9:45 AM
Location: Governor's Square 16

The Arts’ Roles in Centering Equity, Justice, and Liberation Vis-À-Vis Science Knowledge and Identity Construction

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**Strand 13: History, Philosophy, Sociology, and Nature of Science SC-Organized Paper Set**

Post-Secondary Nature of Science

18-Mar-24, 8:15 AM-9:45 AM
Location: Directors Row J

Explicit Incorporation of the Nature of Science in an Undergraduate Science Content Course: Action Research

**Esther Kataate Namakula**, Indiana University, USA

**Valarie Akerson**, Indiana University, USA

Understanding the Nature of Engineering: Insights from Faculty and Practicing Engineers via open-ended VNOE-B Questionnaire

**Erdogan Kaya**, George Mason University, USA

**Ezgi Yesilyurt**, Weber State University, USA

**Hasan Deniz**, University of Nevada, Las Vegas, USA
Strand 14: Environmental Education and Sustainability
Related Paper Set

Considerations for Doing Climate Change Education Work Across Different Contexts, Spaces, and Settings
18-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 7

Developing School-Wide Climate Justice Curriculum in a Progressive Context: Affordances of a Social-Ecological Lens
Kathryn Hayes*, CSU East Bay, USA
Emily Harris, BSCS, USA
Eric Nolan, CSU East Bay, USA
Peter Hiester, Cesar Chavez Middle School, USA
Karina Garbesi, CSU East Bay, USA

Professional Learning in, for, and with Ethics of Care to Foster Just Climate Change Teaching
Deb Morrison*, University of Washington, USA
Amal Ibourk*, Florida State University, USA

Co-Transformation of Schoolyard Landscapes and Curriculum: A Pilot Study of Emergent Climate Change Teaching Practices
Kathryn Lanouette*, William & Mary, USA
Meredeth Dash, Alliance for the Chesapeake Bay, USA

Using Co-Design to Infrastructure Climate Justice Education Across a State-level Teacher Education Network
Phil Bell*, University of Washington, USA
Kelsie Fowler*, University of Washington, USA
Deb Morrison*, University of Washington, USA

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Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set

Socioscientific Issues in Secondary Science Curriculum
18-Mar-24, 8:15 AM-9:45 AM
Location: Directors Row I

Designing and Evaluating a Teaching Module on Socio-scientific Topics within the 10th-grade Ecology Unit
Mustafa CAKIR*, Marmara University, Turkey
Funda Karaer, Ministry of National Education, Turkey

Teaching Argumentation with Energy-related Socio-scientific Issues: The World Café Approach
Shiang-Yao Liu*, National Taiwan Normal University, Taiwan
Meng-Chin Lee, National Taiwan Normal University, Taiwan

Perspectives for Science Curriculum-Making in the Anthropocene
Xavier Fazio*, Brock University, Canada
Todd Campbell*, University of Connecticut, USA

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Nancy Price*, University of Washington, USA
Continental and Diasporic Africa in Science Education (CADASE) Sponsored Session
Unifying Our Community: Implementing Science Education for the Best of Us
18-Mar-24, 10:00 AM-11:30 AM
Location: Governor's Square 10

Unifying Our Community: Implementing Science Education for the Best of Us

ORGANIZERS
Rona Robinson-Hill, Ball State University, USA
Jonathan Hall, California State University, San Bernardino, USA

PANELISTS
Rona Robinson-Hill, Ball State University, USA
Shari Watkins, American University, USA
Olayinka Mohorn-Mintah, University of Memphis, USA

Equity And Ethics Committee Sponsored Session
Connecting Science to Every Student’s Lived Experiences: Promoting Equitable Science Learning through Diverse Contexts and Perspectives
18-Mar-24, 10:00 AM-11:30 AM
Location: Governor’s Square 11

Connecting Science to Every Student’s Lived Experiences: Promoting Equitable Science Learning through Diverse Contexts and Perspectives

ORGANIZERS
Regina McCurdy, Georgia Southern University, USA

Dominick Fantacone, State University of New York - Cortland, USA
Alexandria Muller, University of California - Santa Barbara, USA
Marsha Simon, University of West Georgia, USA

PANELISTS
Jessica Norberto, Fundação Cecierj, Brazil
Noah Feinstein, University of Wisconsin - Madison, USA
Terrance Burgess, Michigan State University, USA
Scott Cohen, Georgia State University, USA

Strand 1: Science Learning: Development of student understanding Related Paper Set
Evolution Education for the Rest of Us: Obstacles and Educational Approaches for Teaching and Learning
18-Mar-24, 10:00 AM-11:30 AM
Location: Governor’s Square 17

Preparing the Ground: Introducing Variation and Inheritance in Plants to Kindergarten Children With a Storybook
Isabell Adler*, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Daniela Fiedler, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Ute Harms, IPN - Leibniz Institute for Science and Mathematics Education, Germany

Evolution in Their Everyday Lives: Qualitative Results of a College Biology Expectancy Value Theory Intervention
Lisa Borgerding*, Kent State University, USA
Mark Kershner, Kent State University, USA
Barbara Currey, Kent State University, USA
Adepeju Prince, Kent State University, USA
Kristina Nieves, Kent State University, USA

A Quasi-Experimental Study of the Differential Impacts of Explanation Construction vs. Critique on Evolution Learning

Evan Abreu*, Stony Brook University, USA
Gena Sbeglia, San Diego State University, USA
Ross Nehm, Stony Brook University, USA

Boosting Diagnostic Competence in Evolution Using Chatbots in Classroom Simulations: Insights Into an Explorative Study

Daniela Fiedler*, IPN Kiel, Germany
Daniel Schönle, Furtwangen University, Germany
Christoph Reich, Furtwangen University, Germany
Ute Harms, IPN Kiel, Germany

Strand 2: Science Learning: Contexts, Characteristics and Interactions Related Paper Set

Challenges and Tensions in Reframing Science Education in Professional Learning Settings
18-Mar-24, 10:00 AM-11:30 AM
Location: Directors Row E

Reframing “Users” in the Creation of NGSS-aligned Curriculum Materials
McKenna Lane*, University of Illinois Urbana Champaign, USA

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies SC-Organized Paper Set

Technology and Computer Science in Elementary Classrooms
18-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 1
Teachers’ Use of ChatGPT to Analyze and Interpret Students’ Assessment Responses: A Pilot Study
Hui Jin*, Georgia Southern University, USA
David Owens*, University of Montana, USA
Brian Riordan, Cisco, USA

Elementary Teachers’ Use of Computational Thinking To Expand Students’ Reflection and Epistemic Engagement in Science
Christina Schwarz*, Michigan State University, USA
Wanjo Ahn, Michigan State University, USA
Aman Yadav, Michigan State University, USA
Zac Opps, Michigan State University, USA

Investigating Impact of Identities on Perspectives of Failure of Students in Course-Based Undergraduate Research Experiences
Sandhya Krishnan*, University of Colorado - Boulder, USA
Lisa Corwin, University of Colorado - Boulder, USA

Strand 6: Science Learning in Informal Contexts
Symposium
Participatory Research in Informal Science Education
18-Mar-24, 10:00 AM-11:30 AM
Location: Governor’s Square 14

Participatory Research in Informal Science Education
Neta Shaby*, University of Southampton, United Kingdom
Ran Peleg*, University of Southampton, United Kingdom
Molly Shea*, University of Washington, USA
Meghna Nag Chowdhuri*, University College London, United Kingdom
Louise Archer*, University College London, United Kingdom
Edna Tan*, University of North Carolina at Greensboro, USA
Ti’Era Worsley, University of North Carolina at Greensboro, USA
Virginia Swindell, University of North Carolina at Greensboro, USA
Wisam Sedawi, University of Michigan, USA
Angela Calabrese Barton, University of Michigan, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Student Perspectives of Laboratory Experiences
18-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 6

Undergraduate Students’ Views of Experimental Physics in Remote and In-Person Laboratories
Luciana Lombardo*, Stony Brook University, USA
Angela Kelly, Stony Brook University, USA

Exploring the Competency in Scientific Argumentation of Undergraduate Students in an Asynchronous Online Physics Laboratory
Yuri Piedrahita Uruena*, Purdue University, USA
Carina Rebello*, Toronto Metropolitan University, Canada
N Rebello*, Purdue University, USA
Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Approaches to Exploring Preservice Learning and Teaching
18-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 2

Pre-Service Middle School Teachers Lead Discussions in a Simulated classroom: Toward Epistemologically Responsive Science Teaching
Daniel Levin*, University of Maryland, USA
Ethan Carpenter*, University of Maryland, USA
Katerina Gorlenko*, University of Maryland, USA
Tomoka Ogawa*, University of Maryland, USA
J Mesiner*, University of Maryland, USA

Preparing Preservice Science Teachers to Enact Responsive Teaching Using a Video-and Practice-Based Teaching Intervention
Kennedy Chan*, The University of Hong Kong, Hong Kong

Preservice Secondary Teachers’ Beliefs about Reformed and Student Centered Teaching: A Comparison of Two Cases
Adam Bennion*, Brigham Young University, USA
Ryan Nixon*, Brigham Young University, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Research in Approaches to Teacher Preparation
18-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 3

Exploration of Secondary Science Teacher Candidates’ Ideological Shifts in an Initial Teacher Preparation Program
Claudia Hagan*, Georgia State University, USA

Colorado Science Education Research
Impacting Preservice Teachers’ Classroom Practice Through the Development of Coherent Science Teacher Education Experiences
Kevin Cherbow*, BSCS Science Learning, USA
Abraham Lo*, BSCS Science Learning, USA
Cari Herrmann Abell, BSCS Science Learning, USA
Karen Askinas, BSCS Science Learning, USA
Betty Stennett, BSCS Science Learning, USA

Shifting Teacher Preparation for Three-Dimensional Science: Using a Networked Improvement Community to Support Faculty Learning
Corinne Lardy*, California State University Sacramento, USA
Michelle Sinapuelas*, San Francisco State University, USA
Michele Korb, California State University East Bay, USA
The Role of Connection-Making and Deeper Learning in Preservice Secondary Science Teachers’ Classrooms and Preparation
Matthew Bennett*, UC Santa Barbara, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
Investigations of Teachers’ Professional Vision
18-Mar-24, 10:00 AM-11:30 AM
Location: Governor’s Square 12

Investigating the Relationship Between Science Teachers’ Professional Vision of NGSS Practice and Their Implementation
Yuxi Huang*, University of Georgia, USA
Joseph Deluca, University of Georgia, USA
Hong Tran, University of Georgia, USA
José Pavez, Western Illinois University, USA
Julie Luft, University of Georgia, USA
Brooke Whitworth, Clemson University, USA

Teacher Appreciation of Analysis as an Instructional Use of Big Ideas
Daniel Capps*, University of Georgia, USA
Jonathan Shemwell, University of Alabama, USA

The Complex Learning of Science Teachers Within Their Districts: Teachers’ Perspectives
Julie Luft*, University of Georgia, USA
Elia Yonai, University of Georgia, USA
Joe DeLuca, University of Georgia, USA
Hatice Ozen, University of Georgia, USA
Elizabeth Ayano, University of Georgia, USA
Yuxi Huang, University of Georgia, USA
Jennifer Bateman, Clemson University, USA

Brooke Whitworth, Clemson University, USA

Connections between Instructional Vision and Rigor Related to Teachers’ Support of Students’ Productive Science Talk
Patrick Enderle*, Georgia State University, USA
Ruveyde Kaya, Florida State University, USA
Norris Boyd, Florida State University, USA
Sierra Morandi, Florida State University, USA
Elif Ozulku, Florida State University, USA
Danielle Rhemer, Florida State University, USA
Ozlem Akcil Okan, Florida State University, USA
Sherry Southerland, Florida State University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
New Teachers’ Resilience and Retention
18-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 7

Douglas Larkin*, Montclair State University, USA
Suzanne Patzelt, Touro University, USA
Mayra Muñoz, Montclair State University, USA
Khadija Ahmed, Montclair State University, USA
Liz Carletta, Montclair State University, USA
Manar Hussein, Montclair State University, USA
Exploring the New Science Teacher Practices that Reflect a Growth Mindset.  
Elizabeth Ayano*, University of Georgia, USA  
Adepeju Prince, Kent State University, USA  
Julie Luft, University of Georgia, USA  
Shannon Navy, Kent State University, USA  
Ella Yonai, University of Georgia, USA

Contextual Factors and Homegrown Early Career Science Teachers  
Adepeju Prince*, Kent State University, USA  
Shannon Navy*, Kent State University, USA  
Kelly Kulp, University of Georgia, USA

From Challenge to Coping: Exploring Resilience Trends and Strategies Among Newly Hired Science Teachers  
Jose Pavez*, Western Illinois University, USA  
Ella Yonai, University of Georgia, USA  
Shannon Navy, Kent State University, USA  
Julie Luft, University of Georgia, USA  
Adepeju Prince, Kent State University, USA  
Lisa Borgerding, Kent State University, USA  
Bo Idsardi, Eastern Washington University, USA

Strand 10: Curriculum and Assessment  
Related Paper Set  
A Partnership to Advance Earth Science Across Biology, Chemistry, and Physics in a Large District  
18-Mar-24, 10:00 AM-11:30 AM  
Location: Plaza Court 5

Centering the Local to Advance a District’s Earth Science Teaching Goals Through Research-Practice Partnership  
Alan Berkowitz*, Cary Institute of Ecosystem Studies, USA  
Lauren Browning, George Washington University, USA  
Beth Covitt, University of Montana, USA  
Karen Draney, University of California Berkeley, USA  
Kevin Garner, Baltimore City Public Schools, USA  
Jonathon Grooms, George Washington University, USA  
Angela Hood, Cary Institute of Ecosystem Studies, USA  
Smriti Mehta, University of California Berkeley, USA  
Edmund Mitzel, Jr., Baltimore City Public Schools, USA  
Carolyn Parker, American University, USA

What Next for Science Standards? NGSS 2.0?  
Jonathan Osborne*, Stanford University, USA  
Andy Zucker*, Independent Scholar, USA  
Daniel Pimentel*, University of Alabama, USA  
Peta White*, Deakin University, Australia  
Douglas Allchin*, University of Minnesota, USA  
Penny Noyce*, Independent Scholar & Publisher, USA
Understanding Teachers’ Perspectives to Help Shape Responsive Partnership and Collaborative Work on Problems of Practice

Lauren Browning*, George Washington University, USA
Beth Covitt, University of Montana, USA
Jonathon Grooms*, George Washington University, USA
Angela Hood, Cary Institute of Ecosystem Studies, USA
Alan Berkowitz, Cary Institute of Ecosystem Studies, USA

Centering Science Assessment Resources and Practices to Mediate Discourse in Collaborative Professional Learning

Jonathon Grooms*, George Washington University, USA
Lauren Browning*, George Washington University, USA
Beth Covitt, University of Montana, USA
Angela Hood, Cary Institute of Ecosystem Studies, USA
Edmund Mitzel, Jr., Baltimore City Public Schools, USA
Alan Berkowitz, Cary Institute of Ecosystem Studies, USA

Co-creating an Assessment System to Meet Teacher and Student Requirements in a Large, Urban District

Beth Covitt*, University of Montana, USA
Jessica Bean, University of California, USA
Lauren Browning, George Washington University, USA
Karen Draney, University of California, USA
David Fischer, Cary Institute of Ecosystem Studies, USA
Kevin Garner, Baltimore City Public Schools, USA
Jonathon Grooms, George Washington University, USA
Smriti Mehta, University of California, USA
Edmund Mitzel, Baltimore City Public Schools, USA

Alan Berkowitz, Cary Institute of Ecosystem Studies, USA

Strand 11: Cultural, Social, and Gender Issues
Related Paper Set
Centering Multilingual Students’ Language Resources and Dynamic Sensemaking Practices in Science Education Research
18-Mar-24, 10:00 AM-11:30 AM
Location: Governor’s Square 16

How Does Translanguaging/Trans-semiotising Support Students Grappling with Uncertainty When Planning Scientific Investigations?
Souhaila Nassar*, Boston University, USA
Eve Manz, Boston University, USA

Developing a Multimodal Assessment System for Science Sensemaking in Elementary Classrooms
Genelle Diaz-Silveira*, Boston University, USA
Eve Manz, Boston University, USA

Enactment of Translanguaging Formative Assessment Designs and Consequences for Multilingual Learners’ Science Sensemaking
Caitlin Fine*, Metropolitan State University of Denver, USA
Melissa Braaten, University of Colorado Boulder, USA

Conceptualizing and Measuring Pedagogical Content Knowledge of Language for Scientific Sensemaking
María González-Howard*, The University of Texas at Austin, USA
Sage Andersen, The University of Texas at Austin, USA
Karina Méndez Pérez, The University of Texas at Austin, USA
Carla Robinson, The University of Texas at Austin, USA

Using Historical Storytelling to Amplify the Voice of Multilingual Learners In High School Science Classrooms
Hosun Kang*, University of California Irvine, USA
Paola Rosenberg, Anaheim Union High School District, USA
Erik Cobian-Mejia, Anaheim Union High School District, USA
Stephen Skoropad*, University of California Irvine, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
Recontextualizing Science Education: Reckoning with Wicked Problems and Structural Injustices
18-Mar-24, 10:00 AM-11:30 AM
Location: Governor's Square 15

Navigating Wicked Problems through intersecting science education and culture: Insights from Ukraine, Estonia, Turkey, Bangladesh
Tapashi Binte Mahmud Chowdhury*, University of Tartu, Estonia
Miia Rannikmäe*, University of Tartu, Estonia
Jack Holbrook*, University of Tartu, Estonia
Maryna Zaluzhna*, Zaporizhzhia National University, Ukraine
Bulent Cavas*, Dokuz Eylül University, Turkey

Racial and Socioeconomic School District Segregation and Secondary Science Outcomes
Christopher Cioffi*, Stony Brook University, USA
Angela Kelly*, Stony Brook University, USA

The School-to-Prison Pipeline: Teacher's Perspectives
Maizie Dyess*, University of Nevada, Las Vegas, USA

Modelling Equity in Science Education: German Street Schools' Approach to Rightful Presence
Matthias Fischer*, Heidelberg University of Education, Germany
Angela Calabrese Barton, University of Michigan, USA

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set
Technology for Science Learning 1
18-Mar-24, 10:00 AM-11:30 AM
Location: Directors Row H

Analyzing the Performance of Chemistry Students and ChatGPT on Acid-Base Calculations
Ted Clark*, The Ohio State University, USA

Mapping New Possibilities in Elementary Science: Expansive Data, Participatory Digital Map Making, and Science Argumentation
Kathryn Lanouette*, William & Mary, USA
Sarah Van Wart, University of North Carolina, Asheville, USA
Tapan Parikh, Cornell Tech, USA
Connecting Representational Levels by Using Augmented Reality (AR) During Chemical Hands-on Experiments – a Mixed-Methods Study

Hendrik Peeters*, Paderborn University, Germany
Sebastian Habig, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
Sabine Fechner, Paderborn University, Germany

Strand 13: History, Philosophy, Sociology, and Nature of Science Symposium

The Nature of Engineering: Exploring Key Questions to Move Research Forward
18-Mar-24, 10:00 AM-11:30 AM
Location: Directors Row J

The Nature of Engineering: Exploring Key Questions to Move Research Forward
Jacob Pleasants*, University of Oklahoma, USA
Allison Antink-Meyer*, Illinois State University, USA
Sevgi Aydin-Gunbatar*, Yuzuncu Yil University, Turkey
Gillian Roehrig*, University of Minnesota, USA
Miriam Barak*, Technion, Israel
Sibel Erduran*, Oxford University, United Kingdom
Hasan Deniz, University of Nevada, Las Vegas, USA
Erogan Kaya*, George Mason University, USA
Ezgi Yesilyurt, Weber State University, USA

Strand 14: Environmental Education and Sustainability

SC-Organized Paper Set

Education for Sustainable Development
18-Mar-24, 10:00 AM-11:30 AM
Location: Directors Row I

Evaluating Student Engagement in Climate Change Education: A Novel Approach to Measuring Environmental Science Agency
Jeffrey Snowden*, BSCS Science Learning, USA
Brian Donovan, BSCS Science Learning, USA
Lindsey Mohan, BSCS Science Learning, USA
Emily Harris, BSCS Science Learning, USA

Fostering Learners’ Action Competence to Deal With the Global Environmental Issue of Insect Decline
Peter Lampert, Karlstad University, Sweden
Daniel Olsson*, Karlstad University, Sweden
Niklas Gericke, Karlstad University, Sweden

Hope and Ecological Identity: Exploring Pathways from Inner to Sustainable Development
Jhu-Chun Yang*, National Sun Yat-sen University, Taiwan
Paichi Pat Shein*, National Sun Yat-sen University, Taiwan

Participatory Photography with Urban Middle School Students: Their Connectedness to and Perceptions of Nature
Andrea Moeller*, University of Vienna, Austria
Social Event
Awards Luncheon
18-Mar-24, 11:15 AM-1:15 PM
Location: Plaza Ballroom ABC/DEF

Keynote Address
Building A Technology Future for the Rest of Us
18-Mar-24, 1:15 PM-2:00 PM
Location: Plaza Ballroom ABC/DEF

Building A Technology Future for the Rest of Us
Charlton McIlwain

Contemporary Methods RIG
Sponsored Session
Epistemic Network Analysis (ENA): A Tool for Providing Nuanced Perspectives in STEM Education Research
18-Mar-24, 2:00 PM-3:30 PM
Location: Governor’s Square 11

Epistemic Network Analysis (ENA): A Tool for Providing Nuanced Perspectives in STEM Education Research

ORGANIZERS
Glenn Dolphin, University of Calgary, Canada
Robert Talbot, University of Colorado Denver, USA
Joseph Taylor, University of Colorado, Colorado Springs, USA
Stanley Lo, UC San Diego, USA

Francesca Williamson, University of Michigan, USA
Brock Couch, University of New Hampshire, USA

PANELISTS
M. Shane Tutwiler, University of Rhode Island, USA
Reagan Siggard, Utah State University, USA
Denise Bressler, DB Engagements, Inc., USA
Amanda Peel, New Mexico State University, USA
Shifath Bin Syed, Texas Tech University, USA
Mark H. Newton, East Carolina University, USA

Latino/a RIG (LARIG)
Sponsored Session
Latinx Science Education Scholarship in Formal and Informal Contexts
18-Mar-24, 2:00 PM-3:30 PM
Location: Plaza Court 2

Latinx Science Education Scholarship in Formal and Informal Contexts

ORGANIZERS
Angela Chapman, UTRGV, Edinburg, TX, USA
Alejandro Gallard, Georgia Southern University, USA

PANELISTS
Miriam Ortiz, UTRGV, Brownsville, TX, USA
Uma Ganesan, UTRGV, Brownsville, TX, USA
Joe DeLeon, UTRGV, Edinburg, TX, USA
Liliana Garcia, UCSB, Santa Barbara, CA, USA
Angela Chapman, UTRGV, Edinburg, TX, USA
Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Attitudes, Motivation, and Engagement
18-Mar-24, 2:00 PM-3:30 PM
Location: Directors Row H

Perceived Competence and Choice as Predictors of Students’ Intrinsic Motivation
Moonika Teppo*, University of Tartu, Estonia
Regina Soobard, University of Tartu, Estonia
Mia Rannikmäe, University of Tartu, Estonia
Prit Reiska, Tallinn University, Estonia

Measuring Interest During a Student Lab Visit: A Question of Situation or Disposition?
Xenia Schäfer*, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
Sebastian Habig, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

Learning From Highly Relevant Topics: Students Interest and Engagement
Natasha Segal*, Weizmann, Israel
David Fortus, Weizmann, Israel

Engineering Integration in Elementary Classrooms
Christa Haverly*, Northwestern University, USA
Alexandre Brunet, Northwestern University, USA
Elizabeth Davis*, University of Michigan, USA

Culturally Sustaining and Responsive Education in Elementary Science Teacher Education: Developing Preservice Teachers’ Critical Consciousness
Tia Madkins*, The University of Texas at Austin, USA
Sonuur Ozturk, The University of Texas at Austin, USA
Allison Skerrett, The University of Texas at Austin, USA

Supporting Preservice Teachers Shift Their Focus Beyond the Content by Pursuing Equity Through Participatory Science
Terrance Burgess*, Michigan State University, USA

Civic Science Education in Pursuit of Scientific Literacy: A Sustainable Path for Elementary Science Education
Maggie DeMarse*, Michigan State University, USA
E. Woo*, Michigan State University, USA

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
Related Paper Set
“The truth is, there’s just no time”: Embracing Interdisciplinary Approaches to Elementary Science
18-Mar-24, 2:00 PM-3:30 PM
Location: Plaza Court 4

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set
Life Science Teaching and Learning
18-Mar-24, 2:00 PM-3:30 PM
Location: Governor’s Square 17
Conjectural Anticipation and the Animating Power of Big Ideas for Agency in Science Learning
Jonathan Shemwell*, University of Alabama, USA
Daniel Capps, University of Georgia, USA

Testing a Design-Oriented Cross-Domain Teaching Process as a Learning Opportunity for Acquiring Biological Knowledge
Markus Reiser*, University of Education Weingarten, Germany
Martin Binder, University of Education Weingarten, Germany
Holger Weitzel, University of Education Weingarten, Germany

Can the Culturo-Techno-Contextual Approach (CTCA) Dissolve Barriers to Learning Variation and Evolution?
Rose Agholor*, Science Education Consultant, USA
Peter Okebukola, Lagos State University, Nigeria
Franklin Onowugbeda, Lagos State University, Nigeria
Adekunle Oladejo, Lagos State University, Nigeria
Juma Shabani, University of Burundi Doctoral School, Burundi

Rahmi Aini*, Middle Tennessee State University, USA
Baylee Edwards, Arizona State University, USA
Sara Brownell, Arizona State University, USA
M. Elizabeth Barnes, Middle Tennessee State University, USA

Are Experiences and Trajectories of Black Students Impacted by the Relationship Between Religion and Science?
Elizabeth Barnes*, Middle Tennessee State University, USA
Angela Google*, University of Rhode Island, USA
Julie Park, University of Maryland, USA
Keon McGuire, Arizona State University, USA
Robert Palmer, Howard University, USA

Am I Represented? Validation of an Instrument to Assess Undergraduate Representation in STEM Courses
Hai Nguyen*, University of Missouri-Columbia, USA
Marcelle Siegel, University of Missouri-Columbia, USA
Megan Hirni, University of Missouri-Columbia, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Understanding Impacts of Identity and Experiences
18-Mar-24, 2:00 PM-3:30 PM
Location: Plaza Court 5

Does Religious Identity Impact the Efficacy of Evolution Instruction With Cultural Competence?

Exploring Emotions in Informal Science Learning
Luisa Massarani*, Brazilian Institute of Public Communication of Science and
Strand 7: Pre-service Science Teacher Education

SC-Organized Paper Set

Exploring Knowledge and Nature of Science in Preservice Teacher Education
18-Mar-24, 2:00 PM-3:30 PM
Location: Plaza Court 1

Preservice Teachers’ Views on Astronomy Through the Lens of Science Storybooks
Julia Plummer*, The Pennsylvania State University, USA
Andrea Ragonese*, The Pennsylvania State University, USA

Pre-service Teachers and Socioscientific Issues: Their Views and Creation of Issues-Based Science Lessons
Savannah Graham*, University of Houston, USA
Hayat Hokayem, Texas Christian University, USA

Elements and Rationale in Nature of Science for Preservice Teacher Training: Towards Enhanced Instruction
Olalekan Badmus*, University of the Free State, South Africa
Loyiso Jita*, University of the Free State, South Africa
Supporting Scientific Sensemaking Through NGSS and Disciplinary Language: Case Studies of Preservice Secondary Science Teachers

John Galisky*, UC Santa Barbara, USA
Valerie Meier, UC Santa Barbara, USA
Matthew Bennett, UC Santa Barbara, USA
Julie Bianchini, UC Santa Barbara, USA

Strand 8: In-service Science Teacher Education Related Paper Set

Science Teacher Learning with Organizational Contexts
18-Mar-24, 2:00 PM-3:30 PM
Location: Governor’s Square 10

(Re)Negotiations and the Relational Politics of Space within a Research-Practice Partnerships

Katherine Ayers*, St. Jude Children’s Research Hospital, USA
Robyn Pennella, St. Jude Children’s Research Hospital, USA

Widening Our Lens: Developing Insights From Elementary Science Professional Learning Using an Institutional Frame

Michelle Brown*, The Pennsylvania State University, USA
Carla Zembal-Saul*, The Pennsylvania State University, USA

Viewing Science Teacher Learning and Curriculum Enactment Through the Lens of Theory of Practice Architectures

Xavier Fazio*, Brock University, Canada
Stephen Kemmis, Charles Sturt University - Wagga Wagga Campus, Australia
Jessica Zugic, Brock University, Canada

Making Sense of Reform Incoherence in a No-Excuses Charter Network

William Lindsay*, University of Colorado Boulder, USA
Valerie Otero, University of Colorado Boulder, USA

From Co-design to Co-Adaptation: The Evolution of Professional Learning Across a Long-Term Research Practice Partnership

Quentin Biddy*, University of Colorado Boulder, USA
Jessie Nixon, Weber State University, USA
Srinjita Bhaduri, University of Colorado Boulder, USA
Jennifer Jacobs, University of Colorado Boulder, USA
Mimi Recker, Utah State University, USA
Jeffrey Bush, University of Colorado Boulder, USA

Organizational Sensemaking During Curriculum Implementation: The Dilemma of Agency, Role of Collaboration, and Discipline-Specific Leadership

Benjamin Lowell*, New York University, USA
Sarah Fogelman, Boston College, USA
Katherine McNeill, Boston College, USA

Co-evolution of Teachers’ Collective Inquiry and Classroom Practice with Contextual Supports After the Grant Ended

Soo-Yean Shim*, Seoul National University, Republic of Korea
Jessica Thompson, University of Washington, USA
Course-Based Teacher Professional Communities (with District and Union Support) at the Center of Three-Dimensional-Science Teaching

Christie Morrison Thomas*, Michigan State University, USA

“It’s Just a Hot Mess”: Engaging Teachers’ Critical Consciousness in Science Professional Learning

Emily Adah Miller*, University of Georgia, USA
Emily Reigh*, University of California, Santa Cruz, USA
Ayca Fackler*, University of Missouri, USA
Maria Simani*, University of California, Riverside, USA

Examining the Affordances of Practical Measures of Science Teacher Learning

Eleanor Anderson, University of Pittsburgh, USA
Jennifer Richards*, Northwestern University, USA

Curriculum Design and Improvement: Integrating AI Concepts and Societal Problems in a Secondary Science Module

Yue Bai*, University of Connecticut, USA
Todd Campbell*, University of Connecticut, USA
Sybille Legitime, University of Connecticut, USA
Derek Aguiar, University of Connecticut, USA
Megan Staples, University of Connecticut, USA
Jacqueline Corricelli, West Hartford Public Schools, USA

Structuring Educative Curriculum Materials in an Issues-Based Unit

Rebecca Lesnfsky*, University of North Carolina, USA
Troy Sadler, University of North Carolina, USA
Zhen Xu, University of North Carolina, USA
David Fortus, Weizmann Institute of Science, Israel

Strand 10: Curriculum and Assessment
SC-Organized Paper Set
Addressing SocioScientific Issues across Curriculum and Assessments
18-Mar-24, 2:00 PM-3:30 PM
Location: Plaza Court 7

Developing a Measure to Assess Students’ Understanding and Reasoning about Issues of Socioscientific Relevance

Eric Schoute*, University of Maryland, USA
Janelle Bailey*, Temple University, USA
Gale Sinatra, University of Southern California, USA
Carla McAuliffe, Institute for Global Environmental Strategies, USA

Developing a Three-Dimensional Learning Progression for Properties and Structure of Matter at Middle School Level

Mingchun Huang*, Michigan State University, USA
Peng He, Michigan State University, USA
Mao-Ren Zeng, Michigan State University, USA
Namsoo Shin, Michigan State University, USA
Jonathan Bowers, Michigan State University, USA
Joseph Krajcik, Michigan State University, USA

Collect, Analyze Interpret, Oh My! 7th grade students’ Intended Engagements in the OpenSciEd Curriculum
Amanda Garner*, University of Tennessee, USA
Hanhui Bao*, University of Tennessee, USA
Joshua Rosenberg, University of Tennessee, USA

Fostering Quantum Understanding: Crafting, Applying, and Assessing A Science Curriculum for Middle School
Zeynep Akademir*, Purdue University, USA
Nicholas Dang, Purdue University, USA
Muhsin Menekse, Purdue University, USA

Middle School Space Science Education: An Investigation of Self-Efficacy, Content Knowledge, and STEM Career Interests
Kristina Otero*, University of Central Florida, USA
Glenda Gunter, University of Central Florida, USA
Debbie Hahs-Vaughn, University of Central Florida, USA

2024 NARST Annual International Conference, Denver

The Impact of Racialized Ideologies on Latino/a/x/e Engineering Students at Emerging HSIs
Joel Mejia*, The University of Texas at San Antonio, USA

Justice-oriented Engineering Design: Latinx/e/a/o Students Finding Inspiration in their Community Resources
Greses Pérez*, Tufts University, USA
Ymbar Polanco Pino, Tufts University, USA
Clara Mabour, Tufts University, USA
G.R. Marvez, Tufts University, USA

Building Meaningful Education with Engineering to Foster Care and Relationality
Brian Gravel*, Tufts University, USA
Eli Tucker-Raymond*, Boston University, USA
Cara Hovhenessian*, Malden Public Schools, USA
Chris Fitzpatrick*, Malden Public Schools, USA
Amon Millner, Olin College of Engineering, USA
Maria Olivares, Boston University, USA

“Not in this Class:” Examining Space, Power, & Identity in the Context of HS Engineering
Christopher Wright*, Drexel University, USA
George Schafer, Drexel University, USA
Monet Harbison, Drexel University, USA
Sinead Meehan, Drexel University, USA
Tajma Cameron, Drexel University, USA

Strand 11: Cultural, Social, and Gender Issues
Related Paper Set
Considering Black and Latinx/é Experiences in Engineering and Science Learning Environments for Justice & Equity
18-Mar-24, 2:00 PM-3:30 PM
Location: Governor’s Square 14
**Strand 11: Cultural, Social, and Gender Issues**

**SC-Organized Paper Set**

**Language in Science Education: Examining Translanguaging and Unsettling Raciolinguistic Hierarchies**

**18-Mar-24, 2:00 PM-3:30 PM**

**Location: Governor's Square 12**

*Equity for Whom? Examining Multilingual Learners' Language Practices Across Asset-Oriented Science and Engineering Education Research*

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

*Interactions in a Multilingual Science Classroom in Lebanon*

**Christelle Fayad**, Texas Christian University, USA  
**Hayat Hokayem**, Texas Christian University, USA

*A Qualitative Look at Raciolinguistic Ideologies Among Preservice Science and Math Teachers*

**Maricela Leon**, Southern Methodist University, USA  
**Quentin Sedlacek**, Southern Methodist University, USA  
**Catherine Lemmi**, California State University Chico, USA  
**Kimberly Feldman**, University of Maryland Baltimore County, USA

*Raciolinguistic Hierarchies of U.S. Science Education: Why Hindsight Matters for Translanguaging Today*

**Kathryn Kirchgasler**, University of Wisconsin–Madison, USA

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**Strand 12: Technology for Teaching, Learning, and Research**

**SC-Organized Paper Set**

**Use Technology in Science Education Research**

**18-Mar-24, 2:00 PM-3:30 PM**

**Location: Governor's Square 15**

*Integrating Artificial Intelligence-Based Methods Into Qualitative Science Education Research – a Case for Computational Grounded Theory*

**Paul Tschisgale**, Leibniz Institute for Science and Mathematics Education, Germany  
**Peter Wulff**, Heidelberg University of Education, Germany  
**Marcus Kubsch**, Freie Universität Berlin, Germany

*An Examination of the Use of Large Language Models to Aid Analysis of Textual Data*

**Robert Tai**, University of Virginia, USA  
**Lillian Bentley**, University of Virginia, USA  
**Xin Xia**, University of Virginia, USA  
**Jason Sitt**, University of Virginia, USA  
**Sarah Fankhauser**, Oxford College of Emory University, USA  
**Ana Chicas-Mosier**, University of Kansas, USA  
**Barnas Monteith**, THInc AI Group, USA


**Britt Miller**, George Mason University, USA  
**Erin Peters-Burton**, George Mason University, USA
Use of Neurocognitive Data to Evaluate Text Summarization of Science Content

Richard Lamb*, East Carolina University, USA
Zachary Pugh, North Carolina State University, USA
Amal Hashky, University of Florida, USA
Surbhi Rathore, University of Rhode Island, USA
Wenyuan Wang, University of North Carolina Chapel Hill, USA
K Kosiur, Department of Defense, USA
Mamoun Margini, University of Florida, USA

Margaret Wang, SubjecttoClimate, USA
Julia Turner, SubjecttoClimate, USA

State Board of Education Expertise in the Development of High School Science Standards

Allison Esparza*, Texas A&M University, USA
Joanne Olson*, Texas A&M University, USA

Strand 15: Policy, Reform, and Program Evaluation
SC-Organized Paper Set
Exploring the Role and Views of Varied Stakeholders in Science Teaching and Learning
18-Mar-24, 2:00 PM-3:30 PM
Location: Directors Row I

Exchanging the Alignment of Elementary Science Specialist and Principal Beliefs about Teaching and Learning Science
Melissa Pearcy*, Washington State University, USA
Danielle Malone*, Washington State University, USA
Rachel Larson*, Washington State University, USA

'I'm Just a Parapro': The Role of Science Paraprofessionals when Elementary Science is Undervalued
Stefanie Marshall*, Michigan State University, USA

Understanding Parents' Perspectives on Climate Change Education
Lauren Madden*, The College of New Jersey, USA
Arti Joshi, The College of New Jersey, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Nature-based, Community-based, and Inquiry-based Practices
18-Mar-24, 3:45 PM-5:15 PM
Location: Directors Row H

"Science Doesn’t Have to Be Scary": The Accessibility of Doing Nature-Based Science
Steph Dean*, Clemson University, USA
Andrew Gilbert, George Mason University, USA
Jim Lane*, Mahtomedi High School, USA
Paul Bocko, Antioch University, USA
Does a Nature-Based Preschool Curriculum Address NGSS Science & Engineering Disciplines and Practices? a Case Study
Jennifer Gallo-Fox*, University of Delaware, USA
Ariadni Kouzeli, University of Delaware, USA

The Hidden Work: A Collaborative Self-Study Approach to Planning Projects for Community-Based Informal STEM Program
Ti’Era Worsley*, The University of North Carolina at Greensboro, USA
Matthew Fisher, The University of North Carolina at Greensboro, USA

Learning Coherence in Inquiry: Supporting Pre-Service Teachers with Inquiry-Based Investigations Tool
Ibrahim Delen*, Usak University, Turkey
Salih Uzun, Usak University, Turkey

9th Grade Students’ Knowledge and Self-Efficacy When Learning to Explain Energy Changes in Chemical Reactions.
Nabeh Alatawna*, Ben-Gurion University, Israel
Elon langbeheim*, Ben-Gurion University, Israel

Drawing Meaning from Student-Generated Drawings: Characterising Chemistry Teachers’ Noticing
Hanna Stammes*, Radboud University, Netherlands
Lesley de Putter, Eindhoven University of Technology, Netherlands

Teaching Particle Physics to Promote Critical Thinking
Farahnaz Sadidi*, Technische Universität Dresden, Germany
Gesche Pospiech, Technische Universität Dresden, Germany

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set
Physical Science Teaching and Learning
18-Mar-24, 3:45 PM-5:15 PM
Location: Governor’s Square 17

Student, Teacher, and School-Level Predictors of AP Chemistry Performance in U.S. High Schools
Martin Palermo, Stony Brook University, USA
Robert Krakehl, Stony Brook University, USA
Angela Kelly*, Stony Brook University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Exploring Sense, Trust and Belonging
18-Mar-24, 3:45 PM-5:15 PM
Location: Governor’s Square 10

Examining the Relationship Between Autonomy and Sense of Belonging Among Aspiring Healthcare Providers
Joey Marion*, North Carolina State University, USA
Soonhye Park, North Carolina State University, USA

Exploring Student Trust in Science by the Tentative Nature of Science, and Epistemological Beliefs
Asghar Gill*, Western Michigan University, USA
Exploring Undergraduate Students’ Momentary Anxiety in Introductory Biology Classes with Intensive Longitudinal Methods

Maryrose Weatherton*, University of Tennessee Knoxville, USA
Joshua Rosenberg, University of Tennessee Knoxville, USA
Elisabeth Schussler, University of Tennessee Knoxville, USA
Alex Lishinski, University of Tennessee Knoxville, USA

Socio-metacognition: Examining How High Stress Environment Reshapes Interactions

Carolina Alvarado, California State University, Chico, USA
Thanh Lê, Western Washington University, USA
Estefania Orozco-Franco*, California State University, Chico, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Mathematics in Science Classrooms
18-Mar-24, 3:45 PM-5:15 PM
Location: Plaza Court 7

Ships in the Night: Mathematics and Science Sensemaking in Four Chemistry Classrooms
Desi*, University of Minnesota - Twin Cities, USA
**Strand 6: Science Learning in Informal Contexts**

**SC-Organized Paper Set**

**Engaging Youth in Interest-based Science Learning Contexts**

18-Mar-24, 3:45 PM-5:15 PM  
Location: Governor's Square 16

*Cosplaying Scientists Use Theoretically-Based Science Communication Techniques at Comic Cons*

Lisa Lundgren*, Utah State University, USA  
Kadie Kunz*, Utah State University, USA  
Emily Slater*, Utah State University, USA  
Man Zhang, Utah State University, USA

*High School Science and Engineering Fairs: Science for Everyone*

Frederick Grinnell*, UT Southwestern Medical Center, USA  
Simon Dalley, Southern Methodist University, USA  
Joan Reisch, UT Southwestern Medical Center, USA

*Supporting Youth STEM Learning and Growth Mindsets Through Baseball-Themed Activities in Informal Education Settings*

Christina Baze*, Northern Arizona University, USA  
Sanlyn Buxner, University of Arizona, USA  
Seneca Miller, University of Arizona, USA  
Erin Turner, University of Arizona, USA  
Ricardo Valerdi, University of Arizona, USA

*Exploration of Play as a Vital Strategy to STEM Literacy*

Sue Tunnicliffe*, University College London, United Kingdom  
Adekunle Oladejo, Lagos State University, Ojo, Nigeria  
Peter Okebukola, Lagos State University, Ojo, Nigeria

**Ibiyinka Ogunlade**, Ekiti State University, Nigeria  
**Juma Shabani**, University of Burundi, Doctoral School, Burundi  
**Rose Agholor**, Lagos State University, Ojo, Nigeria  
**Deborah Agbamimenu**, Lagos State University, Ojo, Nigeria

**Strand 7: Pre-service Science Teacher Education**

**SC-Organized Paper Set**

**Exploring Various Components Within Preservice Teacher Education**

18-Mar-24, 3:45 PM-5:15 PM  
Location: Plaza Court 4

*Influence of Pre-Service Teachers' Interactive Use of Content-Specific Knowledge Components From Students’ Point of View*

Olutosin Solomon Akinyemi*, University of the Witwatersrand, South Africa

*Elementary Education Majors’ Grades in General Education Courses: Comparisons with Other Majors*

Ryan Nixon*, Brigham Young University, USA  
Elizabeth Bailey, Brigham Young University, USA

*Course Modalities: Challenges and Benefits in Preservice Teacher Science Content Courses from Instructors and Students*

Preethi Titu*, Kennesaw State University, USA  
Jessica Reaves*, Kennesaw State University, USA  
Anna Arias, Kennesaw State University, USA  
Soon Lee, Kennesaw State University, USA
Developing a Learning Progression-based Module For Preservice Elementary Teachers: A Pilot Study
James Hancock II*, Alma College, USA
Amanda Harwood, Alma College, USA
Jessie Store, Alma College, USA
Julie Christensen, Michigan State University, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Research Approaches Investigating Mentoring, Discourse patterns, and Science Core teaching Practices
18-Mar-24, 3:45 PM-5:15 PM
Location: Plaza Court 3

Science Pre-Service Teachers' Experience with Mentor Teachers during Teaching Practice
Tafirenyika Mafugu*, University of the Free State, South Africa

The Critical Role of Mentoring for Preservice Science Teachers: Relational, Developmental, and Contextual Dimensions
Maria Rivera Maulucci*, Barnard College, Columbia University, USA
Julie Contino, American Museum of Natural History, USA

A Study on Discourse Patterns in Secondary Science Classroom Based on Lag Sequential Analysis
Xinhao Song*, Beijing Normal University, China
Yixuan Liu, Beijing Normal University, China
Yuanyuan Fang, The Second High School Attached To Beijing Normal University, China

Jianxin Yao, Beijing Normal University, China
Chunmi Li, Beijing Normal University, China

Emerging Themes in a Study Around Science Core Teaching Practices: Examining Two Universities’ Coursework
Dominick Fantaccone*, SUNY Cortland, USA
Elizabeth Edmondson*, Virginia Commonwealth University, USA
Elaine Howes, American Museum of Natural History, USA
Jamie Wallace, American Museum of Natural History, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
Innovative Models of Teacher Professional Development
18-Mar-24, 3:45 PM-5:15 PM
Location: Plaza Court 5

Decomposing Teacher Response - Elementary Science Noticing within an Interactive Model of Professional Learning
Linda Preminger*, California State University East Bay, USA
Kathryn Hayes, California State University East Bay, USA
Dawn O’Connor, Alameda County Office of Education, USA

Critical Dialogue and Positive Evaluation in Peer/Other Video-Based PD: The Complex Role of Facework
Miriam Babichenko, Ben Gurion University of the Negev, Israel
Dana Vedder Weiss*, Ben Gurion University of the Negev, Israel
Catalyzing Change: A Comparative Study of Science Teacher Professional Development Models and Influence on Instruction

Sierra Morandi*, Florida State University, USA
Elif Ozulku*, Florida State University, USA
Sherry Southerland, Florida State University, USA
Patrick Enderle, Georgia State University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
Professional Developments' Impact on Teachers and/or Students
18-Mar-24, 3:45 PM-5:15 PM
Location: Plaza Court 2

Untangling the Effects: A Meta-Analysis Examining the Impact of Professional Development Programs for Science Teachers

Hyesun You*, The University of Iowa, USA
Sunyoung Park, California Lutheran University, USA
Minju Hong, University of Arkansas, USA
Alison Warren, The University of Iowa, USA

Mentorship and Professional Development in Science Education: A Self-Determination Theory Framework for Understanding Teachers' Perspectives
Mayra Marquez-Mendez*, University of Nevada Las Vegas, USA
Adjoa Mensah*, University of Nevada Las Vegas, USA
Tina Vo, University of Nevada Las Vegas, USA

Impact of an Online STEM Professional Development Program for K-3 Teachers on Student Outcomes
Kadir Demir*, Georgia State University, USA
Ryan Duckett, University of Toledo, USA
Christopher Wojciechowski, University of Toledo, USA
Charlene Czerniak, University of Toledo, USA
Susana Hapgood, University of Toledo, USA
Joan Kaderavek, University of Toledo, USA

Strand 10: Curriculum and Assessment
Related Paper Set
Curriculum Materials Adaptations: What Teachers Attend to and the Changes They Make
18-Mar-24, 3:45 PM-5:15 PM
Location: Plaza Court 6

Un/making Curriculum Materials: Teachers' Localized Adaptations of Curriculum Materials in Context
Emily Seeber*, University of Michigan, USA
Christa Haverly*, Northwestern University, USA
Elizabeth Davis*, University of Michigan, USA
Flexible Tool or Verbatim Script?: Teachers’ Framing and Uses of Educative Features in Curricular Materials
Soo-Yean Shim*, Seoul National University, Republic of Korea
Christina Krist, University of Illinois Urbana-Champaign, USA
Kevin Hall, University of Illinois Urbana-Champaign, USA
Mon-Lin Monica Ko, University of Colorado Boulder, USA
Tania Jarosewich, Censeo Group, USA
Barbara Hug, University of Illinois Urbana-Champaign, USA

Preservice Elementary Science Teachers’ Strategies for Expanding What Counts as Science
Jessica Bautista*, University of Michigan, USA
Elizabeth Davis, University of Michigan, USA

"Oh Yeah, That Has Happened to Me": A Teacher’s Strategic Adaptation of a Phenomenon
Nicholas Leonardi*, University of Illinois Urbana-Champaign, USA
Barbara Hug*, University of Illinois Urbana-Champaign, USA
Christina Krist, University of Illinois Urbana-Champaign, USA

Re-Tooing NGSS-aligned Curricula to Promote Agency, Ownership and Relevance
Kerri Wingert*, Good Question Research, LLC, USA
Barbara Hug*, University of Illinois Urbana-Champaign, USA
Monlin Monica Ko, University of Colorado Boulder, USA
Christina Krist, University of Illinois Urbana-Champaign, USA

Strand 11: Cultural, Social, and Gender Issues
Related Paper Set
Engaging Advanced Quantitative Techniques in STEM Education in Pursuit of Justice
18-Mar-24, 3:45 PM-5:15 PM
Location: Governor’s Square 14

Measuring Justly in Mostly White Schools: A Case for Psychometric Effect Coding
Phillip Boda*, University of Illinois Chicago, USA
George Sirrakos, Kutztown University of Pennsylvania, USA
Lisa Frye, Kutztown University of Pennsylvania, USA
Joleen Greenwood, Kutztown University of Pennsylvania, USA

Society’s Educational Debts in Biology, Chemistry, and Physics: Race, Gender, and Class
Ben Van Dusen*, Iowa State University, USA
Jayson Nissen, Nissen Education Research and Design, USA
Odis Johnson, John Hopkins University, USA

Active Engagement Strategies in Undergraduate Calculus: Learning How to Sustain Success for URM STEM Majors
Zenaida Aguirre Munoz*, University of California, Merced, USA
Mayya Tokman, University of California, Merced, USA
Lalita Oka, California State University, Fresno, USA
Keith Thompson, University of California, Merced, USA
Erica Rutter, University of California, Merced, USA
**2024 NARST Annual International Conference, Denver**

**Khang Tran**, California State University, Fresno, USA  
**Lei Yue**, University of California, Merced, USA


**Vandeen Campbell***, Rutgers University, Newark, USA  
**Jiwon Hwang**, California State University, Los Angeles, USA  
**Jessica Zulawski***, Newark Board of Education, USA

**Strand 11: Cultural, Social, and Gender Issues**  
**SC-Organized Paper Set**  
**Refusing Damage-Centered Narratives in Postsecondary STEM Education: Resistance, Thriving, and Desire**  
18-Mar-24, 3:45 PM-5:15 PM  
Location: Governor’s Square 12

*Science Education for Us: Black Males Exercising Resistance to Matriculate through STEM Education*  
**Takeshia Pierre***, University of Florida, USA  
**Jomo Mutegi***, Old Dominion University, USA

*Utilizing an Asset-Based Lens to Examine How Women of Color Thrive in STEM*  
**Anina Mahmud***, University of North Carolina, USA  
**Dionne Cross Francis***, University of North Carolina, USA  
**Pavneet Kaur Bharaj**, California State University, USA  
**Kerrie Wilkins-Yel**, University of Massachusetts, USA

**Aishwarya Shridhar**, University of Massachusetts, USA  
**Dionne White**, Indiana University, USA

*“I Just Got Lucky”: Multiply Marginalized Students’ Experiences with Mentorship in the Medical Education Trajectory*  
**Candice Kim***, Stanford Graduate School of Education, USA

*Desire-Based Research for Alternative World-Building: Possibilities and Tensions for Research in STEM Education*  
**sarah El Halwany***, Université de l’Ontario, Canada  
**Kristal Turner***, University of Calgary, Canada  
**Kristen Schaffer**, Mount Royal University, Canada  
**Jennifer Adams***, University of Calgary, Canada

**Strand 12: Technology for Teaching, Learning, and Research**  
**SC-Organized Paper Set**  
**Assessment of Science Learning Through Technology**  
18-Mar-24, 3:45 PM-5:15 PM  
Location: Directors Row E

*Using Machine Learning to Predict the Productivity of Learning Trajectories in a Digitally Enhanced Classroom*  
**Marcus Kubsch***, Freie Universität, Germany  
**Adrian Grimm**, IPN – Leibniz Institute for Science and Mathematics Education, Germany  
**Sebastian Gombert**, DIPF, Germany  
**Nikol Rummel**, Ruhr -Universität Bochum, Germany  
**Hendrik Drachsler**, DIPF, Germany
Identification of Science Assessment Item Disengagement Through Analysis Using Psychophysiomeasurement

Richard Lamb*, East Carolina University, USA
Knut Neumann, IPN, Germany
Norah Almusharraf, Prince Sultan University, Saudi Arabia
Douglas Hoston, SUNY Buffalo State College, USA

Assessing Student Errors in Experimentation Using Large Language Models: A Comparative Study with Human Raters

Arne Bewersdorff*, Technical University of Munich, Germany
Kathrin Seßler, Technical University of Munich, Germany
Armin Baur, University of Education Heidelberg, Germany
Enkelejda Kasneci, Technical University of Munich, Germany
Claudia Nerdel, Technical University of Munich, Germany

Analysing Students’ Multimodal Representations of Nature of Scientific Practices and Scientific Methods

Kason Ka Ching Cheung*, University of Oxford, United Kingdom
Sibel Erduran, University of Oxford, United Kingdom
Alis Oancea, University of Oxford, United Kingdom

Clarifying Vision 1.5: The Essence of Science

Judith Lederman*, Illinois Institute of Technology, USA
Valarie Akerson, Indiana University, USA
Selina Bartels, Valparaiso University, USA
Renee Schwartz, Georgia State University, USA

“It’s what I have always been taught.” Undergraduate Science Students’ Views about Scientific Inquiry

Renee Schwartz*, Georgia State University, USA
Heidi Turcotte, Georgia State University, USA
Aihanh Maasen, Georgia State University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set
Scientific Inquiry and Shifting Views
18-Mar-24, 3:45 PM-5:15 PM
Location: Plaza Court 1
Strand 14: Environmental Education and Sustainability  
SC-O rganized Paper Set  
*Climate Justice in Science Education*  
18-Mar-24, 3:45 PM-5:15 PM  
Location: Directors Row J

Assessing the First Year of the Environmental Justice STEMM Leadership Academy  
Rachel Gisewhite*, University of Southern Mississippi, USA  
Jennifer Walker, University of Southern Mississippi, USA  
David Holt, University of Southern Mississippi, USA

The Current State of Climate Justice-Related Research in Science Education and Its Implications  
Hong Tran*, University of Georgia, USA  
Emily Adah Miller, University of Georgia, USA  
Ajay Sharma, University of Georgia, USA  
Shweta Lahiri, University of Georgia, USA  
Julie Luft, University of Georgia, USA  
Joseph DeLuca, University of Georgia, USA  
Elizabeth French, University of Georgia, USA

Community Organizing for Climate Change and Environmental Justice Instruction at the School District Level  
Helen Fitzmaurice*, UC Berkeley, USA  
Michelle Hoda Wilkerson, UC Berkeley, USA

Strand 14: Environmental Education and Sustainability  
SC-O rganized Paper Set  
*Collective Learning as a Solution to Environmental Challenges*  
18-Mar-24, 3:45 PM-5:15 PM  
Location: Directors Row I

Evaluating Biological Accuracy and Problem-Solving Utility: Biomimicry Frameworks for Interdisciplinary Innovation and Education  
Dimitri Smirnoff*, University of Minnesota, USA  
Anita Schuchardt, University of Minnesota, USA  
Gillian Roehrig*, University of Minnesota, USA  
Emilie Snell-Rood, University of Minnesota, USA

Education for Sustainable Development through Socioscientific Issues: Pre-service Teachers’ Pedagogical Design Capacity  
Tuba Stouthart*, Eindhoven University of Technology, Netherlands  
Dury Bayram, Eindhoven University of Technology, Netherlands  
Jan van der Veen, Eindhoven University of Technology, Netherlands

Exploring Collective Learning in an Environmental Movement in India using the Community of Practice Framework  
Aparajita Rajwade*, North Carolina State University, USA  
K.C. Busch, North Carolina State University, USA
Exploring Narratives as a Tool for Fostering Transformation Toward Sustainability Through Science Education
Giulia Tasquier*, University of Bologna, Italy
Erik Knain, University of Oslo, Norway
Alfredo Jornet, University of Gerona, Spain
Hanna Rokenes, University of Oslo, Norway

Poster Session A
18-Mar-24, 5:30 PM-6:15 PM
Location: Plaza Foyer

Strand 1: Science Learning:
Development of student understanding
Argumentation in Elementary School, from Evidence and Models
Roger Tobin*, Tufts University, USA
Sara Lacy, TERC, USA
Sally Crissman, TERC, USA

Strand 1: Science Learning:
Development of student understanding
What Predicts Scientific Literacy: Revealing Influential Factors and Group Comparisons via a Machine Learning Model
Hyesun You*, The University of Iowa, USA
Minju Hong, University of Arkansas, USA
Li Zhu, The University of Iowa, USA
Zhenhan Fang, The University of Iowa, USA

Strand 1: Science Learning:
Development of student understanding
Challenges in Latent Variables Test Development based on the concept of Energy

Lauri Kõlamets*, The University of Tartu Institute of Chemistry, Estonia
Heili Kasuk, University of Tartu, Estonia
Jack Holbrook, University of Tartu, Estonia
Rachel Mamlok-Naaman, Weizmann Institute of science, Israel

Strand 1: Science Learning:
Development of student understanding
Post-Secondary Students' Concepts of Elasticity: The Iron and Rubber Dilemma
Md Nazmuzzaman Shifat*, Harvard University, USA
S M Hafizur Rahman, University of Dhaka, Bangladesh

Strand 1: Science Learning:
Development of student understanding
From Anxiety to Empowerment: The Role of Error Beliefs in Mathematics Learning
Xingfeiyue Liu*, The Ohio State University, USA
Eric Anderman, The Ohio State University, USA
Lynley Anderman, The Ohio State University, USA
Tzu-Jung Lin, The Ohio State University, USA
Michael Glassman, The Ohio State University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Media and Information in Science Lessons: An Analysis of Discursive Interactions in a Brazilian Classroom
Ludmila Kelles, Universidade Federal de Minas Gerais, Brazil
Nathan Lima, Universidade Federal do Rio Grande do Sul, Brazil
Luiz Franco*, Universidade Federal de Minas Gerais, Brazil
**Strand 3: Science Teaching — Primary School (Grades preK-6):**
**Characteristics and Strategies**
Teaching and Learning Sequences on the Floating and Sinking Phenomenon: An Evidence-Based Comparison
Francisco Castillo Hernández*, University of Groningen, Netherlands
María Jiménez-Liso, University of Almería, Spain
Digna Couso, Autonomous University of Barcelona, Spain

**Strand 4: Science Teaching — Middle and High School (Grades 5-12):**
**Characteristics and Strategies**
A Dual Case Study of Science Teachers’ who Implemented Self-Regulated Learning in their Classrooms
Boaz Hadas*, Technion, Israel
Avivit Arvatz, Technion, Israel
Rotem Waitzman, Charles E. Smith High School for the Arts, Israel
Yehudit Dori, Technion, Israel

**Strand 4: Science Teaching — Middle and High School (Grades 5-12):**
**Characteristics and Strategies**
Embodied Cognition: Unknown by Teachers but Used Surprisingly Often in Class
André Meyer*, Leibniz University Hannover, Germany
Gunnar Friege, Leibniz University Hannover, Germany

**Strand 4: Science Teaching — Middle and High School (Grades 5-12):**
**Characteristics and Strategies**
A Systematic Literature Review of Teaching Approaches in Advanced Placement Science Courses
Robin Bulleri*, North Carolina State University, USA

Soonhye Park, North Carolina State University, USA

**Strand 4: Science Teaching — Middle and High School (Grades 5-12):**
**Characteristics and Strategies**
Factors Affecting Science Teaching in STEM: A Systematic Review
Heba EL-Deghaidy*, American University in Cairo, Egypt
Zahrah Almasabi, Najran University, Saudi Arabia
Hamdan Alamri, King Saud University, Saudi Arabia
Maha Albogami, King Saud University, Saudi Arabia
Nidhal Alahmad, King Saud University, Saudi Arabia
Saeed Alshamrani, King Saud University, Saudi Arabia
Abdo Almufti, King Saud University, Saudi Arabia
Nasser Mansour, Qatar University, Qatar
Abdulaziz Alfayez, King Saud University, Saudi Arabia
Fahad Alshaya, King Saud University, Saudi Arabia

**Strand 4: Science Teaching — Middle and High School (Grades 5-12):**
**Characteristics and Strategies**
Iterative Modeling of Earth’s Interior for Conceptual Change in Middle School Earth Science
Melissa Olson*, Texas Tech University, USA
Jocelyn Miller, Texas Tech University, USA
Gina Childers, Texas Tech University, USA
Kristie Gutierrez, Old Dominion University, USA
Jin Kyeong Jung, Texas Tech University, USA
Strand 4: Science Teaching — Middle and High School (Grades 5-12):
Characteristics and Strategies
Exploring the Impacts of Educatively Model-Based Biology Instructional Materials on Teacher Outcomes
Cari Herrmann Abell*, BSCS Science Learning, USA
Jeffrey Snowden, BSCS Science Learning, USA
Molly Stuhlsatz, BSCS Science Learning, USA
Brian Donovan, BSCS Science Learning, USA
Cynthia Passmore, UC Davis School of Education, USA
Christopher Wilson, BSCS Science Learning, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12):
Characteristics and Strategies
Pragmatic Model Building: A 4D Socially Enacted Understanding of Celestial Mechanics
Michael Leary*, University of Georgia, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12):
Characteristics and Strategies
Data Fluency Landscape Analysis: Identifying Strengths, Needs, and Resources for Data-Rich Instruction in Earth Science
Nicole Wong*, WestEd, USA
Rasha Elsayed, WestEd, USA
Kirsten Daehler*, WestEd, USA
Katy Nilsen, WestEd, USA
Svetlana Darche, WestEd, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Impact of a Forum for Chemistry and Math Introductory Course Instructors – a Professional Development Model.
Oluwatobi Odeleye*, West Virginia University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Examining Students’ Peer-to-Peer Questions During an In-Class Collaborative Activity: Trends and Outcomes.
James Nyachwaya*, North Dakota State University, USA
Soren Miller, St> Olaf College, USA
Tarah Dahl, North Dakota State University, USA
Krystal Grieger, North Dakota State University, USA

Strand 6: Science Learning in Informal Contexts
Community Dimensions of STEM Learning at Science Fiction Conventions: Communities of Practice & Modes of Belonging
Rebecca Hite*, Texas Tech University, USA
Gina Childers*, Texas Tech University, USA
Kania Greer, Georgia Southern University, USA
Samantha Noble, Texas Tech University, USA
Olivia Kuper, Texas Tech University, USA

Strand 6: Science Learning in Informal Contexts
Belonging in Science: Perspectives from High School Students
Linda Morell*, University of California, USA
Strand 7: Pre-service Science Teacher Education
Reevaluating FOCIS Survey with Pre-service Elementary Teachers: CFA on Latent Constructs of Discovering and Making
Lillian Bentley*, University of Virginia, USA
Xin Xia, University of Virginia, USA

Strand 7: Pre-service Science Teacher Education
Making Space for Repertoires, Community Resources, and Sensemaking with Elementary Science Teacher Candidates
Mutia Syifa*, The Ohio State University, USA
Ashlyn Pierson*, The Ohio State University, USA
Sophia Jeong*, The Ohio State University, USA
Andrea Henrie*, The Ohio State University, USA

Strand 7: Pre-service Science Teacher Education
Effect of Teacher Preparation Program on Science Teachers’ Use of Academic Language Development Strategies
Rachel Benzoni*, University of Nebraska-Lincoln, USA
Elizabeth Lewis, University of Nebraska-Lincoln, USA

Strand 7: Pre-service Science Teacher Education
Pre-Service Teachers’ Orientations to the Role of Student Thinking in Instruction across the Two-Worlds Pitfall
Ryan Coker*, Florida State University, USA
Lama Jaber, Florida State University, USA
Sherry Southerland, Florida State University, USA

Strand 8: In-service Science Teacher Education
Toward a Framework for Equity-Focused STEM Teacher Leadership
Matthew Kloser*, University of Notre Dame, USA
Michael Szopiak, University of Notre Dame, USA
Catherine Wagner, University of Notre Dame, USA
D’Anna Pynes, University of Notre Dame, USA
Gina Svarovsky, University of Notre Dame, USA

Strand 8: In-service Science Teacher Education
Incoherence in Administrators’ Perceptions of Elementary Engineering Education and Teacher Professional Development Needs
Danielle Rhemer*, Florida State University, USA
Minjung Lee, Old Dominion University, USA
Kristie Gutierrez*, Old Dominion University, USA
Jennifer Kidd, Old Dominion University, USA

Strand 8: In-service Science Teacher Education
Science Professional Learning that Offers Growth in Engineering Self-Efficacy for Rural School Elementary Teachers
John Galisky*, UC Santa Barbara, USA
Meghan Macias*, WestEd, USA
Ashley Iveland*, WestEd, USA
Martha Inouye, University of Wyoming, USA
Rebekah Hammack, Purdue University, USA
Julie Robinson, University of North Dakota, USA
Cathy Ringstaff, WestEd, USA
Ryan Summers, University of North Dakota, USA

**Strand 10: Curriculum and Assessment**


Amanda Peel*, New Mexico State University, USA
Steven McGee, The Learning Partnership, USA

Eylon Langbeheim, Ben Gurion University of the Negev, Israel

**Strand 10: Curriculum and Assessment**

*Mediation among Epistemic Orientation and Epistemic Tools on Teacher Implementation of Knowledge Generation Approaches*

Gavin Fulmer*, NWEA, USA
Amanda Duffey*, University of Iowa, USA
Brian Hand, University of Iowa, USA
Jee Kyung Suh, University of Alabama, USA

**Strand 10: Curriculum and Assessment**

*Promoting Model-informed Reasoning Through Engagement with Multiple Models*

Jamie Elsner*, University of North Carolina at Chapel Hill, USA
Eric Kirk, University of North Carolina at Chapel Hill, USA
Zhen Xu, University of North Carolina at Chapel Hill, USA
Laura Zangori, University of Missouri, USA
Li Ke, University of Nevada Reno, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA

**Strand 10: Curriculum and Assessment**

*Evaluating a Genetics Unit from a Science Identity Perspective*

Sarah Fogelman*, Boston College, USA
Maria Moreno Vera*, Boston College, USA
Katherine McNeill*, Boston College, USA

**Strand 11: Cultural, Social, and Gender Issues**

*Designing for Low-High Spaces in White Science Teacher Education*

Jonathan McCausland*, New Mexico Highlands University, USA

**Strand 11: Cultural, Social, and Gender Issues**

*Student Outcomes through Culturally and Linguistically Responsive Science Instruction: A Systematic Review*

Niki Koukoulidis*, University of Florida, USA
Julie Brown*, University of Florida, USA

**Strand 11: Cultural, Social, and Gender Issues**

*Teachers’ Views and Response to Equity Issues at Higher Education Science Classroom in Bangladesh*

S M Hafizur Rahman*, Institute of Education and Research (IER), University of Dhaka, Bangladesh
Sonia Yeasmin*, Institute of Education and Research (IER), University of Dhaka, Bangladesh
Strand 11: Cultural, Social, and Gender Issues
Queerness in STEM: A Review of National Science Foundation (NSF) Research Grants
George Schafer*, Drexel University, USA

Strand 11: Cultural, Social, and Gender Issues
Centering Biodiversity: Queering Sex Determination in a Developmental Biology Course
Aramati Casper*, Colorado State University, USA
Brandon Hylton, Colorado State University, USA
Deborah Garrity, Colorado State University, USA

Strand 12: Technology for Teaching, Learning, and Research
Erin Peters-Burton*, George Mason University, USA
Timothy Cleary, Rutgers University, USA
Peter Rich, Brigham Young University, USA
Anastasia Kitsantas, George Mason University, USA
Brittany Miller, George Mason University, USA
Hong Tran, Purdue University, USA
Haley Mckeen, George Mason University, USA

Strand 12: Technology for Teaching, Learning, and Research
Investigating New Roles for Digital Technology in Teaching Computer Studies in Africa Through a Virtual-Learning-Environment
Deborah Agbanimu*, National Open University of Nigeria, Nigeria
Peter Okebukola, Lagos State University-ACEITSE, Nigeria
Juma Shabani, Univeristy of Burundi, Burundi
Franklin Onowugbeda, Lagos State University-ACEITSE, Nigeria
Esther Peter, Lagos State University-ACEITSE, Nigeria
Adekunle Oladejo, Lagos State University-ACEITSE, Nigeria
Olasunkanmi Gbeleyi, Lagos State University-ACEITSE, Nigeria
Ibukunolu Ademola, Lagos State University-ACEITSE, Nigeria

Strand 12: Technology for Teaching, Learning, and Research
Exploring Promises and Pitfalls of Artificial Intelligence in Education: A Pilot Study
Divya Baranwal*, Southern Methodist University, USA

Strand 12: Technology for Teaching, Learning, and Research
Exploring Automated Evaluation of Teacher Attention to Student Ideas During Argumentation-Focused Science Discussions
Jamie Mikeska*, ETS, USA
Alessia Marigo, ETS, USA
Jessica Tierney, ETS, USA
Tricia Maxwell, ETS, USA
Duy Pham, ETS, USA
Beata Beigman Klebanov, ETS, USA
Strand 12: Technology for Teaching, Learning, and Research
Cultivating Hardware Engineering Interest in High School Students Using Hands-on Learning
Andrea Ramirez-Salgado*, University of Florida, USA
Pavlo Antonenko, University of Florida, USA

Strand 12: Technology for Teaching, Learning, and Research
Technology to Support the NGSS Practice of Mathematical and Computational Thinking in Early Elementary Classrooms
Kristina Tank*, Iowa State University, USA
Tamara Moore, Purdue University, USA
Anne Ottenbreit-Leftwich, Indiana University, USA
Barbara Fagundes, Purdue University, USA
Zarina Wafula, Iowa State University, USA
Sohheon Yang, Indiana University, USA

Strand 12: Technology for Teaching, Learning, and Research
Strand 13: History, Philosophy, Sociology, and Nature of Science
Exploring the Development of Students’ Nature of Engineering Views and their Identification with Engineering
Jacob Pleasants*, University of Oklahoma, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
Towards a Multidisciplinary Framework for Teaching Socio-scientific Issues
Scott Bonham*, Western Kentucky University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
Re-evaluating the Impact of School Size on Students’ Physical Science Enrollment and Performance
Monika Siepsiak*, Stony Brook University, USA
Keith Sheppard, Stony Brook University, USA
Angela Kelly, Stony Brook University, USA

Strand 14: Environmental Education and Sustainability
Mothers as Ambassadors of Climate Change Behaviors Education: Multi-Case Study between Mexico and United States
Regina Ayala Chavez*, NC State University, USA
K.C. Busch, NC State University, USA

Strand 14: Environmental Education and Sustainability
Understanding Teachers’ Knowledge and Confidence in Teaching Climate Change & Marine Science
Lauren Madden*, The College of New Jersey, USA
Louise Ammentorp, The College of New Jersey, USA
Nathan Magee, The College of New Jersey, USA
Graceanne Taylor, Save Barnegat Bay, USA

National Center for Science Education
Sponsored Session
Safeguarding Sound Science – Resolving Science Misconceptions in the Secondary Classroom
18-Mar-24, 5:30 PM-6:15 PM
Location: Governor’s Square 10

Safeguarding Sound Science – Resolving Science Misconceptions in the Secondary Classroom

ORGANIZERS
Amanda Townley, National Center for Science Education, USA
Lin Andrews, National Center for Science Education, USA
Wendy Johnson, National Center for Science Education, USA

PhET Interactive Simulation, CU-Boulder
Sponsored Session
Discover PhET-iO Simulations for Research with Full API Control and Backend Data
18-Mar-24, 5:30 PM-6:15 PM
Location: Governor’s Square 11

Discover PhET-iO Simulations for Research with Full API Control and Backend Data

ORGANIZERS
Kathy Perkins, University of Colorado Boulder, USA

PANELISTS
Kathy Perkins, University of Colorado, Boulder, USA
Amy Rouinfar, University of Colorado, Boulder, USA
Kathryn Woessner, University of Colorado, Boulder, USA

Research in Artificial Intelligence-Involved Science Education (RAISE) Sponsored Session
RAISE Book Talk: Uses of Artificial Intelligence for STEM Education
18-Mar-24, 7:00 PM-9:00 PM
Location: Directors Row I

RAISE Book Talk: Uses of Artificial Intelligence for STEM Education

ORGANIZERS
Xiaoming Zhai, University of Georgia, USA
Kent Crippen, University of Florida, USA

PANELISTS
Joe Krajcik, Michigan State University, USA

International Journal of Science Education
Social Event
IJSE Reception
18-Mar-24, 6:30 PM-7:30 PM
Location: Plaza Ballroom ABC/DEF

Equity And Ethics Committee
Social Event
Equity & Ethics Committee Dinner
18-Mar-24, 7:00 PM-9:00 PM
Location: Off Site

ORGANIZERS
Phillip Boda, University of Illinois, USA
Iliana De La Cruz, Texas A&M University, College Station, TX, USA
19 MARCH 2024

Committee Meeting
Publications Advisory Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 10

Committee Meeting
Social Media, Website, Communications Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 11

Committee Meeting
Program Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 12

Committee Meeting
Elections Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 16

Committee Meeting
Awards Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 17

Committee Meeting
Research Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 1

Committee Meeting
Equity and Ethics Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 2

Committee Meeting
External Policy and Relations Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 3

Committee Meeting
International Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 4

Committee Meeting
Graduate Student Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 5

Committee Meeting
Membership Committee Meeting
19-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 6
Roundtables Session 2
19-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Ballroom ABC/DEF

Strand 6: Science Learning in Informal Contexts Roundtable
STEMming the Slide: Enhancing Self-Efficacy via a Summer Academy
Caleb Smith*, Southeastern Oklahoma State University, USA
Katheryn Shannon*, Southeastern Oklahoma State University, USA
Michael Hardy*, Southeastern Oklahoma State University, USA

Strand 6: Science Learning in Informal Contexts Work-in-progress Roundtable
"Escaping the Room, Entering the Nano-World": Learning about Nano through a Chemical Escape Room
Shelley Rap*, Weizmann Institute of Science, Israel
Malka Yayon, Weizmann Institute of Science, Israel
Ron Blonder, Weizmann Institute of Science, Israel

Strand 6: Science Learning in Informal Contexts Roundtable
Kitchen Chemistry Boosts STEM Identity and Increases STEM Career Interests.
Chen Chen*, University of Hong Kong, Hong Kong
Jiaxin Chen*, University of Hong Kong, Hong Kong
Liang Ju, University of Hong Kong, Hong Kong
Gerhard Sonnert, Harvard-Smithsonian Center for Astrophysics, USA

Philip Sadler, Harvard-Smithsonian Center for Astrophysics, USA

Strand 6: Science Learning in Informal Contexts Work-in-progress Roundtable
Storied Experiences of Informal Science Learning in U.S. College Students and Impacts on Science Identity
Paul Le*, University of Colorado Denver, USA
Sarah Hug, Colorado Evaluation and Research Consulting, USA

Strand 6: Science Learning in Informal Contexts Work-in-progress Roundtable
Using Community Ethnography and Networks of Support to Foster Consequential Learning through Community-Centered Energy Engineering
Carlos Meza-Torres*, Arizona State University, USA
Michelle Jordan, Arizona State University, USA
Steve Zuiker, Arizona State University, USA

Strand 6: Science Learning in Informal Contexts Work-in-progress Roundtable
Drawing from Narrative Techniques to Explore Impact Identity and Scientist Public Engagement: A Pilot Study
Brenda Guerrero*, Florida International University, USA

Strand 7: Pre-service Science Teacher Education Roundtable
BIPOC Teacher Candidates’ Translanguaging Selves: Their Assets and Identities as Future Elementary Science Teachers
Strand 7: Pre-service Science Teacher Education

Work-in-progress Roundtable
Field Experience Reconceptualized for Elementary Science and Mathematics Methods Courses
Sheryl McGlamery*, University of Nebraska at Omaha, USA
Saundra Shillingstad*, University of Nebraska at Omaha, USA

Using the Draw-A-Scientist Test to Understand Pre-Service Elementary Teachers’ Perceptions of Scientists
Sissy Wong*, University of Houston, USA
Maria Walsh, University of Houston, USA
Samuel Katende, University of Houston, USA

Elementary Preservice Teachers’ Competence in Planning and Implementing Empathic Design in Cross-Cultural STEM Education
Soo Won Shim*, Illinois State University, USA
Selcen Gauzy, Purdue University, USA

Strand 7: Pre-service Science Teacher Education

Work-in-progress Roundtable
Exploring How Elementary Preservice Teachers Develop Reform-Minded Science Teacher Identities Across a Science Methods Course
Jenna Gist*, Purdue University, USA
Brenda Capobianco, Purdue University, USA

Elementary Preservice Teachers’ Competence in Planning and Implementing Empathic Design in Cross-Cultural STEM Education
Soo Won Shim*, Illinois State University, USA
Selcen Gauzy, Purdue University, USA
Strand 8: In-service Science Teacher Education
Work-in-progress Roundtable
Supporting Teachers' Understanding and Infusion of Culturally Responsive and Anti-Racist Teaching in Science
Shannon Davidson*, University of Alabama, USA
Roxanne Hughes, Florida State University, USA
Stacey Hardin, University of Washington, USA

Strand 8: In-service Science Teacher Education
Work-in-progress Roundtable
Longitudinal Studies of In-Service Teacher Education: A Discussion of Methods
Chris Pavlovich*, Montana Technological University, USA
Rayelynn Brandl*, Montana Technological University, USA

Strand 10: Curriculum and Assessment
Work-in-progress Roundtable
How Does the Framing of Anchoring Phenomena Affect Student Perception of Interest and Relevance?
Zoe Buck Bracey*, BSCS Science Learning, USA
Jamie Noll*, BSCS Science, USA
Diego Rojas-Perilla*, BSCS Science Learning, USA
Joe Kremer*, Denver Public Schools, USA

Strand 7: Pre-service Science Teacher Education
Work-in-progress Roundtable
Preservice Teachers' Facilitation of Argumentation: Exploring Their Attention to and Perceived Complexity of Students' Thinking
Meredith Park Rogers*, Indiana University, USA
Taiwo Ogundapo*, Indiana University, USA
Esther Namakula*, Indiana University, USA
Kady Lane*, Indiana University, USA
Dionne Cross Francis, University of North Carolina - Chapel Hill, USA
Pavneet Kaur Bharaj, CSU-Bakersfield, USA
Weverton Ataide Pinheiro, Texas Tech University, USA
Adam Maltese, Indiana University, USA
Jamie Mikeska, Educational Testing Service, USA
Calli Shekell, Thiel College, USA

Strand 7: Pre-service Science Teacher Education
Work-in-progress Roundtable
Exploring the Use of Model Eliciting Activities to Promote Quantitative Reasoning Among Preservice Teachers
Cynthia Lima*, University of Texas at San Antonio, USA

Strand 7: Pre-service Science Teacher Education
Work-in-progress Roundtable
Laying the Foundation for Translanguaging Pedagogy in Preservice Secondary Science and Math Teacher Preparation
Edward Lyon*, Sonoma State, USA
Strand 7: Pre-service Science Teacher Education
Work-in-progress Roundtable
Examining the Dimensionality of NGSS Learning Objectives Generated by Preservice Elementary Teachers
Lin Xiang*, University of Kentucky, USA
Corinne Lardy*, California State University, Sacramento, USA
YoungJin Song*, California State University, Long Beach, USA
Michele Korb*, California State University, East Bay, USA
Hui-Ju Huang*, California State University, Sacramento, USA

Strand 8: In-service Science Teacher Education
Work-in-progress Roundtable
"You Can't Take for Granted That Kids Know That!": Centering Teacher Learning Around Equity Supports
Jennifer Jackson*, The Pennsylvania State University, USA
Scott McDonald, The Pennsylvania State University, USA

Strand 8: In-service Science Teacher Education
Work-in-progress Roundtable
Unlocking Potential: Navigating Universal Design for Learning in Elementary Engineering for Diverse Learners
Bree Jimenez*, The University of Texas Arlington, USA
Ginevra Courtade, University of Louisville, USA
Mary Elliott, University of Louisville, USA
Jennifer Fosbinder, University of Louisville, USA

Strand 8: In-service Science Teacher Education
Work-in-progress Roundtable
Engaging with Science Educators through Flipped Observations to Support Enactment of Social Justice Practices
Felisha Dake*, Oregon State University, USA
Cory Buxton, Oregon State University, USA
Melissa Livingston, Oregon State University, USA
Karla Hale, Oregon State University, USA

Strand 8: In-service Science Teacher Education
Work-in-progress Roundtable
Supporting Teachers in Developing and Using Data Literacy Skills Through Research Experience for Teachers Program
Amanda Morrison*, Oregon State University, USA
Michael Giamellaro, Oregon State University, USA

Strand 8: In-service Science Teacher Education
Work-in-progress Roundtable
Effective Engineering Education for Elementary Multilingual Learners: A Conceptual Framework for Transformative Professional Learning
Jerome Shaw*, University of California, Santa Cruz, USA

Strand 10: Curriculum and Assessment Roundtable
Stemtelling: Learning Science and Building Epistemic Communities Through Storytelling
Jenny Tilsen*, University of Minnesota, USA
Strand 10: Curriculum and Assessment Roundtable
The Impact of Ungrading on Secondary Physics Students’ Self Determination
Christopher Sarkonak, Crocus Plains Regional Secondary School, Canada
Ellen Watson*, Brandon University, Canada

Strand 10: Curriculum and Assessment Roundtable
The State of Framework-aligned Assessment Tasks: Where are we?
Clarissa Deverel-Rico*, BSCS Science Learning, USA
Patricia Olson, BSCS Science Learning, USA
Cari Herrmann Abell, BSCS Science Learning, USA
Chris Wilson, BSCS Science Learning, USA

Strand 10: Curriculum and Assessment Work-in-progress Roundtable
The Grand Challenges Project: Co-Developing an International Interdisciplinary SSI-Based Science Curriculum
Keren Dalyot*, Weizmann Institute of Science, Israel
Nannan Fan, University of North Carolina at Chapel Hill, USA
Heewoo Lee, University of North Carolina at Chapel Hill, USA
Rebecca Lesnfsky, University of North Carolina at Chapel Hill, USA
Shira Passentin, Weizmann Institute of Science, Israel
Natasha Segal, Weizmann Institute of Science, Israel
Zhen Xu, University of North Carolina at Chapel Hill, USA

Troy Sadler, University of North Carolina at Chapel Hill, USA
David Fortus, Weizmann Institute of Science, Israel

Strand 8: In-service Science Teacher Education Roundtable
Empowering Science Teachers’ Pedagogical Transformation through Participation in an Online Asynchronous Graduate Program
Elizabeth Saville*, UBC Okanagan, Canada
David Anderson, UBC, Canada
Marina Milner-Bolotin, UBC, Canada

Publications Advisory Committee Sponsored Session
NARST/NSTA Annual Research Worth Reading Recognition
19-Mar-24, 8:15 AM-9:45 AM
Location: Governor's Square 16

NARST/NSTA Annual Research Worth Reading Recognition

ORGANIZERS
Lindsay Lightner, Washington State University Tri-Cities, USA
Tina Vo, University of Nevada, Las Vegas, USA
Emily Dare, Louisiana State University, USA
G. Michael Bowen, Mount Saint Vincent University, Canada
Shiang-Yao Liu, National Taiwan Normal University, Taiwan
Deborah Hanuscin, Western Washington University, USA
Strand 1: Science Learning: Development of student understanding
Related Paper Set
Science Learning Progression Research: Insights, Challenges, and Future Directions
19-Mar-24, 8:15 AM-9:45 AM
Location: Directors Row E

Learning Progression in Genetics
Ravit Duncan*, Rutgers University, USA
Moraima Castro-Faix, Rutgers University, USA

Learning Progressions for Energy in Physical Sciences
Jeffrey Nordine*, University of Iowa, USA
David Fortus, Weizmann Institute of Science, Israel

Geology & Earth Systems Sciences Learning Progressions
Richard Duschl, Southern Methodist University, USA
Scott McDonald*, Penn State University, USA

Developing Three-Dimensional Learning Progressions of Energy, Interaction, and Matter at Middle School: A Design-Based Research
Namsoo Shin*, Michigan State University CREATE for STEM Institute, USA
PENG HE*, Michigan State University CREATE for STEM Institute, USA
Joseph Krajcik, Michigan State University CREATE for STEM Institute, USA

Learning Progression in Environmental Science
Wendy Johnson*, National Center for Science Education, USA

Emily Scott, Washington State Office of the Superintendent of Public Instruction, USA
Hannah Miller, Vermont State University, USA
Charles Anderson, Michigan State University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Identity and Diversity
19-Mar-24, 8:15 AM-9:45 AM
Location: Governor's Square 11

Science Identity Development Across Multiple Spatial Configurations: A Narrative Inquiry Project
Alison Happel-Parkins*, University of Memphis, USA
Katherine Ayers*, St. Jude Children's Research Hospital, USA
Olayinka Mohorn-Mintah*, University of Memphis, USA

Minoritized High Schoolers' Perceptions of Science and Scientists
Jennifer Tripp*, University at Buffalo, SUNY, USA
Noemi Waight, University of Buffalo - SUNY, USA
Xiufeng Liu, University at Buffalo, SUNY, USA

Not the Only Novice in the Room: Partnership and Belongingness in a Research Immersion Program
Robyn Pennella*, St. Jude Children's Research Hospital, USA
Katherine Ayers, St. Jude Children's Research Hospital, USA
Olayinka Mohorn-Mintah, University of Memphis, USA
Summer Jasper, St. Jude Children’s Research Hospital, USA
Susan Nordstrom, University of Memphis, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set
Teacher Learning
19-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 1

Comparison of an AI Professional Development Program’s Impact on Science and non-Science Teacher AI Literacy
Katherine Moore, MIT STEP Lab, USA
Phylis Wilson*, Richmond Public Schools, USA
Helen Zhang, Boston College, USA
Irene Lee, MIT STEP Lab, USA

A Longitudinal Study of Teacher Leadership Identity Development
Christine Lotter*, University of South Carolina, USA
Jan Yow, University of South Carolina, USA
Denae Kizys, University of South Carolina, USA
Latrice Jones, University of South Carolina, USA

Conceptualization and Development of an Instrument for Exploring the Metacognition of Junior High Science Teachers
Gamolnaree Laikram, The Institute for the Promotion of Teaching Science and Technology, Thailand
Gregory Thomas*, University of Alberta, Canada

Exploring Science Teachers Sensemaking of Generic Equity-focused Professional Development
Matt Stewart*, University of Washington, USA

Framing the Game: Teachers’ Perspectives of Varied Epistemological Framing
Christine Hirst Bernhardt*, University of Maryland, USA
Janelle Bailey*, Temple University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Metacognition and Conceptual Understanding in Biology
19-Mar-24, 8:15 AM-9:45 AM
Location: Governor’s Square 17

Using the Inventory of Biotic Climate Literacy: Identifying Target Conceptions for Undergraduate Biology Courses
Emily Holt*, University of Northern Colorado, USA
Sara Gilese, University of Maryland, USA
Gili Marbach-Ad, University of Maryland, USA
Kaci Thompson, University of Maryland, USA
Karen Carleton, University of Maryland, USA

Exploring Before Instruction to Improve Conceptual Understanding in Biology
Raina Isaacs*, University of Louisville, USA
Natalie Christian, University of Louisville, USA
Rachel Hopp, University of Louisville, USA
Jeffery Masters, University of Louisville, USA
Linda Fuselier, University of Louisville, USA
Lianda Velic, University of Louisville, USA
Jeffrey Hieb, University of Louisville, USA  
Raymond Chastain, University of Louisville, USA  
Marci DeCaro, University of Louisville, USA

Individual Variation in Undergraduate Student Metacognitive Monitoring and Error Detection During Biology Model Evaluation  
Joe Dauer*, University of Nebraska, USA  
Mei Grace Behrendt, University of Nebraska, USA  
McKenna Elliott, University of Nebraska, USA  
Bethany Gettings, Michigan State University, USA  
Carrie Clark, University of Nebraska, USA  
Tammy Long, Michigan State University, USA

Undergraduate Students’ Utilization of Central Dogma Content Knowledge in Argumentation after Problem-based Learning  
Katherine Sharp*, Missouri University of Science and Technology, USA  
Jeffrey Chalfant, University of Kentucky, USA  
Rebecca Krall, University of Kentucky, USA

2024 NARST Annual International Conference, Denver

Citizen/community and Place-Based Science  
Roberta Hunter*, Michigan State University, USA  
Gail Richmond, Michigan State University, USA  
Rachel Stronach, University of Massachusetts Dartmouth, USA  
Hamza Malik, University of Massachusetts Dartmouth, USA  
Stephen Witzig, University of Massachusetts Dartmouth, USA  
Zion Michal, Bar-Ilan University, Israel  
Batzon Nimrod, Bar-Ilan University, Israel  
Jadda Miller, University of California Davis, USA  
Emma Schectman, University of California, Davis, USA  
Heidi Ballard, University of California, Davis, USA

Strand 6: Science Learning in Informal Contexts  
Symposium
Science in the Outdoors: Engaging Teachers and Students in Citizen/Community and Place-based Science  
19-Mar-24, 8:15 AM-9:45 AM  
Location: Directors Row H

Science in the Outdoors: Engaging Teachers and Students in

How Preservice Elementary Teachers Notice Opportunities for Equitable Sensemaking in Science  
Amanda Benedict-Chambers*, Missouri State University, USA  
Carrie-Anne Sherwood*, Southern Connecticut State University, USA

Pre-Service Science Teachers’ Conceptualization of Responsive Teaching  
Nessrine Machaka*, University of Illinois at Urbana-Champaign, USA  
Christina (Stina) Krist*, University of Illinois at Urbana-Champaign, USA
Approaches to Equity as a Lens to Understand PST's Noticing and Responding
Heather Johnson*, Vanderbilt University, USA
Miray Tekkumru-Kisa*, RAND Corporation, USA
Tara Barnhart*, Chapman University, USA

Exploring the Noticing Practices of Learning Assistants that Support Formative Assessment in STEM College Courses
Patricia Moreira*, University of Arizona, USA
Young Ae Kim, University of Arizona, USA
Paul Blowers, University of Arizona, USA
Lisa Elfring, University of Arizona, USA
Vicente Talanquer, University of Arizona, USA

How Instructional Coaching Supports Noticing for In/equity in the Science Classroom
Janet Carlson*, Stanford University, USA

Teacher Noticing in Appalachia: Context-Specific Knowledge of Place and Community in 5th Grade Teachers' Noticing
Melissa Luna*, West Virginia University, USA

Examining Teacher Noticing and Responding for Cultivating Science-as-Practice
Jennifer Richards*, Northwestern University, USA
Miray Tekkumru-Kisa*, RAND Corporation, USA

How Teachers Leading Professional Development for Peers Support

Professional Noticing in Formative Assessment Activities
Hannah Sevian, University of Massachusetts Boston, USA
Rebecca Lewis*, Hingham High School, USA

Strand 8: In-service Science Teacher Education Symposium
Curriculum-Based Professional Development to Support Multilingual Learners: Conceptual Framework, Instruments, and Impacts
19-Mar-24, 8:15 AM-9:45 AM
Location: Governor's Square 12

Curriculum-Based Professional Development to Support Multilingual Learners: Conceptual Framework, Instruments, and Impacts
Eric Banilower*, Horizon Research, Inc., USA
Scott Grapin, University of Miami, USA
Alison Haas, New York University, USA
Okhee Lee, New York University, USA
Alycia Sterenberg Mahon, Western Michigan University, USA
Courtney Plumley, Horizon Research, Inc., USA
Abigail Schwenger, New York University, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set Assessment Development and Validation
19-Mar-24, 8:15 AM-9:45 AM
Location: Directors Row J
Shiyu Xu*, UCL Institute of Education, United Kingdom
Michael Reiss, UCL Institute of Education, United Kingdom
Wilton Lodge, UCL Institute of Education, United Kingdom

Development and Validation of Science Self-Efficacy Survey Scales for Short-Term Intervention
Mikkel Bergqvist*, LIFE Foundation, Denmark

Comparing the Draw A Scientists-Test with the Closed Views of Scientists, their Activities, and Locations-Instrument
Bianca Reinisch*, University of Potsdam, Germany
Moritz Krell, Leibniz Institute for Science and Mathematics Education, Germany
Charlotte Schramme, Freie Universität Berlin, Germany
Petra Skiebe-Corrette, Freie Universität Berlin, Germany

Applying Rasch Model to Validate the Instrument of Student Attitudes Toward Stem (S-Stem)
Yueying Shi*, Xingyao Campus Yunnan University Secondary School, China
Xiaoming Zhai, University of Georgia, USA
Shuchen Guo*, Nanjing Normal University, China
Enshan Liu, Beijing Normal University, China

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
Critical Perspectives on Engineering Identities: Questioning Ideologies and Epistemologies
19-Mar-24, 8:15 AM-9:45 AM
Location: Governor’s Square 14
Economic Motivations for the Pursuit of STEM Careers: Implications for Inclusion and Justice
Christopher Irwin*, Florida International University, USA
Zahra Hazari*, Florida International University, USA
Remy Dou, Florida International University, USA
Philip Sadler, Harvard University, USA
Gerhard Sonnert, Harvard University, USA

A Systematic Literature Review of Survey Research on Engineering Identity
Amdad Ahmed Awsaf*, Florida International University, USA
Heidi Cian, MMSA, USA
Remy Dou, Florida International University, USA

An Intersectional, Longitudinal Analysis of Latiné Girls’ Critical Consciousness
Summer Blanco*, University of Georgia, USA
Jessica Ortega, University of Georgia, USA
Tatiane Russo-Tait, University of Georgia, USA

Strand 11: Cultural, Social, and Gender Issues
Symposium
Working on Equity in Science Education Across Places and Spaces
19-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 3

Working on Equity in Science Education Across Places and Spaces
Henriette Holmegaard*, University of Copenhagen, Denmark
Lucy Avraamidou, University of Groningen, Netherlands
Cristiano Moura*, Simon Fraser University, Canada

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set
Technology for Science Learning 2
19-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 5

The Effect of Working Memory Capacity on Multimedia Learning
Do Hyong Koh*, University of Florida, USA
Muhammad Rahman, University of Florida, USA
Christine Wusylko, University of Florida, USA
Priyadharshini Prasad, University of Florida, USA
Xiaoman Wang, University of Florida, USA
Kara Dawson, University of Florida, USA
Marc Pomplun, University of Massachusetts Boston, USA
Jonathan Martin, University of Florida, USA
Albert Ritzhaupt, University of Florida, USA
Pasha Antonenko, University of Florida, USA

Felicia Mensah*, Columbia University, USA
Louise Archer*, University College London, United Kingdom
Natalie King*, Georgia State University, USA
Lene Madsen, University of Copenhagen, Denmark
Christina Siry*, University of Luxembourg, Luxembourg
Betzabe Torres Olave, University of Leeds, United Kingdom
Zahra Hazari, Florida International University, USA
Laura Peña-Telfer*, Georgia State University, USA
Mi’Kayla Newell*, Georgia State University, USA
Examining Networked Participation Patterns within an Online Community Science Project
Richard Bex*, Illinois State University, USA

3D Plants: Integrating Science, Technology, and Design in STEAM+Ag Education Using Emergent Technologies
Sandra Arango-Caro*, Donald Danforth Plant Science Center, USA
Kaitlyn Ying, Donald Danforth Plant Science Center, USA
Michelle Arellano Haberberger, Saint Louis Public Schools, USA
Tiffany Langewisch, Donald Danforth Plant Science Center, USA
Nathaniel Ly, Donald Danforth Plant Science Center, USA
Kristine Callis-Duehl, Donald Danforth Plant Science Center, USA

Using Scanning Electron Microscopy for Exploring Dental Erosion in Middle-school
Bat-Shahar Dorfman*, Weizmann Institute of Science, Israel
Anat Yarden, Weizmann Institute of Science, Israel

Is Virtual Reality an Effective Instructional Tool for Learning Anatomy and Physiology?
Carmen Carrion*, Agnes Scott College, USA
Rocio Campo-Paz, Agnes Scott College, USA
Nathan Hutcheson, Agnes Scott College, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science SC-Organized Paper Set
Socioscientific Issues and Implications
19-Mar-24, 8:15 AM-9:45 AM
Location: Plaza Court 2

Promoting College Students’ Resistance to Misinformation Through SSI Instruction
Sarah Poor*, Texas A&M University, USA
Benjamin Herman*, Texas A&M University, USA
Tamara Powers, Texas A&M University, USA

Beliefs in Conspiracy Theories and in the Scientific Facts About COVID-19
Anastasia Melagonitou, National and Kapodistrian University of Athens, Greece
Apostolia Galani, National and Kapodistrian University of Athens, Greece
Constantine Skordoulis, National and Kapodistrian University of Athens, Greece
Martha Georgiou, National and Kapodistrian University of Athens, Greece
Nausica Kapsala, National and Kapodistrian University of Athens, Greece
Evangelia Mavrikaki*, National and Kapodistrian University of Athens, Greece

The Contextualization of Socioscientific Issues in an Age of Accountability
Karrie Wikman*, University of South Florida, USA

What are the Views of Scientists’ and News’ on Nature of Science in COVID-19
Xiao Huang*, College of Education, Zhejiang Normal University, China
Cheng Ding, College of Education, Zhejiang Normal University, China
Zhuang Zheng, Zhejiang Normal University, China
Strand 14: Environmental Education and Sustainability

Related Paper Set

**Educating in the Climate Crisis: Contextualizing Climate Change Understanding by Humanizing Pedagogy**

19-Mar-24, 8:15 AM-9:45 AM
Location: Directors Row I

*The Landscape of Elementary Climate Change Curriculum in Nations Across the Globe*

Shweta Lahiri*, University of Georgia, USA
Emily Adah Miller*, University of Georgia, USA
Hong Tran, University of Georgia, USA
Ajay Sharma, University of Georgia, USA
Julie Luft, University of Georgia, USA
Joseph DeLuca, University of Georgia, USA
Elizabeth French, University of Georgia, USA

*Climate Change as an Entry Point for Justice-Centered Ambitious Science Teaching*

Hannah Cooke*, University of Connecticut, USA

Research in Artificial Intelligence-Involved Science Education (RAISE) Sponsored Session

**Research in Artificial Intelligence-involved Science Education Poster Session**

19-Mar-24, 10:00 AM-11:30 AM
Location: Governor's Square 10

*Research in Artificial Intelligence-involved Science Education Poster Session*

ORGANIZERS
Xiaoming Zhai, University of Georgia, USA
Kent Crippen, University of Florida, USA

PANELISTS
Gyeong-Geon Lee Lee, University of Georgia, USA
Marcus Kubsch, Freie Universität Berlin, Germany
Christina Krist, University of Illinois at Urbana-Champaign, USA
Jamie Mikeska, ETS, USA
Geeta Verma, University of Colorado Denver, USA
Ashis Biswas, University of Colorado Denver, USA
Jennie Shin, University of Florida, USA

Mapping Local Knowledge of Landscape, Nature, Climate, and History to Humanize Climate Data

Heather Killen*, University of Maryland, USA

Enacting Multispecies Care Through Engineering Design

Veronica Cassone McGowan*, University of Washington Bothell, USA
Awards Committee
Sponsored Session
**A Celebration of NARST Award Recipients: Distinguished Contributions to Research Award [DCRA]**
19-Mar-24, 10:00 AM-11:30 AM  
Location: Governor’s Square 15

A Celebration of NARST Award Recipients: Distinguished Contributions to Research Award [DCRA]  
**ORGANIZERS**  
Amelia Gotwals, Michigan State University, USA

**PANELISTS**  
Xiufeng Liu, University at Buffalo, USA

Indigenous Science Knowledge (ISK-RIG)
Sponsored Session
**Embedding Indigenous Science Knowledge and Ways of Knowing to Promote Biocultural Diversity and Sustainability**
19-Mar-24, 10:00 AM-11:30 AM  
Location: Governor’s Square 16

Embedding Indigenous Science Knowledge and Ways of Knowing to Promote Biocultural Diversity and Sustainability

**ORGANIZERS**  
Julie Robinson, University of North Dakota, USA  
Sharon Nelson-Barber, WestEd, San Francisco, CA, USA

**PANELISTS**  
Bhaskar Upadhyay, University of Minnesota, USA  
Dana Zeidler, University of South Florida, USA  
Michelle Kooman, Gustavus Adolphus College, USA  
Julie Robinson, University of North Dakota, USA  
David Owens, University of Montana, USA  
Jared Tenbrink, University of Michigan – Ann Arbor, USA  
Pauline Chinn, University of Hawai‘i at Mānoa, USA  
Stacy Potes, University of Hawai‘i at Mānoa, USA  
David Zandvliet, Simon Fraser University, Canada  
Joshua Hunter, University of North Dakota, USA

Strand 1: Science Learning: Development of student understanding
SC-Organized Paper Set
**Advancing Science Learning Through Innovative Instructional Approaches**
19-Mar-24, 10:00 AM-11:30 AM  
Location: Directors Row E

Advancing Equitable Science Education: Meta-synthesis on Addressing Needs of Refugee Children in the Science Classroom  
Shukufe Rahman*, Indiana University, USA  
Arya Karumanthra*, Indiana University, USA  
Gayle Buck, Indiana University, USA

Enhancing Repeating Grade 12 Students Conception of Life Science Concepts using Dialogical Argumentation  
Frikkie George*, Cape Peninsula University of Technology, South Africa
A Systematic Literature Review of Scientific Uncertainty at the Pedagogical Level
Carlos Meza-Torres*, Arizona State University, USA
Ying-Chih Chen, Arizona State University, USA
Jongchan Park, Arizona State University, USA

Exploratory and Confirmatory Factor Analyses of an Uncertainty Management for Productive Struggle Scale
Jongchan Park*, Arizona State University, USA
Emily Starrett*, Arizona State University, USA
Carlos Meza-Torres*, Arizona State University, USA
Ying-Chih Chen*, Arizona State University, USA
Michelle Jordan*, Arizona State University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions Symposium
Disrupting Epistemic and Ontological boundaries of doing science and producing science knowledge in K-12 classrooms
19-Mar-24, 10:00 AM-11:30 AM
Location: Governor's Square 11

Strand 3: Science Teaching — Primary School (Grades preK-6):
Characteristics and Strategies
SC-Organized Paper Set
Disciplinary Literacies and Science and Engineering Practices
19-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 4

Teachers' Enactment of Disciplinary Literacy in Elementary Science Instruction
Melissa Mendenhall*, Utah State Board of Education, USA
Colby Tofel-Grehl, Utah State University, USA
Kimberly Lott, Utah State University, USA
Elementary Teacher Background and Confidence in Science Content, Crosscutting Concepts, and Science and Engineering Practices
Laura Longo*, SUNY Stony Brook, USA
Angela Kelly, SUNY Stony Brook, USA

Examining Elementary Preservice Teachers’ Initial Abilities to Engage in Asking Investigation Questions about Three-Dimensional Scenarios
Anna Maria Arias, Kennesaw State University, USA
Soon Lee*, Kennesaw State University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12):
Characteristics and Strategies
SC-Organized Paper Set
Developing Student Interest and Science Identities
19-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 1

Social and Emotional Skills and High School Junior Students’ STEM Major Selection and GPA Scores
Adam Sahin*, Harmony Public Schools, USA
Hersh Waxman, Texas A&M University, USA
Daijazi Tang, University of Houston, USA

Middle School Students’ Science Career Interests Improve with School Garden and STEAM Projects Elective Course
Michelle Parslow*, Utah State University, USA
Katherine Vela*, Utah State University, USA
Rita Hagevik, University of North Carolina-Pembroke, USA
Kathy Trundle, Utah State University, USA
Laura Wheeler, Brigham Young University, USA

Bearing Witness During Community Science Data Talks: Small-Scale Stretches Towards Justice Oriented Teaching
Imogen Herrick*, University of Kansas, USA
Michael Lawson, Kansas State University, USA

Cultivating science identity: An Automated Table-top Greenhouse Project with Middle School Students
Sheikh Ahmad Shah*, Boston College, USA
Daniel Raphael, Boston College, USA
Jaai Phatak, Boston College, USA
Avneet Hira, Boston College, USA
Helen Zhang, Boston College, USA
Mike Barnett, Boston College, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Addressing Bias and Equity in STEM
19-Mar-24, 10:00 AM-11:30 AM
Location: Governor’s Square 17

Analyzing, Critiquing, and Reimagining Diversity, Equity, and Inclusion Statements
Max Sherard*, Southern Methodist University, USA
Tatiane Russo-Tait*, University of Georgia, USA

Teaching More Than Facts: A Systematic Approach for Detecting Bias in Scientific Communications
Felicity Crawford, Boston University, USA
Mae Rose Gott, Boston University, USA
Adam Labadorf*, Boston University, USA
Melisa Osborne, Boston University, USA
Thomas McKenna*, Boston University, USA
Theresa Rüger, Newcastle University, United Kingdom
Barkha Shah, Boston University, USA

Examining Equitable, Student-Centered STEM Undergraduate Instruction Across Three U.S. Institutions
Dustin Van Orman*, Western Washington University, USA
Dan Hanley*, Western Washington University, USA
Josie Melton*, Western Washington University, USA
Abbey Gray*, Western Washington University, USA
Makayla Wilson*, Western Washington University, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Critical Thinking to Support Teaching and Learning
19-Mar-24, 10:00 AM-11:30 AM
Location: Directors Row H

A Complex Systems Analysis of a Preservice Elementary Teacher’s Physical Computing Design
Gozde McLaughlin*, Penn State University, USA
Amy Voss Farris, Penn State University, USA

Designing to Foster Play in Preservice Elementary Teachers’ Science Learning
Amy Farris*, Penn State University, USA
Anna Kim, Penn State University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
Subject Specific Professional Development for Science Teachers
19-Mar-24, 10:00 AM-11:30 AM
Location: Governor’s Square 12

Exploring a Professional Development Program Focused on Environmental Health Sciences for Middle School Teachers
Andrea Dexheimer*, Southern Illinois University Edwardsville, USA
Jennifer Zuercher, Southern Illinois University Edwardsville, USA
Carol Colaninno, Emory University, USA
Charlie Blake, Southern Illinois University Edwardsville, USA
Ben Greenfield, University of Southern Maine, USA
Candice Johnson, Southern Illinois University Edwardsville, USA
Georgia Bracey, Southern Illinois University Edwardsville, USA
Sharon slockey@siue.edu, Southern Illinois University Edwardsville, USA

Camp Conservation: A Teacher Professional Development Program to Promote Conservation Action
Karen Hays*, Denver Zoological Foundation, USA
Emily Peterson, Denver Zoological Foundation, USA
Luis Vasquez, Denver Zoological Foundation, USA
Angela Moss-Barber, Denver Zoological Foundation, USA
Nichole Nageotte*, Denver Zoological Foundation, USA
Shelby McDonald, Denver Zoological Foundation, USA
Rachel Dickler, Denver Zoological Foundation, USA

*Making Sense of Complex Genetics Together: A Science Teacher’s Organizational Sensemaking During Co-Design.

Sara Porter*, University of North Carolina at Greensboro, USA

Hilleary Osheroff, Exploratorium, USA

White Board Speed-Dating in Physics Teacher Professional Development

Maggie Mahmood*, University of Illinois at Urbana-Champaign, USA

Devyn Shafer, University of Illinois at Urbana-Champaign, USA

Hamideh Talafian*, University of Illinois at Urbana-Champaign, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
Teaching and Learning Focused on Emerging Technologies
19-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 6

Professional Development for Improving Precollege Teachers’ Attitudes Towards Teaching Quantum Information Science and Technology

Michele Darienzo*, Stony Brook University, USA

Angela Kelly, Stony Brook University, USA

Tzu-Chieh Wei, Stony Brook University, USA

Dominik Schneble, Stony Brook University, USA

Essential Elements of Technology Mediated Lesson Study (TMLS) Cycles: A Study with Rural Science Teachers

Clara Smith*, Brigham Young University, USA

Heather Leary, Brigham Young University, USA

Michelle Hudson, Brigham Young University, USA

Max Longhurst, Utah State University, USA

Rebecca Sansom, Brigham Young University, USA

Supporting Teacher Learning for K-12 Quantum Teaching & Learning

Nancy Holincheck*, George Mason University, USA

Tiffany Butler*, George Mason University, USA

Michele Colandene, George Mason University, USA

Jessica Rosenberg, George Mason University, USA

Ben Dreyfus, George Mason University, USA

Mia Russell, George Mason University, USA

Arion Mitchell, George Mason University, USA

Teachers’ Engaging in Systems Thinking through Game Design: A Teacher Professional Development Program

Michael Cassidy, TERC, USA

Gillian Puttick*, TERC, USA

Debra Bernstein, TERC, USA

Santiago Gasca, TERC, USA

Strand 10: Curriculum and Assessment
Related Paper Set
Deconstructing the Three Dimensions of Science Learning in Assessment
19-Mar-24, 10:00 AM-11:30 AM
Location: Directors Row J
Applying the Construct Mapping Approach to Three Dimensional Assessment
Mark Wilson*, UC, Berkeley, USA
Linda Morell, UC, Berkeley, USA

Assessing Student Progress for the Crosscutting Concept of Patterns
Kristin Gunckel*, University of Arizona, USA
Malissa Hubbard, University of Arizona, USA
Sean Tan, University of California, Berkeley, USA

Assessing Students’ Proficiency in Argumentation Across Three Scientific Domains: Physical, Life and Earth Science
Anna MacPherson*, American Museum of Natural History, USA
Mingfeng Xue, University of California, Berkeley, USA

How Teachers Use Results From Three Dimensional Tasks to Inform Their Practice
Linda Morell*, University of California, USA
Sara Dozier*, California State University, USA

Matheus dos Santos Barbosa da Silva*, University of São Paulo, Brazil
Ana Kasseboehmer, University of São Paulo, Brazil

Complicating Identity and Representation in the Elementary STEM Classroom
Sheila Castro*, University of Florida, USA
Amy Christensen, University of Florida, USA
May Steward*, University of Florida, USA
Julie Brown*, University of Florida, USA
Ebony Terrell Shockley, University of Maryland, USA
Chonika Coleman King, University of Florida, USA

Understanding to Unlearn: Implications of Unconscious Bias in STEM Teaching and Learning
Uchenna Emenaha Miles*, University of Texas at San Antonio, USA
Ian Thacker, University of Texas at San Antonio, USA
Samantha Leihsing, University of Texas at San Antonio, USA

Views About Social Justice in Science Education Among Academic Staff Responsible for Initial Teacher Education
Michael Reiss*, UCL, United Kingdom
Wilton Lodge, UCL, United Kingdom
Marian Mulcahy, UCL, United Kingdom

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
Recognition, Representation, and Responsibility: Social Justice in STEM Education
19-Mar-24, 10:00 AM-11:30 AM
Location: Governor’s Square 14

A Social Justice Lens to Investigate the Institutional Nature of Recognition in Science

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
Transnational Lenses: Refusing Deficit Portrayals and Recognizing Diasporic Identities
19-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 3
Challenges and Opportunities to Navigate Identities in STEM: A Case for a Black Immigrant TA
Sule Aksoy*, CUNY Graduate Center, USA

(Re)conceptualizing Culturally Responsive STEM in US Schools: Including Voices of Black Immigrant Students
Chonika Coleman-King, University of Florida, USA
Takeshia Pierre*, University of Florida, USA
Kenesma John, University of Florida, USA
Mercedes Machado, University of Florida, USA
Taryrn Brown, University of Florida, USA
Hyunyi Jung, University of Florida, USA
Koree Badio, University of Florida, USA

The Role of Culture and Socialization on South Asian Women’s Pursuit of STEM Education
Kinza Shaukat*, University of Western Ontario, Canada
Anton Puvirajah, University of Western Ontario, Canada

Strand 12: Technology for Teaching, Learning, and Research
Related Paper Set
Leveraging Embodied Cognition Using Virtual Reality in Middle School Science Education
19-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 5

Co-Designing a Science Lesson with VR in Middle School Science
Eduardo Estrada-Rosado*, Wake County Public School System, USA
Tyler Harper-Gampp, North Carolina State University, USA
Cesar Delgado, North Carolina State University, USA

Ruth Mathenge, North Carolina State University, USA
Matthew Peterson, North Carolina State University, USA
Karen Chen, North Carolina State University, USA
Linfeng Wu, North Carolina State University, USA

Impact of VR Science Lesson on Students’ Knowledge of Scale
Cesar Delgado*, North Carolina State University, USA
Tyler Harper-Gampp, North Carolina State University, USA
Ruth Mathenge, North Carolina State University, USA
Matthew Peterson, North Carolina State University, USA
Karen Chen, North Carolina State University, USA

Student Impressions about a VR Science Lesson
Tyler Harper-Gampp*, North Carolina State University, USA
Cesar Delgado, North Carolina State University, USA
Matthew Peterson, North Carolina State University, USA
Karen Chen, North Carolina State University, USA
Ruth Mathenge, North Carolina State University, USA
Karen Chen, North Carolina State University, USA

Impact of a VR Science Lesson on Reform-Oriented Nature of Science Instruction
Ruth Mathenge*, North Carolina State University, USA
Robert Kulasingam, North Carolina State University, USA
Cesar Delgado, North Carolina State University, USA
Matthew Peterson, North Carolina State University, USA
Karen Chen, North Carolina State University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set
Information Engagement
19-Mar-24, 10:00 AM-11:30 AM
Location: Plaza Court 2

The Inevitably Social Nature of Public Engagement With Science: Epistemic Networks and Science Education
Ayelet Baram-Tsabari, Technion - Israel Institute of Technology, Israel
Noah Weeth Feinstein*, University of Wisconsin-Madison, USA

“Placebo works wonders.” – Chinese and German Biology Students’ Beliefs about Alternative Medicine and Evidence-based Medicine
Elvira Schmidt*, Justus-Liebig-University, Germany
Jing Jin, Stockholm University, Sweden
Shu-Nu Chang-Rundgren, Stockholm University, Sweden
Kerstin Kremer, Justus-Liebig-University, Germany

"We’re Putting All Our Trust Into What He’s Saying": Students’ Evaluations of Science (Dis)Information
Daniel Pimentel*, University of Alabama, USA

Educating Future STEM Professionals through Misinformation/Disinformation Responsive Instruction

Benjamin Herman*, Texas A&M University, USA
Sarah Poor, Texas A&M University, USA
Aaron Kidd, Texas A&M University, USA
Daniel De Jesús, Texas A&M University, USA
Davis Varghese, Texas A&M University, USA
Michael Clough, Texas A&M University, USA
Asha Rao, Texas A&M University, USA

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set
Science as Civic Learning in K-12 System
19-Mar-24, 10:00 AM-11:30 AM
Location: Directors Row I

Youth Civic Engagement for the Environment and Sustainability
Ailee Odom, University of Florida, USA
Megan Ennes*, University of Florida, USA
Martha Monroe, University of Florida, USA
Exploring the Intersection of Civic and Science Outcomes: The Heat Island Task
Dante Cisterna*, ETS, USA
Karen Quintero, ETS, USA

Environmental Education in the Classroom: Selected Early-Career Teachers’ Experiences Navigating Pre-service and In-service Activity Systems
Sarah Nuss*, William & Mary, USA

Lunch Break - See the City!
19-Mar-24, 11:30 AM-2:30 PM
Location: Off Site
Awards Committee
Sponsored Session
A Celebration of Early Career Research Award [ECRA], Outstanding Dissertation Research Award [ODRA], and NARST Fellows
19-Mar-24, 2:30 PM-4:00 PM
Location: Governor’s Square 15

A Celebration of Early Career Research Award [ECRA], Outstanding Dissertation Research Award [ODRA], and NARST Fellows

ORGANIZERS
Amelia Gotwals, Michigan State University, USA

PANELISTS
Lama Jaber, Florida State University, USA
Julia Plummer, Penn State University, USA
Douglas Larkin, Montclair State University, USA

Strand 1: Science Learning:
Development of student understanding
SC-Organized Paper Set
Complex Systems and Socio Scientific Issues
19-Mar-24, 2:30 PM-4:00 PM
Location: Directors Row E

Exploring Quantitative Reasoning
Through Computational Modeling of a Socio-Scientific Issue
Laura Zangori*, University of Missouri, USA
Zhen Xu*, University of North Carolina, USA
Troy Sadler*, University of North Carolina, USA
Swarna Mahapatra*, University of Missouri, USA

Identifying Building Blocks and Misconceptions: Exploring Undergraduates’ Perceptions of Decentralization and Stochasticity in Complex Systems
Lin Xiang*, University of Kentucky, USA
Hunter Chandler*, Bluegrass Community & Technical College, USA

Exploring System Dynamics of Complex Societal Issues Through Socio-Scientific Models
Li Ke*, University of Nevada, Reno, USA
Eric Kirk, University of North Carolina at Chapel Hill, USA
Rebecca Lesnieszky, University of North Carolina at Chapel Hill, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA

Exploring Students’ Certainty of Assumptions About Socioscientific Issues
Jenny Dauer*, University of Nebraska-Lincoln, USA
Asghar Gill*, University of Nebraska-Lincoln, USA
Caitlin Kirby, Michigan State University, USA
Amanda Sorensen, Michigan State University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Discourse and Argumentation
19-Mar-24, 2:30 PM-4:00 PM
Location: Governor’s Square 11

Students’ Interest in Science: Influence of Students’ Brain Type
Julia Welberg*, University of Münster, Germany
Daniel Laumann, University of Münster, Germany
Susanne Heinicke, University of Münster, Germany

Exploring Speech and Listening Characteristics of Elementary Teachers in Generative Science Classrooms
Ercin Sahin, University of Iowa, USA
Zeynep Mentesoglu*, University of Iowa, USA
Jee Suh, University of Alabama, USA
Brian Hand, University of Iowa, USA
Gavin Fulmer, University of Iowa, USA

Grade 8 Students’ Argumentation about Scientific vs Socio-Scientific Issues
Ihsan Ghazal*, Texas Christian University, USA
Saouma Boujaoude, American University of Beirut, Lebanon
Hayat Hokayem, Texas Christian University, USA

Evidence of Global Thinking in Students’ Socioscientific Issues Discourse
Mary Short*, The George Washington University, USA

Evolving Argumentation Goals And Shifting Discourse Moves: Tracing The Work Of One Middle School Student
Harini Krishnan*, University of Utah, USA
Lama Jaber, Florida State University, USA
Sherry Southerland, Florida State University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set
Inclusive Teaching Practices
19-Mar-24, 2:30 PM-4:00 PM
Location: Directors Row I

Strategies to Support Multilingual Learners Engaging in Science Practices
Collins Moga*, University of Massachusetts Dartmouth, USA
Stephen Witzig, University of Massachusetts Dartmouth, USA

Using Culturally and Linguistically Responsive Teaching to Promote Students’ Engagement in Science and Engineering Practices
Hada Herring*, University of Florida, USA
Amber Deig, University of Florida, USA
Julie Brown*, University of Florida, USA
Mark Pacheco, University of Florida, USA

Game On: Facilitating Students’ Interest in Gaming as a Vehicle for Science Learning
Justice Ejike*, Georgia State University, USA
Natalie King, Georgia State University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Innovations in Teaching and Analysis Strategies
19-Mar-24, 2:30 PM-4:00 PM
Location: Governor’s Square 17
Using Natural Language Processing to Analyze Students’ Problem-Solving Strategy Essays
Winter Allen*, Purdue University, USA
Jeremy Munsell, Purdue University, USA
Carina Rebello, Toronto Metropolitan University, Canada
Sanjay Rebello, Purdue University, USA

Navigating the New Frontier: Testing an Approach for Enhancing AI Awareness Among Non-STEM Undergraduates
Rebecca Zulli*, Cynosure Consulting LLC, USA
Adrienne Smith, Cynosure Consulting LLC, USA
Sambit Bhattacharya, Fayetteville State University, USA
Xiaochen Hu, Fayetteville State University, USA
Zahra Shekarkhar, Fayetteville State University, USA

Johnstone’s Triangle as a Lens for Teaching With Case Studies in Undergraduate Classrooms.
Ally Hunter*, University of Massachusetts, USA
Melissa Zwick*, Stockton University, USA

Analyzing How Supplemental Instruction Impacts Student Motivation in an Introductory Organic Chemistry Course for Non-Majors
Michael Guyot*, University of Florida, USA
Samantha Hsu*, University of Central Florida, USA
Javlon Nizomov, University of Florida, USA
Pavlo Antonenko*, University of Florid, USA
Stefanie Habenicht, University of Florida, USA

Using fictionalized student dialogues to investigate students’ exploration of alternative perspectives
Thanh Le*, Western Washington University, USA
Carolina Alvarado, California State University, Chico, USA
Andrew Boudreau, Western Washington University, USA
Jayson Nissen, Nissen Education Research and Design, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Supporting and Exploring What it Means to Teach in Equitable Ways 19-Mar-24, 2:30 PM-4:00 PM
Location: Plaza Court 4

Expanding Pre-Service Teachers’ Anti-Deficit Noticing Abilities Using an Iterative Classroom Design
Alison Mercier*, University of Wyoming, USA
David Steele*, Alder Graduate School of Education, USA
Tierney Hinman, Auburn University, USA

Supporting Equitable Noticing in Elementary Science Methods Courses
Ashlyn Pierson*, The Ohio State University, USA
Andrea Henrie*, Vanderbilt University, USA
Mutia Syifa*, The Ohio State University, USA
Teo Keifert*, University of North Texas, USA
Sophia Jeong*, The Ohio State University, USA
Heather Johnson*, Vanderbilt University, USA
Bethany Daniel, Vanderbilt University, USA
Sarah Lee*, Vanderbilt University, USA
Indonesia Teacher Candidates’ Noticing and Navigating Equitable Sense-making in Teaching Physics Classrooms  
Mutiara Syifa*, The Ohio State University, USA 
Lin Ding*, The Ohio State University, USA

Exploring Preservice Teachers’ Perspectives on Equity in Science Education in an Equity-focused Science Methods Course  
Wanjoo Ahn*, Michigan State University, USA 
Christina Schwarz, Michigan State University, USA

Strand 7: Pre-service Science Teacher Education  
SC-Organized Paper Set  
Systematic Reviews in Science Teacher Education  
19-Mar-24, 2:30 PM-4:00 PM  
Location: Plaza Court 5

A Systematic Literature Review of Science Methods Instructors’ Pedagogical Practices  
Syahrul Amin*, Texas A&M University, USA 
Joanne Olson*, Texas A&M University, USA

Systems Thinking in Science Teacher Education: A Systematic Review  
Samia Khan*, University of British Columbia, Canada 
Moritz Krell*, IPN – Leibniz Institute for Science and Mathematics Education, Germany

Promoting a Healthy Stress Response: A Systematic Review of Using Mindfulness with Pre-Service Teachers

Anne Levendusky*, University of Florida, USA

Strand 8: In-service Science Teacher Education  
SC-Organized Paper Set  
Growing and Supporting District and Teacher Leadership  
19-Mar-24, 2:30 PM-4:00 PM  
Location: Governor’s Square 12

Initial Growth of Inclusive Knowledge and Leadership Practices by Science Education Teacher-Leaders  
Elizabeth Lewis*, University of Nebraska-Lincoln, USA 
Elizabeth Hasseler, University of Nebraska-Lincoln, USA 
Rachel Benzoni, University of Nebraska-Lincoln, USA 
Gina Matkin, University of Nebraska-Lincoln, USA

Exploring the Formative Experiences of District Science Coordinators  
Khushbu Singh*, Clemson University, USA 
Jennifer Bateman, Clemson University, USA 
Meredith Schwendemann, Clemson University, USA 
Brooke A. Whitworth, Clemson University, USA

Exploring District Science Coordinators’ Learning  
Brooke Whitworth*, Clemson University, USA 
Jennifer Bateman, Clemson University, USA 
Meredith Schwendemann, Clemson University, USA 
Khushbu Singh, Clemson University, USA 
Hatice Ozen, University of Georgia, USA 
Ashley Hunter, Clemson University, USA
**Julie Luft**, University of Georgia, USA

*Contributions of Race on a STEM Teacher Leader’s Self-Efficacy, Agency, Values, and Teacher Leadership*

**Damaries Blondonville-Ford**, Morgan State University, USA

**Diana Cheng**, Towson University, USA

**Derrick Grubb**, Morgan State University, USA

**Justin Leonard**, Prince Georges' County Public Schools, USA

**Xiaoyin Wang**, Towson University, USA

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**Strand 8: In-service Science Teacher Education**

**SC-Organized Paper Set**

*Investigating and Supporting STEM Teaching and Learning*

19-Mar-24, 2:30 PM-4:00 PM

Location: Directors Row H

*Evaluation of a National Training Program of STEM-based Competencies in Oman*

**Mohamed Shahat**, Sultan Qaboos University, Oman

**Sulaiman Al Balushi**, Sultan Qaboos University, Oman

**Marwa Alhinai**, Ministry of Education, Oman

**Mahmoud Amer**, Sultan Qaboos University, Oman

**Nabil Alhabsi**, Ministry of Education, Oman

**Khoula Alhosni**, Sultan Qaboos University, Oman

**Amur Al-Yahmedi**, Sultan Qaboos University, Oman

**Mohammed Al-Amri**, Sultan Qaboos University, Oman

**Sameh Ahmed**, Sultan Qaboos University, Oman

**Ehab Omara**, Sultan Qaboos University, Oman

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**Exploring Physics Teachers' Resource Networks in Technology-Enhanced Learning Environments**

**Jaika Hott**, IPN - Leibniz Institute for Science and Mathematics Education, Germany

**Stefan Sorge**, IPN - Leibniz Institute for Science and Mathematics Education, Germany

**Marcus Kubsch**, FU Berlin, Germany

**Knut Neumann**, IPN - Leibniz Institute for Science and Mathematics Education, Germany

*From Design to Practice: Secondary Science Teachers’ Reflections on an Integrated STEM Observation Protocol*

**Emily Dare**, Louisiana State University, USA

**Joshua Ellis**, Louisiana State University, USA

**Chris Irwin**, Florida International University, USA

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**Strand 10: Curriculum and Assessment**

**SC-Organized Paper Set**

*Assessments Informing Instructional Practices*

19-Mar-24, 2:30 PM-4:00 PM

Location: Directors Row J

*Developing Instructionally Relevant Assessments in Middle School Chemistry*

**Katherine Lazenby**, NWEA, USA

**Gavin Fulmer**, NWEA, USA

**Yon Soo Suh**, NWEA, USA

**Rob Howard**, NWEA, USA

**Alexis Prijoles**, NWEA, USA

**Susan Kowalski**, NWEA, USA

*Rethinking the Design of 3D Elementary Assessments: Considering the Role of Language in Science Learning*
Alison Billman, University of California, Berkeley, USA
Jill Wertheim*, WestEd, USA
Lauren Brodsky, University of California, Berkeley, USA
Christopher Harris, WestEd, USA

Measuring Students 3D Learning and Transfer Using NGSS-Designed Life Science Assessments
Consuelo Morales*, Michigan State University, USA
Jane Lee*, Michigan State University, USA
Emil Eidin*, University of Wyoming, USA
Peng He, Michigan State University, USA
Irene Bayer, Michigan State University, USA

Integrating Curriculum-Independent Science Assessment Tasks into Elementary Teachers’ Instruction
Sania Zaidi, University of Illinois at Chicago, USA
Brian Gane, University of Kansas, USA
Debbie Leslie, University of Chicago, USA
Carla Strickland*, University of Chicago, USA
Jeanne DiDomenico*, University of Chicago, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
Science Teachers’ Perspectives and Practices: Noticing Inequities, Envisioning Social Justice, and Enacting Decolonial Pedagogies
19-Mar-24, 2:30 PM-4:00 PM
Location: Governor’s Square 14

Teachers’ Noticing of Science During Facilitated Equity Debriefs
Linsey Brennan*, Michigan State University, USA

Teaching and Learning Science as Social Justice: Perspectives of Students and Teachers
Katie Wade-Jaimes*, University of Nevada, USA
Maizie Dyess*, University of Nevada, USA
Burak Sahin*, University of Nevada, USA
Colorado Science Education Research
Does “Teaching Science for Social Justice” Change Over Time for Science Teachers?
Jessica Mader*, Colorado State University, USA
Laura Sample McMeeking, Colorado State University, USA
Andrea Weinberg, Arizona State University, USA
Diane Wright, Colorado State University, USA
Madison Scheer, Dawson School, USA
Meena Balgopal, Colorado State University, USA

Culturally Relevant STEM Education in Nigeria: An Exploratory Study of STEM Teacher Ideas About Teaching
Grace Tukurah*, Michigan State University, USA

Strand 14: Environmental Education and Sustainability
Related Paper Set
Frameworks and Considerations for Justice-Oriented, Place-based Learning
19-Mar-24, 2:30 PM-4:00 PM
Location: Governor’s Square 10

Social Justice as Paradigm and Pedagogy
Bryan Brown, Stanford University, USA
Kendra Sobomehin*, Stanford University, USA
Tamara Sobomehin, Stanford University, USA

A Systematic Literature Review of Climate Change Education Studies Using Place-Based Theoretical and Pedagogical Frameworks
Asli Sezen-Barrie*, NSF, USA

Sara Tolbert, University of Canterbury, New Zealand
Sociopolitically-Conscious Science Teaching in the Garden
Christopher Jadallah*, UCLA, USA

Centering Racial Equity and Values-Based Research in Preservice Science Teacher Education in Undergraduate STEM Courses
Carrie Tzou, University of Washington Bothell, USA
Veronica Cassone McGowan*, University of Washington Bothell, USA
Symone Gyles, University of Washington Bothell, USA
Bryan White, University of Washington Bothell, USA
Elizabeth Starks, University of Washington Bothell, USA
Megan Bang, Northwestern University, USA

The Connect-Investigate-Interrogate-Act Framework for Designing and Studying Critical Place-based Learning
Heidi Carlone*, Vanderbilt University, USA
Jingyi Chen*, Vanderbilt University, USA
Hannah Ziegler*, Vanderbilt University, USA
Liwei Zhang, Vanderbilt University, USA
Zachary Conley, Vanderbilt University, USA
Yelena Janumyan, Vanderbilt University, USA
Tessaly Jen, Vanderbilt University, USA
Blaine Smith, Vanderbilt University, USA
Quinn Tanner, Vanderbilt University, USA

Leveraging Place-based Instruction for Climate Justice Education
Amal Ibourk*, Florida State University, USA

Collaboration for Local Sustainability: Indigenous Community Guided
Transformative Science in a High School in Nepal

Aguwa Aguwa, Thakurdwara, Nepal
Bhaskar Upadhyay*, University of Minnesota, USA
Kamal Koirala, Tribhuvan University, Nepal

Supporting Justice-Oriented and Community-Based Environmental Action through Near-Peer Mentorship, Geospatial Technology, & Digital Media Storytelling

Laura Cisneros, University of Connecticut, USA
Todd Campbell*, University of Connecticut, USA
Nicole Freidenfelds, University of Connecticut, USA
Anna Lindemann, University of Connecticut, USA
Heather Elliot-Famularo, University of Connecticut, USA
Cary Chadwick, University of Connecticut, USA
David Dickson, University of Connecticut, USA
Byung-Yeol Park, University of Connecticut, USA


**Poster Session B**
19-Mar-24, 4:15 PM-5:00 PM  
Location: Plaza Foyer

**Strand 1: Science Learning:**  
**Development of student understanding**  
*The Science Teachers’ Perspective on the Disciplinary Core Idea Map of Genetic Variation*  
Helen Semilarski*, University of Tartu, Estonia  
Helin Semilarski, University of Tartu, Estonia

**Strand 1: Science Learning:**  
**Development of student understanding**  
*Student Self-Efficacy: Exploring Anxiety, Career Awareness, and Transversal Skills in Science Education*  
Janari Teessar*, University of Tartu, Estonia  
Miia Rannikmäe, University of Tartu, Estonia  
Regina Soobard, University of Tartu, Estonia  
Jack Holbrook, University of Tartu, Estonia

**Strand 1: Science Learning:**  
**Development of student understanding**  
*Do Students Learn Better When “Thinking Periods” Are Interspersed Within Online Science Lectures?*  
Ella Ofek-Geva*, University of Connecticut, USA  
Sarah Gilmore, University of Connecticut, USA  
Ido Davidesco, University of Connecticut, USA  
Kyra Conville, University of Connecticut, USA

**Strand 2: Science Learning: Contexts, Characteristics and Interactions**  
*Engaging Students in Visualization for an Inclusive Learning Environment*  
Qingna Jin*, Cape Breton University, Canada

**Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies**  
*Preservice Primary Teachers’ Perceptions of STEM-Based Teaching in Natural Sciences and Technology Classrooms*  
Maria Tsakeni*, University of the Free State, South Africa  
Tafirenyika Mafugu, University of the Free State, South Africa  
Loyiso Jita, University of the Free State, South Africa

**Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies**  
*Fostering Sixth-grade Students’ Science Divergent and Convergent Thinking with Augmented Reality*  
Ya-Ting Chuang, Taipei Municipal Taiping Elementary School, Taiwan  
Yu-Ling Lu*, National Taipei University of Education, Taiwan

**Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies**  
*Instructional Strategies that Support Multidimensional, Meaningful, and Equitable Model-Based Teaching: A Systematic Literature Review*  
Grace Carroll*, North Carolina State University, USA

**Mary Kate Coburn**, University of Connecticut, USA  
**Sa’ar Karp Gershon**, -, Denmark
Soonhye Park, North Carolina State University, USA
Matt Reynolds, North Carolina State University, USA
Amanda Hall, North Carolina State University, USA
Laura Chalfant, North Carolina State University, USA
Scott Ragan, North Carolina State University, USA
Jason Painter, North Carolina State University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
Collective PCK of Teachers Using American Sign Language to Teach Science With Deaf Students
Scott Cohen*, Georgia State University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
A New Path to Artificial Intelligence Proficiency: The Impact of CTCA
Racheal Fredrick*, Lagos State University, Nigeria
Esther Peter, Lagos State University, Nigeria
Peter Okebukola, Lagos State University, Nigeria
Juma Shabani, Universite du Burundi, Burundi

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
Impact of Qualitative and Quantitative Characteristics of Students' Solutions when Problem-Solving with Productive Failure
Julia Hiniborch*, Leibniz University Hannover, Germany

Gunnar Friege, Leibniz University Hannover, Germany
Jakob Hoffmann, Leibniz University Hannover, Germany

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
Secondary Science Teachers' pPCK of the Science and Engineering Practices and Their Implementation
Harleen Singh*, California State University Stanislaus, USA
Yuxi Huang, University of Georgia, USA
Hong Tran, University of Georgia, USA
Julie Luft, University of Georgia, USA
Brooke Whitworth, Clemson University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
Pedagogical Content Knowledge of Scientific Online Reasoning: An Exploratory Case Study
Daniel Pimentel*, University of Alabama, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
Exploring Secondary Science Educators' Knowledge and Experiences with Place-Based Education
Jake Johnson*, University of Nevada, Las Vegas, USA
Merryn Cole*, University of Nevada, Las Vegas, USA
Strand 4: Science Teaching — Middle and High School (Grades 5-12):
Characteristics and Strategies
Toward a Theoretical Framework for Data Fluency Teaching and Learning in Middle School STEM
Nicole Wong*, WestEd, USA
Rasha Elsayed, WestEd, USA
Leticia Perez*, WestEd, USA
Kirsten Daehler*, WestEd, USA
Pai-rou Chen, WestEd, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Wicked Problems and Wicked Solutions: Graduate Students’ Experiences in A Convergent Research Environment
M. Gail Jones*, NCSU, USA
Julianna Nieuwmsa, NCSU, USA
Kathleen Bordewieck, NCSU, USA
Gina Childers, NCSU, USA
Steve McDonald, NCSU, USA
Anna Marshall, University of Illinois, USA
Christine Hendren, App State University, USA
Brooke Mayer, Marquette, USA
John Classen, NCSU, USA
Maude Cuchiara, NCSU, USA

Strand 6: Science Learning in Informal Contexts
Museum Facilitator Understanding of Exhibit Potential for Open-Ended and Interactive Facilitation Encounters
Alexandria Muller*, University of California, Santa Barbara, USA
Ron Skinner, MOXI, The Wolf Museum of Exploration + Innovation, USA
Danielle Harlow, University of California, Santa Barbara, USA

Strand 6: Science Learning in Informal Contexts
Fostering a Sense of Belonging in a Research Immersion Program
Summer Jasper*, St. Jude Children's Research Hospital, USA
Robyn Pannella, St. Jude Children's Research Hospital, USA
Katherine Ayers, St. Jude Children's Research Hospital, USA

Strand 6: Science Learning in Informal Contexts
Cultivating Community and Identity with Latino STEM Undergraduates: Facilitating Science Learning in Family Gardens
Samuel Severance*, Northern Arizona University, USA
Alex Zazueta, University of California, Santa Cruz, USA
Isabella Rubalcava, University of California, Santa Cruz, USA
Samantha Salguera, University of California, Santa Cruz, USA
Alexie Leauthaud, University of California, Santa Cruz, USA

Strand 7: Pre-service Science Teacher Education
Representations, Decompositions, and Approximations: Improving PSETs Lesson
Development through Pedagogies for Teaching Practice  
**David Owens***, University of Montana, USA  
**Kimberly Kirstein**, Georgia Southern University, USA

**Strand 7: Pre-service Science Teacher Education**  
*Exploration of the Use of Teacher Time-Outs to Develop Reflection-In-Action in Preservice Science Teacher Education*  
**Laura Chalfant***, North Carolina State University, USA  
**Matt Reynolds**, North Carolina State University, USA  
**Soonhye Park**, North Carolina State University, USA

**Strand 7: Pre-service Science Teacher Education**  
*Eliciting Preservice Teachers' Content Knowledge for Teaching the Small Particle Model Using Practice-Based Measures*  
**Deborah Hanuscin***, Western Washington University, USA  
**Emily Borda**, Western Washington University, USA  
**Josie Melton***, Western Washington University, USA  
**Jamie Mikeska***, ETS, USA

**Strand 8: In-service Science Teacher Education**  
*Science-Specific Teaching Challenges Among Early Career Science Teachers*  
**Lisa Borgerding***, Kent State University, USA  
**Shannon Navy**, Kent State University, USA  
**Robert Idsardi**, Eastern Washington University, USA  
**Shane Thomas**, Washington State University, USA

**Strand 8: In-service Science Teacher Education**  
*Exploring the Resilience of Early Career and Experienced Teachers Facing an Emerging Crisis*  
**Ella Yonai***, University of Georgia, USA  
**Julie Lu**, University of Georgia, USA  
**Shelley Rap**, Weizmann Institute Of Science, Israel  
**Blonder Ron**, Weizmann Institute Of Science, Israel

**Strand 8: In-service Science Teacher Education**  
*Designing Elementary PD to Promote Science and Engineering Practices*  
**Ryan Cain***, Weber State University, USA  
**Sara Gailey**, Weber State University, USA

**Strand 10: Curriculum and Assessment**  
*Detecting FOCIS Survey with the Partial Credit Model and Rasch Model*  
**Xin Xia***, University of Virginia, USA

**Strand 10: Curriculum and Assessment**  
*Revalidating a Measurement Instrument of Spatial Thinking Ability for Middle School and High School Students*  
**Kannaki Thayaseelan***, University at Buffalo, USA
Yanfang Zhai, Capital Normal University, China
Xiufeng Liu, University at Buffalo, USA

Strand 10: Curriculum and Assessment
Evaluating the Impact of NASA’s STEM Programs on Student Interest, Identity, Self-Efficacy and Skills
Carla Johnson*, NC State University, USA
Janet Walton*, NC State University, USA
Toni May*, Drexel University, USA
Sera Harold*, NC State University, USA

Strand 10: Curriculum and Assessment
Linking Scientific and Engineering Content for the Development of Interdisciplinary STEM Projects
Janne-Marie Bothor*, University of Kassel, Germany
David-Samuel Di Fuccia, University of Kassel, Germany

Strand 11: Cultural, Social, and Gender Issues
Exploring U.S. Graduate Education through the Lens of Self-determination Theory
Karen Collier*, North Carolina State University, USA
Margaret Blanchard, North Carolina State University, USA

Strand 11: Cultural, Social, and Gender Issues
K-12 Science and Mathematics Teachers’ Experiences Supporting Students’ Critical Consciousness: A Descriptive Systematic Review
Sheila Castro*, University of Florida, USA
Julie Brown*, University of Florida, USA
Kent Crippen, University of Florida, USA

Strand 11: Cultural, Social, and Gender Issues
The STEM Pipeline Metaphor: Ineffective, Dehumanizing, and Marginalizing
Christian Glandorf*, New Mexico State University, USA
Claudia Trevino, New Mexico State University, USA
H. Prentice Baptiste, New Mexico State University, USA
Paulette Vincent-Ruz, New Mexico State University, USA

Strand 11: Cultural, Social, and Gender Issues
A Look at the Spectrum of Physics Teacher Identity Among Physics Instructors
Maya Patel*, Michigan State University, USA
Maria Horak, Michigan State University, USA
Clausell Mathis, Michigan State University, USA
Delwrick Nanthou, University of Washington-Bothell, USA

Strand 11: Cultural, Social, and Gender Issues
Examining The Experiences of Students from Underrepresented Populations in STEM Through a Decolonized Pathway Model
Jessica McClain*, Indiana University, USA
Gayle Buck, Indiana University, USA

Strand 11: Cultural, Social, and Gender Issues
All of Us Working Together: Examining Bidirectional Critical Relationality in a Community-Based Informal STEM Program
Ti’Era Worsley*, The University of North Carolina at Greensboro, USA
**Strand 12: Technology for Teaching, Learning, and Research**

*Science Education and Emerging STEM Careers: The Case of Underwater ROV Operators*

Minji Yun, University of Florida, USA
Kent Crippen*, University of Florida, USA

**Strand 12: Technology for Teaching, Learning, and Research**

*Evaluation of Machine Learning Generated Feedback for Concept Maps*

Tom Bleckmann*, Leibniz University Hannover, Germany
Gunnar Friege, Leibniz University Hannover, Germany

**Strand 12: Technology for Teaching, Learning, and Research**

*Core Concepts of Artificial Intelligence in Education Using Robots (AIEDuRo): A Delphi Study*

Divya Baranwal*, Southern Methodist University, USA
Ming Liu, National Dong Hwa University, Taiwan
Richard Duschl, Southern Methodist University, USA

**Strand 12: Technology for Teaching, Learning, and Research**

*Using ArcGIS Online in an Environmental High School Science Classroom*

Jonah Firestone*, Washington State University, USA
Danielle Malone, Washington State University, USA
Sarah Newcomer, Washington State University, USA
Judith Morrison, Washington State University, USA
Lindsay Lightner, Washington State University, USA

**Strand 12: Technology for Teaching, Learning, and Research**

*Developing Digital Education Readiness in Tertiary Education: The STEM Digitalis project*

Argyris Nipyrakis*, University of Groningen, Netherlands
Lucy Avraamidou, University of Groningen, Netherlands
Gunnar Friege, Leibniz University Hannover, Germany
Eilish McLoughlin, Dublin City University, Ireland
Priit Reiska, Tallinn University, Estonia
Dimitris Stavrou, University of Crete, Greece

**Strand 12: Technology for Teaching, Learning, and Research**

*Problem Solving in Physics – Process Data from Eyetracking-Research*

Gunnar Friege*, Leibniz University Hannover, Germany
Alexander Machleid, Leibniz University Hannover, Germany
Sonja Kohlmeier, Leibniz University Hannover, Germany
Tom Bleckmann, Leibniz University Hannover, Germany
André Meyer, Leibniz University Hannover, Germany
Dirk Brockmann-Behnse, Leibniz University Hannover, Germany

**Strand 12: Technology for Teaching, Learning, and Research**

*Lesson Plan to Use ChatGPT in Science Teaching: Lessons from Pre-Service Teachers’ Perspectives*

Cyeong-Geon Lee*, University of Georgia, USA
Xiaoming Zhai, University of Georgia, USA
Strand 13: History, Philosophy, Sociology, and Nature of Science
On Problematizing the Epistemic and Axiological Nexus of Post-Normal Science Education
Hendra Agustian*, University of Copenhagen, Denmark

Strand 13: History, Philosophy, Sociology, and Nature of Science
Comparing Chemists’ Views of the Nature of Science (NOS) With Their Levels of Research Expertise
Tulana Ariyaratne*, Systems Development & Improvement Center, University of Cincinnati, USA
Valarie Akerson, Indiana University, USA
Cathrine Reck, Indiana University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
A framework to Conceptualize Misinformation Literacy in Science Tasks
Dante Cisterna*, ETS, USA
Cheryl Lavigne, ETS, USA

Strand 14: Environmental Education and Sustainability
"Wait, We Get to Build That?" Outcomes of a Co-Created, Classroom Citizen Science Project
Laura Carsten Conner*, University of Alaska, Fairbanks, USA
Nathan Kettle, University of Alaska, Fairbanks, USA
William Simpson, University of Alaska, Fairbanks, USA
Krista Heeringa, University of Alaska, Fairbanks, USA

Strand 14: Environmental Education and Sustainability
Learning About Climate Change – Comparison of Three Instructional Approaches
Sophia Siegmann*, Institute for Didactics of Mathematics and Physics, Physics Education Group, Germany
Gunnar Friege, Institute for Didactics of Mathematics and Physics, Physics Education Group, Germany

SeeMeTeach
Sponsored Session
Teacher Observation Reimagined – Using the SeeMeTeach Observation App
19-Mar-24, 4:15 PM-5:00 PM
Location: Governor’s Square 10

Teacher Observation Reimagined – Using the SeeMeTeach Observation App

ORGANIZER
Craig Berg, SeeMeTeach, USA

Community Training and Assistance Center (CTAC)
Sponsored Session
Integrated PreK-12 STEM as a District-Wide Equity Move
19-Mar-24, 4:15 PM-5:00 PM
Location: Governor’s Square 11

Integrated PreK-12 STEM as a District-Wide Equity Move

ORGANIZER
Scott Reynolds, Community Training and Assistance Center (CTAC), USA
JRST
Social Event
JRST Editors’ Dinner
19-Mar-24, 5:15 PM-6:45 PM
Location: Governor's Square  16

Research Committee
Sponsored Session
Sandra K. Abell Institute for Doctoral
Students Poster Symposium
19-Mar-24, 5:15 PM-6:45 PM
Location: Governor's Square  10

ORGANIZERS
Julianne Wenner, Clemson University, USA
Amelia Gotwals, Michigan State University, USA
Christina Schwarz, Michigan State University, USA
Brooke Whitworth, Clemson University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Engineering, Physics, and Control-of-Variables
19-Mar-24, 5:15 PM-6:45 PM
Location: Plaza Court 6

A Method to Their Madness; Characterizing Early Elementary Children’s Artifact Change During Engineering Design

Christine McGrail*, University of North Dakota, USA

Examining Middle School Students’ Epistemic Practices of Engineering During Small Group Work
Muhammad Purwanto*, University of Minnesota Twin Cities, USA
Gillian Roehrig*, University of Minnesota Twin Cities, USA
Jeann Wieselmann, Southern Methodist University, USA
Ramya Sivaraj, University of Minnesota Twin Cities, USA

Interpreting Graded Problem Solutions: The Inconsistent Messages That Students Receive
J. Caleb Speirs*, University of North Florida, USA
Mark Swartz, University of North Florida, USA
Sarah Nguyen, University of North Florida, USA
W. Brian Lane, University of North Florida, USA

Learning the Control-of-Variables Strategy through Self-Generated and Vicarious Errors
Linda Haemmerle*, University of Vienna, Austria
Shelbi Kuhlmann, University of Memphis, USA
Theresa Krause-Wichmann, Saarland University, Germany
Andrea Moeller, University of Vienna, Austria

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
Related Paper Set

Citizen Science in Elementary Settings: Fostering Engaging, Authentic, and Meaningful Science Learning
19-Mar-24, 5:15 PM-6:45 PM
Location: Plaza Court 2

MothEd - Authentic Science for Elementary and Middle School Students
Peter White*, Michigan State University, USA
Brian Keas, Michigan State University, USA
David Stroupe, The University of Utah, USA

Supporting Elementary Teachers’ Science Instruction through School-Community Partnerships to Design and Teach Locally-Relevant Citizen Science
Lara Gengarelly*, University of New Hampshire, USA
Sameer Honwad, University at Buffalo, USA
Megan Glenn, University of New Hampshire, USA
Erik Froburg, University of New Hampshire, USA
Malin Clyde, University of New Hampshire, USA
Haley Andreozzi, University of New Hampshire, USA

Engaging Elementary School Students in Community and Citizen Science to Support Socio-Ecological Systems Resilience
Shulong Yan*, University of California, Davis, USA
Alexandra Race, University of California, Davis, USA
Heidi Ballard, University of California, Davis, USA
Citizen Science in Elementary Classrooms: A Tale of Two Teachers
Patrick Smith*, Horizon Research, Inc., USA
Sarah Carrier, North Carolina State University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Related Paper Set
Shifting Perspectives: Embracing Systemic Lenses in Discipline-Based Education Research
19-Mar-24, 5:15 PM-6:45 PM
Location: Governor’s Square 11

Drawing Connections Between Macro-Activity Systems and Micro-Interactions: Variation in Learning Assistant Facilitation Practices
Ira Caspari-Gnann*, Tufts University, USA
Nicolette Maggiore, Tufts University, USA
Jessica Karch, Tufts University, USA
Problematizing Effective Learning: What Does It Mean for a Learning Moment to Be Considered Effective?
Jessica Karch*, Tufts University, USA
Ira Caspari-Gnann, Tufts University, USA

When Boundaries become Barriers: Investigating Admission Standards for Chemistry Graduate Programs
Jocelyn Nardo*, The Ohio State University, USA
Beyond Large Enrollments: Cultivating Latine Student Success in Introductory Chemistry through Servingness-Centered Evidence-Based Pedagogies
Paulette Vincent-Ruz*, New Mexico State University, USA
MaryAnn Long, New Mexico State University, USA
Christian Glandorf, New Mexico State University, USA
Taiwo Adesunloye, New Mexico State University, USA

Understanding First-Generation Students’ Experiences: An Asset-Based Approach
Klaudja Caushi*, Boston University, USA
Binyomin Abrams, Boston University, USA

Emergence of Embedded Activity Systems in the Chemistry Laboratory
Clarissa Keen*, Boston College, USA
Hannah Sevian, University of Massachusetts Boston, USA

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set
Effects on informal Science Learning on STEM Career Interests
19-Mar-24, 5:15 PM-6:45 PM
Location: Governor’s Square 12

Virtual and Augmented Reality Enhanced Science Learning and Incorporating Socioscientific Issues in Informal Learning Environment
Sharfun Islam Nancy*, University of South Florida, USA
Dana Zeidler, University of South Florida, USA

Improving High School Students’ Attitudes Towards Quantum Information Science and Technology in a Summer Program
Angela Kelly*, Stony Brook University, USA
Michele Darienzo, Stony Brook University, USA
Tzu-Chieh Wei, Stony Brook University, USA

Dominik Schneble, Stony Brook University, USA

The SEMinal Impact of Out-of-School Science: A Study of Affective Models in Authentic Learning
Ella Yonai*, Weizmann institute of science, Israel
Ron Blonder, Weizmann institute of science, Israel

Profiling International Students in a Science Competition – Insights Regarding Science Education and Promising STEM-Careers
Charlotte Falkenberg*, Leibniz Institute for Science and Mathematics Education, Germany
Ute Harms, Leibniz Institute for Science and Mathematics Education, Germany

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Approaches to Enhance STEM Teaching
19-Mar-24, 5:15 PM-6:45 PM
Location: Plaza Court 4

Enhancing STEM Teaching to Support English Learners
Catherine Lussier*, University of California, Riverside, USA
Melissa Klaib, University of California, Riverside, USA
Jack Eichler, University of California, Riverside, USA
Leslie Bushong, University of California, Riverside, USA

Identity Development of Preservice STEM Teachers After Teaching Practicum
Emine Sahin-Topalcengiz*, Mus Alparslan University, Turkey
Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set
Justice-oriented and Humanizing Practices and Critical Stance Science Teaching Perspectives
19-Mar-24, 5:15 PM-6:45 PM
Location: Directors Row E

Examining Pre-service Teacher’s Humanization of Science through a Research Experience for Teachers
Matthew Adams*, Michigan State University, USA
David Stroupe*, University of Utah, USA

Investigating Secondary Science Preservice Teachers’ Onto-epistemologies as Pathways to Justice-Oriented Science Teaching
Kate Miller*, Michigan State University, USA

“Students Have the Right to Learn Science”: Antiracist Science Teacher Preparation for Elementary Preservice Teachers
Jessica Chen*, Teachers College, Columbia University, USA

Exploring Possibilities for Teaching Science From a Critical Stance Perspective
Elaine Howes*, American Museum of Natural History, USA
Jamie Wallace*, American Museum of Natural History, USA

From Matter to Mattering: Reconstructing Science Methods Courses Towards Emancipatory Pedagogies and Abolitionist Teaching
Vanessa Louis*, University of Michigan, USA

Natalie King*, Georgia State University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set
Attending to Equity and Sociocultural Issues in Science and STEM
19-Mar-24, 5:15 PM-6:45 PM
Location: Governor’s Square 17

Capturing the Nature of SSI Teaching by using the Five-Dimensions Model of Practice
Dury Bayram*, Eindhoven University of Technology, Netherlands
Yael Shwartz*, Weizmann Institute of Science, Israel

Communities of Practice in Support of Urban Elementary Teachers’ Thinking about Critical Pedagogy of Place
Gail Richmond*, Michigan State University, USA
Roberta Hunter, Michigan State University, USA
Tali Tal, Technion Israel Institute of Technology, Israel
Grace Tukurah, Michigan State University, USA

South African Teachers’ Experiences in Positioning Science Education for Equal Access to All Students
Paul Iwuanyanwu*, Northwest University, South Africa
Meshach Ogguniyi, University of the Western Cape, South Africa
“We are better together”: An Equity-Focused, Collaboration-Forward Engineering Professional Development Experience for Middle School Teachers
Gina Svarovsky*, University of Notre Dame, USA
Catherine Wagner*, University of Notre Dame, USA
Shannon McManus, Museum of Science, USA

Preparing Rural Teachers to Design Framework-Aligned Assessment Tasks: Variations in Who Learns and Why
William Penuel*, University of Colorado Boulder, USA
Abraham Lo*, BSCS Science Learning, USA

Fostering Teachers’ Ambitious Teaching Practices for Supporting the Implementation of Performance Assessments in Science
Miray Tekumru-Kisa*, RAND Corporation, USA
Jill Wertheim*, WestEd, USA

Core Practices of Storyline Instruction for Reforming Novice Teacher Education
Sage Andersen*, The University of Texas at Austin, USA
María González-Howard, The University of Texas at Austin, USA

Strand 8: In-service Science Teacher Education Related Paper Set
Designing Teacher Learning for Promoting 3D Instruction and Assessment
19-Mar-24, 5:15 PM-6:45 PM
Location: Governor's Square 15

Leveraging a School-Based Professional Learning Community to Support Teachers Customization of a Reform-Oriented OER Curriculum.
Austin Moore*, Boston College, USA
Katherine McNeill, Boston College, USA
Maria Morena Vera, Boston College, USA

Curriculum-Based Professional Learning and Teacher Attention to the Epistemic Aspects of Classroom Talk and Collaboration
Chris Griesemer*, University of California Davis, USA
Cynthia Passmore*, University of California Davis, USA
Jessica Alzen, University of Colorado Boulder, USA
Jason Buell, Northwestern University, USA
Kelsey Edwards, Northwestern University, USA
William Penuel, University of Colorado Boulder, USA
Brian Reiser, Northwestern University, USA

Strand 10: Curriculum and Assessment Related Paper Set
Innovative and Equitable Curriculum, Instruction, and Assessment Resources Aligned with the Next Generation Science Standards
19-Mar-24, 5:15 PM-6:45 PM
Location: Directors Row J

Overview of Project Goals, Design Frameworks, & Products
James Pellegrino, University of Illinois Chicago, USA
Ellen Forte*, edCount, USA

Illustration of the Curriculum Map and Resources for a Grade Level Unit
Erin Buchanan, edCount, LLC, USA
Charlene Turner*, edCount, LLC, USA
Example of the Stage 3 Learning Plan for a Grade Level Unit

Jared Ten Brink\textsuperscript{a}, University of Michigan-Ann Arbor, USA
Mary Nyaema, University of Illinois-Chicago, USA
Donald Wink, University of Illinois-Chicago, USA
Sania Zaidi, University of Illinois-Chicago, USA

Examples of End of Unit (EOU) Assessments with Discussion of a Pilot Study Results

Howard Everson\textsuperscript{a}, City University of New York, USA

Strand 10: Curriculum and Assessment

SC-Organized Paper Set Perspectives of Curriculum Adaptation and Core Ideas 19-Mar-24, 5:15 PM-6:45 PM Location: Directors Row H

Collaboration for Curriculum Implementation in Lesotho: Insights From a Distributed Instructional Leadership Perspective
Nthooa Lisene\textsuperscript{a}, University of the Free State, South Africa
Loyiso Jita, University of the Free State, South Africa

Exploring Core Ideas: A Systematic Literature Review of Core Ideas in Science Education
Helen Semilarski\textsuperscript{a}, University of Tartu, Estonia
Helin Semilarski, University of Tartu, Estonia

Exploring the Level of Content Knowledge Emphasis Among Botany Curriculums of Public Universities in Bangladesh
Sheikh Tahmina Awal\textsuperscript{a}, Institute of Education and Research, University of Dhaka, Bangladesh

A Teacher’s Journey Through Co-designing and Adapting Curricular Materials
Katarzyna Pomian Bogdanov\textsuperscript{a}, Northwestern University, USA

Strand 11: Cultural, Social, and Gender Issues

Related Paper Set Empowering Students in Engineering: Ethical and Transformative Learning Approaches for a Socially Conscious Future 19-Mar-24, 5:15 PM-6:45 PM Location: Plaza Court 3

Cultivating Community Connections between Undergraduates and Elementary Students through the Co-Design of Engineering Games
G. R. Marvez\textsuperscript{a}, Tufts University, USA
Greses Pérez, Tufts University, USA

Fostering Critical Consciousness: Faculty Impact on Teaching Social Responsibility in Engineering Education
Sindia Rivera-Jiménez\textsuperscript{a}, University of Florida, USA

Engineering Students’ Epistemologies in Design Problem Solving: Exploring the Gap Between Professed and Enacted Epistemologies
Trevion Henderson\textsuperscript{a}, Tufts University, USA
Joshua Cohen\textsuperscript{a}, Tufts University, USA
Renegotiating Roles & Responsibilities in an Undergraduate Engineering Design Course

Monica Cardella*, Florida International University, USA
Alexandra Strong, Florida International University, USA
Stephen Secules, Florida International University, USA
Trina Fletcher, Florida International University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
STEM Identity Trajectories: Intersectional Interplays of Capital, Aspirations, and Resistance
19-Mar-24, 5:15 PM-6:45 PM
Location: Plaza Court 1

Young Women’s STEM Trajectories, Age 10-22: Intersectional interplays of Identity, Capital, Field and ‘Luck’
Louise Archer*, University College London, United Kingdom

Supporting First-Generation Refugee Families’ STEM Aspirations and College Navigation
Eugene Judson*, Arizona State University, USA
Mohammed Ibrahim, Arizona State University, USA

STEM Identity Progression/Evolution in Black Students: From Undergraduate HBCUs to Graduate PWIs
Karen Marshall*, Oakwood University, USA
Carmen Bucknor*, Oakwood University, USA
Sylvia Butterfield*, National Science Foundation, USA

Christyn Byrd*, University of Alabama in Birmingham, USA

Asian and Asian American Women in STEM: Stories of Challenge and Resistance
Jasmyne Yeldell*, University of North Carolina, USA
Dionne Cross Francis, University of North Carolina, USA
Pavneet Kaur Bharaj, California State University, USA
Anina Mahmud*, University of North Carolina, USA
Raven Walters, University of North Carolina, USA
Kerrie Wilkins-Yel, University of Massachusetts, USA

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set
Technology for Science Learning 3
19-Mar-24, 5:15 PM-6:45 PM
Location: Plaza Court 5

Comparing Two Iterations of a Place-Based Socioscientific Issues Course Embedded with Different Extended Reality Applications
Mark Newton*, East Carolina University, USA
Len Annetta*, East Carolina University, USA

Framing the Hybrid: A Multi-Dimension Perspective
Ehud Aviran*, Weizmann Institute of Science, Israel
Ron Blonder, Weizmann Institute of Science, Israel
Analysis and Evaluation of Socioscientific Issues Collaborative Argumentation from Interpersonal Neural Synchronization Perspective

Yangchunxiao Wang*, Beijing Normal University, China
Yong Xie, Beijing Normal University, China
Xingda Li, Beijing Normal University, China
Shuhao Yang, Beijing Normal University, China
Dana Zeidler, University of South Florida, USA
Chunming Lu, Beijing Normal University, USA
Yonghe Zheng, Beijing Normal University, China

From Chalkboard to Keyboard: Effect of Paced-Flexible-Model on Achievement in Evolution via a Virtual-Learning Environment

Franklin Onowugbeda*, Lagos State University-ACEITSE, Nigeria
Peter Okebukola, Lagos State University-ACEITSE, Nigeria
Juma Shabani, University of Burundi, Burundi
Deborah Agbanimu, National Open University of Nigeria, Nigeria

Comparison of Rural and Urban Secondary School Teachers' Perceptions About Sustainable Development and Sustainability Competences

Anne Laius*, University of Tartu, Estonia
Rolf Saarna, University of Tartu, Estonia

A Coastal Ecology Summer Course: Engaging Future Photographers, Policy Makers, Engineers, & Community Workers

Hamza Malik*, University of Massachusetts, USA
Rachel Stronach*, University of Massachusetts, USA
Stephen Witzig*, University of Massachusetts, USA

Context Matters When Assessing Science Civic Engagement in Science Literacy Students

Jennifer Teshera-Levy*, University of Nebraska-Lincoln, USA
Irfanul Alam, University of Colorado, USA
Lisa Corwin, University of Colorado, USA
Jenny Dauer, University of Nebraska-Lincoln, USA

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set

Sustainability Literacy
19-Mar-24, 5:15 PM-6:45 PM
Location: Directors Row 1

Environmental Attitude’s Role in Student-Centered Learning About the Forest Ecosystem and Sustainability

Tessa-Marie Baierl*, University of Bayreuth, Germany
Franz Bogner, University of Bayreuth, Germany
Zhongyan Zhang, University of Leeds, United Kingdom
Lauren Wagner, Florida State University, USA

Social Event
STEM Trivia Night!
19-Mar-24, 6:45 PM-7:45 PM
Location: Governor’s Square 15

ORGANIZERS
Margaret Blanchard, NC State University, USA
Matt Reynolds, NC State University, USA

Indigenous Science Knowledge (ISK-RIG)
Sponsored Session
Fireside Chat: Networking, Socializing and Getting to Know and Learn From and With ISK-RIG Enthusiasts
19-Mar-24, 6:45 PM-7:45 PM
Location: Governor’s Square 14

Fireside Chat: Networking, Socializing and Getting to Know and Learn From and With ISK-RIG Enthusiasts

Continental and Diasporic Africa in Science Education (CADASE)
Social Event
CADASE Social: Reconnecting Across the Diaspora
19-Mar-24, 6:45 PM-7:45 PM
Location: Governor’s Square 12

ORGANIZERS
Rona Robinson-Hill, Ball State University, USA.
Shari Watkins, American University, USA

Fellows Program
Social Event
NARST Fellows Inaugural Gathering (Invited Social Event)
20-Mar-24, 7:00 AM-8:00 AM
Location: Directors Row I

NARST Fellows Inaugural Gathering (Invited Social Event)
20 MARCH 2024

Committee Meeting
Strand 1 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 10

Committee Meeting
Strand 2 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 11

Committee Meeting
Strand 3 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 12

Committee Meeting
Strand 4 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 14

Committee Meeting
Strand 5 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 16

Committee Meeting
Strand 6 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Governor's Square 17

Committee Meeting
Strand 7 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 8

Committee Meeting
Strand 8 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 2

Committee Meeting
Strand 10 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 3

Committee Meeting
Strand 11 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 4

Committee Meeting
Strand 12 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 5

Committee Meeting
Strand 13 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 6

Committee Meeting
Strand 14 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Plaza Court 7

Committee Meeting
Strand 15 Meeting
20-Mar-24, 7:00 AM-8:00 AM
Location: Directors Row E

Plenary Session
Membership and Business Meeting
20-Mar-24, 8:15 AM-9:15 AM
Location: Plaza Ballroom ABC/DEF
Graduate Student Committee
Sponsored Session
Graduate Student Research Symposium
20-Mar-24, 9:15 AM-10:45 AM
Location: Governor's Square 10

Graduate Student Research Symposium

ORGANIZERS
Savannah Graham, University of Houston, USA
Justin Andersson, University of Nebraska-Omaha, USA
Johan Tabora, University of Illinois at Chicago, USA
Mutiara Syifa, The Ohio State University, USA
Alyssa Freeman, Middle Tennessee State University, USA
Andrea Reeder, Middle Tennessee State University, USA
Austin Jenkins, Purdue University, USA
Sierra Morandi, Florida State University, USA
Cathy Cullicott, Arizona State University, USA
Allison Metcalf, Florida State University, USA

Strand 1: Science Learning: Development of student understanding
Related Paper Set
The Value of Cognitive Linguistics for the Design of Fruitful Learning Environments in Biology Education
20-Mar-24, 9:15 AM-10:45 AM
Location: Plaza Court 2

Quo Vadis – Learning Progressions in the Context of the Conceptual Metaphor Theory
Denis Messig*, Department of Science Education, Germany
Jorge Gross, Department of Science Education, Germany

Understanding Student Conceptions About Cell Membranes
Leonie Johann, Nord University, Norway
Jorge Groß*, Leibniz Universität Hannover, Germany
Fredrik Rusk, Åbo Akademi University, Finland

The Benefit of Moral Metaphors for Fostering Decision-Making Competence in the Field of Animal Ethics
Nadine Tramowsky*, University of Education Freiburg, Germany

Peer Interaction - Tracking Conceptual Transformation in Collaborative Learning Environments
Malte Michelsen*, Leibniz Universität Hannover, Germany
Jorge Groß, Leibniz Universität Hannover, Germany

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
Undergraduate Pedagogy and Practices
20-Mar-24, 9:15 AM-10:45 AM
Location: Plaza Court 5

What is a Geoscientist? Uncovering Conceptual Profiles in Undergraduate Student Drawings
William Romine*, Wright State University, USA
Deepika Menon, University of Nebraska, USA
Peggy McNeal, Towson University, USA

Undergraduate Virtual Mentorship in Support of K-12 Science Inquiry Practices
Alex St. Louis*, Augusta University, USA

Can I Kick It: The Evolution of University Students’ Pedagogical Practices in a Sneaker Lab
Kareem Edouard*, Drexel University, USA
Sinead Meehan, Drexel University, USA

Strand 3: Science Teaching — Primary School (Grades preK-6):
Characteristics and Strategies
SC-Organized Paper Set
Science Teacher Learning
20-Mar-24, 9:15 AM-10:45 AM
Location: Plaza Court 3

Scaffolding Elementary Students’ Scientific Evaluations of Model-Evidence Relationships About Fossils
Timothy Klavon*, Black Hills State University, USA
Sydney Haugland, Black Hills State University, USA
Nancy Gans, University of Maryland, USA
Melissa Schwiesow, Black Hills State University, USA

A Case of Preservice Elementary Teachers Making Meaning Through Modeling Practices
Ayça Fackler*, The University of Missouri, USA

Examining Influences on Elementary Teachers’ Transfer of Learning from a Science Professional Development Program

Andrea Phillips*, Indiana University, USA
Meredith Park Rogers, Indiana University, USA

Fostering Pedagogical Judgment in Novice Elementary Science Teachers
Christopher Mangogna*, University of Washington, USA

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set
Learning science with families
20-Mar-24, 9:15 AM-10:45 AM
Location: Governor’s Square 11

The Interplay between Interest Development, Conceptual Change, Affect, and Agency in Everyday Family Science Interactions
Irit Vivante*, Ben Gurion University of the Negev, Israel
Dana Vedder-Weiss*, Ben Gurion University of the Negev, Israel

Capturing Family Engagement during an At-Home STEM Intervention
Kristie Gutierrez*, Old Dominion University, USA
Margaret Blanchard*, NC State University, USA
Kylie Swanson*, University of Colorado Colorado Springs, USA

Science Identity Work and Persistence from an Intensive Family Workshop Series
Debbie Siegel*, Institute for Learning Innovation, USA
Scott Byrd*, Medomak Consulting Group, USA
Elysa Corin, Institute for Learning Innovation, USA
Paseos and Outdoor School: Developing Latina/o/x Families’ Interest and expertise in the outdoors.

**Diana Crespo-Camacho***, Oregon State University, USA

**Strand 7: Pre-service Science Teacher Education**

**SC-Organized Paper Set**

**Reflective Practice to Support Teaching and Learning**

**20-Mar-24, 9:15 AM-10:45 AM**

**Location: Plaza Court 4**

*Reflective Practice-Driven Pre-Service Teachers Develop Science and Engineering Lesson*

**Tharuesean Prasoplarb***, Kasetsart University, Thailand

**Chatree Faikhamta**, Kasetsart University, Thailand

*Elementary Teacher Candidates’ Reflection on Their Roles as Educators After Engaging in a Digital Simulation.*

**Zoubeida Dagher***, University of Delaware, USA

**Christy Metzger**, University of Delaware, USA

**Strand 8: In-service Science Teacher Education**

**SC-Organized Paper Set**

**Enacting Social Justice Focused Science and STEM Learning**

**20-Mar-24, 9:15 AM-10:45 AM**

**Location: Governor’s Square 12**

*Transforming STEM Education: Co-creating Educator Critical Identities through Social Justice and Culturally Sustaining Pedagogies*

**Karla Hale***, Western Oregon University, USA

**Cory Buxton**, Oregon State University, USA

**Felisha Dake**, Oregon State University, USA

**Melissa Livingston**, Oregon State University, USA

*Core to What? Novice STEM Teachers’ Perceptions of Antiracist and Socially Just Core Teaching Practices*

**Rachael Gordon***, University of Michigan, USA

**A Symposium Applying Conjecture Mapping to Learn From Design Tensions in Curriculum-Based Professional Learning**

**Cynthia Passmore***, University of California, Davis, USA

**Stina Krist***, University of Illinois, USA

**Jason Buell***, Northwestern University, USA

**Chris Griesemer***, University of California, Davis, USA

**Barbara Hug***, University of Illinois, USA

**Katherine McNeill***, katherine.mcneill@bc.edu, USA

**Sean Smith**, Horizon Research, USA

**Brian Reiser***, Northwestern University, USA
Describing Teachers’ Everyday Efforts to Enact Social Justice Teaching in Their Science Classrooms

Jarod Kawasaki*, California State University, Dominguez Hills, USA
Sandy Chang, University of California, Los Angeles, USA

"Making the Invisible, Visible!": Visualizing Science and Social Justice through Modeling

Marisa Ritchie*, California Polytechnic State University, USA
Spencer Paine*, California Polytechnic State University, USA
Christina Fuller*, California Polytechnic State University, USA
Jasmine Nation*, California Polytechnic State University, USA
Kurt Holland*, California Polytechnic State University, USA

Strand 10: Curriculum and Assessment Symposium
Measuring Computational Thinking in Non-Programming Contexts: Progress and Challenges
20-Mar-24, 9:15 AM-10:45 AM
Location: Plaza Court 6

Measuring Computational Thinking in Non-Programming Contexts: Progress and Challenges
Eben Witherspoon*, American Institutes for Research, USA
Jonathan Margolin, American Institutes for Research, USA
Dorothy Bennett*, New York Hall of Science, USA
Ibrahim Dahlstrom-Hakki*, TERC, USA
Jessica Bailey*, EDC, USA
Jackie DeLisi, EDC, USA
Emily Relkin, EDC, USA

Leiny Garcia*, WestEd, USA
Yvonne Kao, WestEd, USA
Arif Rachmatullah, SRI, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set
Supporting Agency, Access, and Community Building: From Middle School to Graduate School
20-Mar-24, 9:15 AM-10:45 AM
Location: Governor’s Square 17

STEM ACCESS: Conceptualizing a University-School Partnership Model to Engineer Justice in STEM Education
Meredith Kier*, William & Mary, USA
Lindy Johnson, William & Mary, USA

Student Agency in Science Education: Navigating Structures for Inclusivity and Empowerment
Danielle Malone*, Washington State University, USA
Judith Morrison, Washington State University, USA

Conceptualizing a Slow-Science Approach to Fieldwork
Rie Malm*, University of Copenhagen, Denmark
Sriparna Saha, University of Colorado Boulder, USA
Lisa Corwin, University of Colorado Boulder, USA
Ben Kennedy, University of Canterbury, New Zealand

Role of Field Experiences and Student Identities in Community Building in EBIO Graduate Students
Sriparna Saha*, University of Colorado, USA
Lisa Corwin, University of Colorado, USA  
Nancy Emery, University of Colorado, USA  
Scott Taylor, University of Colorado, USA  
Julian Resasco, University of Colorado, USA  
Sandhya Krishnan, University of Colorado, USA  
Valerie Mckenzie, University of Colorado, USA  

Enhancing Undergraduate Students' Socioscientific Reasoning and Addressing Misconceptions through Internationalized Climate Change Instruction  
Conghui Liu*, Indiana University Bloomington, USA  
Shukufe Rahman*, Indiana University Bloomington, USA  
Gayle Buck, Indiana University Bloomington, USA  

Promoting Functional Scientific Literacy Through Community Service: Implications for Curriculum Development in Secondary Environmental Education  
Emily Little*, Georgia State University, USA  
Renee Schwartz, Georgia State University, USA  

Erasure of Socioecological Violence in Science Education  
Ajay Sharma*, University of Georgia, USA  
SungEun Min, Kutztown University of Pennsylvania, USA  

How to Cultivate Critical Awareness of Climate Change Using Socioscientific Perspectives  
Eric Nolan*, California State University, East Bay, USA  

Strand 15: Policy, Reform, and Program Evaluation  
SC-Organized Paper Set  
Advancing Students' Scientific Literacy and Equitable and Socially Transformative Science Pedagogy  
20-Mar-24, 9:15 AM-10:45 AM  
Location: Directors Row I
"Post-truth" and Science Education: Towards an Updated Vision of Scientific Literacy
Katrin Vaino*, University of Tartu, Estonia
Anastasiya Astapova, University of Tartu, Estonia
Konstantinos Korfiatis, University of Cyprus, Cyprus
Oleg Popov, Umeå University, Sweden
Hans Orru, Umeå University, Sweden
Ana Valdmann, University of Tartu, Estonia

Socially-Transformative Engineering Pedagogy
Senay Purzer*, Purdue University, USA

“Filling the Gaps”: Leaders Building Capacity for Equitable K-12 Computer Science Education in States
Stefanie Marshall*, Michigan State University, USA
Ain Grooms*, University of Wisconsin-Madison, USA
Joshua Childs*, University of Texis- Austin, USA
SJ Hemmerich*, University of Wisconsin-Madison, USA
Grace Tukurah*, Michigan State University, USA

Roundtables Session 3
20-Mar-24, 11:00 AM-12:30 PM
Location: Plaza Ballroom ABC/DEF

Strand 11: Cultural, Social, and Gender Issues
Roundtable
The STEM Continuum: Understanding Female Perceptions
Carol Waters*, University of Houston-Clear Lake, USA
Mary Curtis, University of Houston-Clear Lake, USA

Strand 11: Cultural, Social, and Gender Issues
Roundtable
Examining the Identity Transformation of African American Students in STEM Counterspaces
Lezly Taylor*, Virginia Tech, USA
Brenda Brand, Virginia Tech, USA

Strand 11: Cultural, Social, and Gender Issues
Roundtable
The Impact of the NARST Sandra K. Abell Institute for Doctoral Students: A Counterstory
Seema Rivera*, Clarkson University, USA
Meredith Kier, William and Mary, USA
Julianne Wenner, Clemson, USA
Shelly Rodriguez, University of Texas at Austin, USA

Strand 11: Cultural, Social, and Gender Issues
Roundtable
Science is For Us Too: Elevating Black and Latina Girls’ Voices Through Community and Care
Laura Peña-Telfer*, Georgia State University, USA
Natalie King, Georgia State University, USA

Strand 11: Cultural, Social, and Gender Issues
Roundtable
Exploring STEM Teacher Educators’ Perspectives on Culturally Responsive Practices
Uchenna Emenaha*, The University of Texas at San Antonio, USA
Jessica Gehrtz, The University of Texas at San Antonio, USA
Strand 10: Curriculum and Assessment
Work-in-progress Roundtable
A Design-Based Research Approach to Fostering Middle Schoolers' Socio-scientific Argumentation Skills
Samuel Bullard*, University of Minnesota, USA
Keisha Varma, University of Minnesota, USA

Strand 10: Curriculum and Assessment
Work-in-progress Roundtable
Global and Local Dynamics Navigating Grand Challenges
Heewoo Lee*, University of North Carolina at Chapel Hill, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA
David Fortus, Weizmann Institute of Science, Israel
Rebecca Lesnefsky, University of North Carolina at Chapel Hill, USA
Keren Dalyot, Weizmann Institute of Science, Israel
Nannan Fan, University of North Carolina at Chapel Hill, USA
Zhen Xu, University of North Carolina at Chapel Hill, USA
Shira Passentin, Weizmann Institute of Science, Israel
Natasha Segal, Weizmann Institute of Science, Israel

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
Centering Economic Equity in STEM: Challenges on the Road to Expanding Access to STEM Degrees
Leandra Cate, University of Washington, USA
Lia Wetzstein*, University of Washington, USA
Katie Kovacich, University of Washington, USA

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
Formation of Disciplinary Science Identities in Upper Secondary School
Jonas Niemann*, University of Copenhagen, Denmark

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
(re)Shaping Science Curricula: A Multicultural Approach
Sarah Ragoub*, University of Manitoba, Canada

Strand 11: Cultural, Social, and Gender Issues
Roundtable
A Longitudinal Study of Engineering Major Attrition: Gender Disparities
Niyazi Erdogan, Texas A&M University, USA
Olukayode Apata, Texas A&M University, USA
Karen Rambo-Hernandez, Texas A&M University, USA
Strand 11: Cultural, Social, and Gender Issues
Roundtable
Using Active Learning Strategies to Close Equity Gaps for Biology Students of Historically Underrepresented Backgrounds
Stephanie Marin-Rothman*, Indiana University, USA

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
Navigating Emotions in Women Undergraduate Students’ Developing Science Identities
Hillary Mason*, University of Nebraska-Lincoln, USA

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
Adapting the Family Resilience Framework to Understand Strengths of Latinx Families in Early STEM Learning
Smirla Ramos Montañez*, TERC, USA
Scott Pattison, TERC, USA
María Quijano, Metropolitan Family Service, USA
Shauna Tominey, Oregon State University, USA
Viviana López Burgos, TERC, USA

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
Mentors Matter: Queer Undergraduate Students’ Perceptions of Research
Aramati Casper*, Colorado State University, USA

Kelly Lane, University of Minnesota - Twin Cities, USA
Sarah Eddy, University of Minnesota - Twin Cities, USA

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
Boys Perceptions of Women Scientist: Shifting the Lens on Gender Disparity in STEM
Sara Sweetman*, University of Rhode Island, USA

Strand 11: Cultural, Social, and Gender Issues
Work-in-progress Roundtable
Successful Scientists with (dis)Abilities: Identities and Views on the Nature of Science
Jonathan Hall*, California State University, San Bernardino, USA
Mila Rosa Carden*, University of North Texas, USA

Strand 11: Cultural, Social, and Gender Issues
Roundtable
Science Teachers’ Perspectives on Multicultural Dynamics in Science Classrooms
Selvet Ece Genek*, The Ohio State University, USA
Lin Ding, The Ohio State University, USA

Strand 12: Technology for Teaching, Learning, and Research
Roundtable
Virtual Learning Experiences: A Pilot Study of Technology Integration and Creative Production
Doris Chin*, Stanford Graduate School of Education, USA
Rachel Wolf*, Stanford Graduate School of Education, USA

**Strand 12: Technology for Teaching, Learning, and Research Roundtable**
Investigating the Effectiveness of Using Technology for Remediation of High School Students’ Misconceptions
Narendra Deshmukh*, Homi Bhabha Centre for Science Education, TIFR, India

**Strand 12: Technology for Teaching, Learning, and Research Roundtable**
Harnessing Digital Curation for Personalized Science Learning in Science Secondary School
Gal Stern*, Technion, Israel Institute of Technology, Israel
Dina Tsybulsky, Technion, Israel Institute of Technology, Israel

**Strand 12: Technology for Teaching, Learning, and Research Work-in-progress Roundtable**
Investigating College Science Teachers’ Digital Practices: A Global Study
Le Quan Ly*, University of Technology, Sydney, Australia
Tracey-Ann Palmer, University of Technology, Sydney, Australia
Kirsty Young, University of Technology, Sydney, Australia
Matthew Kearney, University of Technology, Sydney, Australia

**Strand 12: Technology for Teaching, Learning, and Research Work-in-progress Roundtable**
Connecting the Dots: How Students Communicate Through Virtual Field Trips
Aman Desai*, Stanford University, USA
Rachel Wolf, Stanford University, USA

Kristen Blair, Stanford University, USA
Doris Chin, Stanford University, USA

**Strand 14: Environmental Education and Sustainability Roundtable**
A Scoping Review of the Intersection of Environmental and Science Identity
Roberta Hunter*, Michigan State University, USA
Susan Caplow, University of Montevallo, USA

**Strand 14: Environmental Education and Sustainability Work-in-progress Roundtable**
Developing a Background Survey to Measure Teachers’ Knowledge and Practices Around Environmental Justice
Katy Nilsen*, WestEd, USA
Ashley Ivelan, WestEd, USA
Melissa Rego, WestEd, USA

**Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies Work-in-progress Roundtable**
Teachers’ Attention to Student Interest in Selecting Anchoring Phenomena in an Environmental Justice Project
Susan Zwiep*, BSCS Science Learning, USA
Katherine Nilsen*, WestEd, USA
Jill Grace, WestEd, USA
Zoe Buck Bracey, BSCS Science Learning, USA
Ashley Ivelan, WestEd, USA

**Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies Roundtable**
Student Expression of Transformative Learning Following Science Instruction
Using a Current Case of Environmental Injustice
Shondricka Burrell*, Morgan State University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science Roundtable
Conceptions of Uncertainty: A Delphi Study With Science Education Researchers and Scientists.
Simon Blauza*, University of Münster, Centre for Biology Education, Germany
Kerstin Kremer, Justus Liebig University, Institute for Biology Education, Germany
Benedikt Heuckmann, University of Münster, Centre for Biology Education, Germany

Strand 13: History, Philosophy, Sociology, and Nature of Science Roundtable
The Integration of the Nature, Philosophy, and History of Science in Canadian Science Education Degrees
Ellen Watson*, Brandon University, Canada
Sarah Ragoub*, University of Manitoba, Canada

APISER RIG
Sponsored Session
Asian and Pacific Islanders in Science Education Research Poster Session
20-Mar-24, 11:00 AM-12:30 PM
Location: Governor’s Square 10

Jennifer Tripp, University at Buffalo, USA.
Hosun Kang University of California-Irvine, USA

PANELISTS
Pauline Chinn, University of Hawai’i at Mānoa
Andy Trinh, University of California, San Diego, USA
Meena Balgopal, Colorado State University, USA
Emily Slater, Utah State University, USA
Joe Deluca, University of Georgia
Jaesung Park, University at Albany-SUNY, USA
Tony Chontong, California State University, Fresno, USA

Exploring Relationships between Elementary Students’ Mechanistic Reasoning and Argumentation about their Engineering Design Solutions
Mustafa Topcu*, Yildiz Technical University, Turkey
Kristen Wendell, Tufts University, USA

Students’ Ideas About Heat Transfer Tell Us a Lot: Are We Heeding?
Rajashri Priyadarshini*, Indian Institute of Technology Bombay, India
Chandan Dasgupta, Indian Institute of Technology Bombay, India
Sahana Murthy, Indian Institute of Technology Bombay, India
Greek Secondary School Students’ Teleology and Essentialism Conceptions About Genes
Florian Stern*, University Teacher Training Institute (IUFE), University of Geneva, Switzerland
Panagiotis Stasinakis, Ministry of Education Greece, Greece
Antonios Krimitzas, Ministry of Education, Greece
George Verroios, Ministry of Education, Greece
Katerina Gioti, Ministry of Education, Greece
Andreas Mueller, University Teacher Training Institute (IUFE), University of Geneva, Switzerland
Kostas Kampourakis, Faculty of Science, Section of Biology, University of Geneva, Switzerland

Exploring Epistemic Heterogeneity in a Critical Place-based Science Curriculum
Hannah Ziegler*, Vanderbilt University, USA
Heidi Carlone*, Vanderbilt University, USA
Zachary Conley, Vanderbilt University, USA
Yelena Janumyan Doe, Vanderbilt University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set
STEM Expectations, Opportunities, Skills
20-Mar-24, 11:00 AM-12:30 PM
Location: Plaza Court 5

Science Career Expectations and Science-Related Motivation: A Latent Profile Analysis Using PISA 2015 Data
Yanfang zhai*, Capital Normal University, China

Xiufeng Liu, University at Buffalo, State University of New York, USA

Nice to Run into ‘Roo: Examining Middle School Students’ Conceptual Understanding of Change over Time
Rochelle Cassells*, University of Utah, USA
Harini Krishnan*, University of Utah, USA
Louisa Stark, University of Utah, USA

Identifying STEM Opportunities for K-12 Students within a District
Elizabeth Crotty*, University of Wisconsin - Eau Claire, USA
Emily Landwehr, University of Wisconsin - Eau Claire, USA
Whitney Onyancha, University of Wisconsin - Eau Claire, USA
Elizabeth Stretch, University of Minnesota, USA

Non-Science Performances in Small Group Positioning
Marta Stoeckel*, University of Minnesota, USA
Anjar Putro Utomo*, University of Minnesota, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set
Socioscientific Foci for Scientific Literacy
20-Mar-24, 11:00 AM-12:30 PM
Location: Directors Row I

Towards Transformative Science Education for Responsible Citizenship: Investigating Science Teachers’ Integration of Informed Decision Making
Erik Barendsen*, Radboud University, Netherlands
**Ineke Henze**, Radboud University, Netherlands

**Dury Bayram**, Eindhoven University of Technology, Netherlands

**Collective Pedagogical Content Knowledge to Develop Teaching About Sustainability Issues**

**Annika Forsler**, Halmstad University, Sweden

**Pernilla Nilsson**, Halmstad University, Sweden

**Susanne Walan**, Karlstad University, Sweden

**Cultivating Informed Citizens Through Socioscientific Issues: A Systematic Review**

**Jing Lin**, Beijing Normal University, China

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**Colorado Science Education Research**

**Scoping Review of Articles Measuring Climate Change Acceptance**

**Jessica Duke**, University of Northern Colorado, USA

**Emily Holt**, University of Northern Colorado, USA

**Karliegh Wattier**, University of Northern Colorado, USA

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**Strand 5: College Science Teaching and Learning (Grades 13-20)**

**SC-Organized Paper Set**

**Examining Approaches for Supporting Student Performance**

20-Mar-24, 11:00 AM-12:30 PM

**Location**: Governor's Square 12

Implementing Brokering and Multi-mentor Approaches to Support Retention of Undergraduate STEM Majors from Minoritized Groups

**Stacy Olitsky**, Saint Joseph's University, USA

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**Examining Students’ General Chemistry Performance Following a Voluntary Supplemental Course**

**Brayan Diaz**, North Carolina State University, USA

**Tyler Harper-Gampp**, North Carolina State University, USA

**Undergraduate STEM Students' Expectations and Value Perceptions from a Longitudinal STEM-focused Support Program Experience**

**John Tillotson**, Syracuse University, USA

**Gaye Ceyhan**, Bogazici University, Turkey

**Gizem Ozyazici**, Syracuse University, USA

**Amanda Surman**, Syracuse University, USA

**Investigating Responsive Pedagogical Approaches to Promote University Students’ Trust in Well-Established Science**

**Benjamin Janney**, Texas A&M University, USA

**Benjamin Herman**, Texas A&M University, USA

**Tamara Powers**, Texas A&M University, USA

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**Strand 6: Science Learning in Informal Contexts**

**SC-Organized Paper Set**

**Meaningful Science Learning Experiences for High Schoolers and Undergraduates in Informal Contexts**

20-Mar-24, 11:00 AM-12:30 PM

**Location**: Governor's Square 11

Contributing and Belonging: Mentorship and Participation in a Research Experience for Undergraduates

**Stephen Burgin**, The University of Arkansas, USA
Zephaniah Greenwell, The University of Arkansas, USA

Environmental Education Internships Over Time: How Current and Former Interns Describe Their Experiences

Rachel Stronach*, University of Massachusetts Dartmouth, USA

Hamza Malik, University of Massachusetts Dartmouth, USA

Stephen Witzig, University of Massachusetts Dartmouth, USA

Urban Farming within a Transdisciplinary Research Practice Partnership

Marc Sager*, Southern Methodist University, USA

Anthony Petrosino*, Southern Methodist University, USA

Perceived Authenticity of Out-of-school Chemistry Learning Environments

Christian Strippel*, Ruhr-University Bochum, Germany

Lena Finger, Ruhr-University Bochum, Germany

Joachim Wirth, Ruhr-University Bochum, Germany

Katrin Sommer, Ruhr-University Bochum, Germany

Tamar Ginzburg*, Technion - Israel Institute of Technology, Israel

Miri Barak, Technion - Israel Institute of Technology, Israel

Sibel Erduran, The University of Oxford, United Kingdom

The Engineering Design Efficacy Journey of Novice Science Teachers

Laura Wheeler*, Brigham Young University, USA

Max Longhurst, Utah State University, USA

Preservice Science Teachers’ Development in Understanding the Relevance of Scientific and Engineering Practices

Young Ae Kim*, Defense Language Institute, USA

Michele Korb*, CSU East Bay, USA

Scientific Thinking Beyond Science Contexts: Everyday Science as a Frame Beyond Labs and Classrooms

Bryan Nichols*, Florida Atlantic University, USA

Strand 7: Pre-service Science Teacher Education

SC-Organized Paper Set
Research Investigating Competency in Preparing Preservice Teachers and Teacher Educators
20-Mar-24, 11:00 AM-12:30 PM
Location: Governor's Square 14

Can STEM and non-STEM Major Preservice Teachers Acquire Same Teaching Competence From STEM Method Course

Hsiao-Lin Tuan*, National Changhua University of Education, Taiwan

Chi-Chin Chin, National Taichung University of Education, Taiwan
**Becoming a Globally Competent Educator: Self-Study of My Theoretical and Practical Understanding of Global Competency.**

*Arya Karumanthra*, Indiana University, USA

**Gayle Buck**, Indiana University, USA

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**Evaluating Questioning Competency in Elementary Pre-Service Teachers Using Likert-Scale Questions**

*Jianlan Wang*, Texas Tech University, USA

**Shahin Kashef**, University of Georgia, USA

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**Strand 11: Cultural, Social, and Gender Issues**

**SC-Organized Paper Set**

**Exploring Science Aspirations, Process Skills, and Capital Across Sociocultural Contexts**

20-Mar-24, 11:00 AM-12:30 PM

Location: Governor's Square 15

**Differences in Science Expectancy-Value Beliefs and STEM Career Pathways by Rurality**

*Guan Saw*, Claremont Graduate University, USA

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**Reclaiming Missed Opportunity: Reflections on the Influence of Culture on Development of Science Process Skills**

*Peter Okebukola*, Lagos State University, Nigeria

**Moses Emmanuel**, Lagos State University, Nigeria

**Atinuke Adekoya**, Lagos State University, Nigeria

**Joshua Akinpelu**, Lagos State University, Nigeria

**Ann Itodo**, Lagos State University, Nigeria

**Abdulazeez Balogun**, Lagos State University, Nigeria

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**Modupe Omokongbe**, Lagos State University, Nigeria

**A Theoretical Framework To Understand The Effect of Cultural Context On Immigrant Students' Science Attitudes**

*Havva Gorkem Altunbas*, UCL - Institute of Education, United Kingdom

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**Strand 11: Cultural, Social, and Gender Issues Symposium**

**Indigenizing STEM Within Teacher Education and Professional Development**

20-Mar-24, 11:00 AM-12:30 PM

Location: Governor's Square 17

**Indigenizing STEM within Teacher Education and Professional Development**

*Julie Robinson*, University of North Dakota, USA

**Rebekah Hammack**, Purdue University, USA

**Paichi Shein**, National Sun Yat-sen University, Taiwan

**Agnes Ahanonye**, University of The Witwatersrand, South Africa

**Bhaskar Upadhyay**, University of Minnesota, USA

**Pauline Chinn**, University of Hawaii at Manoa, USA

**Lenora Crabtree**, University of North Carolina Charlotte, USA

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**Strand 13: History, Philosophy, Sociology, and Nature of Science**

**SC-Organized Paper Set**

**History of Science**

20-Mar-24, 11:00 AM-12:30 PM

Location: Plaza Court 3
Explicit NOS Instruction in Chemical Experiments using Reflective Scientific Inquiry and History of Science Approaches
Janne-Marie Bothor*, University of Kassel, Germany
David-Samuel Di Fuccia, University of Kassel, Germany

Unraveling the Fictionalized Ideal: The Evolution of “The” Scientific Method in the 19th Century
Farnaz Avarzamani*, Arizona State University, USA
Mila Rosa Carden, University of North Texas, USA
Peter Rillero, Arizona State University, USA
Samira Golshani, Islamic Azad University, Iran, Islamic Republic of

Impact of Historical Science Stories on Post-Secondary Students’ NOS Understanding and Attitudes Toward Science
Michael Clough*, Texas A&M University, USA
Benjamin Herman, Texas A&M University, USA
Alex Sobotka, Texas A&M University, USA
Alister Olson, Texas A&M University, USA

Interaction of History and STEM Learning Goals in Teacher-Developed Curriculum Materials
Wonyong Park*, University of Southampton, United Kingdom

**Strand 14: Environmental Education and Sustainability**
**Related Paper Set**
Science Teacher Education Towards Environmental Justice: Approaches, Strategies and Frameworks
20-Mar-24, 11:00 AM-12:30 PM
Location: Plaza Court 8

Centering ‘Āina-Based [land, earth] Education in Place-Based STEM Instruction
Tara O’Neill*, University of Hawaii at Manoa, USA

Double Stimulation: Repositioning Preservice Elementary Teachers as Agents of Social and Environmental Justice
Jenny Martin*, Australian Catholic University, Australia

Art and Science-based Cyanotype Experiences Help Promote Environmental Awareness and Stewardship in Pre-service Teacher Training
Maraliz Fischler-Barraza*, San Diego State University, USA

Children Leveraging Science Practices, Care and Expertise towards Hyperlocal and Global Climate Justice
Kathleen Schenkel*, San Diego State University, USA
Cassie Brownell, Ontario Institute for Studies in Education, University of Toronto, Canada
Jon Wargo, University of Michigan, USA
Strand 3: Science Teaching — Primary School (Grades preK-6):
Characteristics and Strategies
SC-Organized Paper Set
Supporting Diverse Science Instruction
20-Mar-24, 1:45 PM-3:15 PM
Location: Plaza Court 2

Elementary School Teachers’ Use of Educative Support Curricula: Citizen Science Projects in Science Instruction
Sarah Carrier*, North Carolina State University, USA
Patrick Smith, Horizon Research, Inc., USA
Jill McGowan, North Carolina State University, USA
Lindsey Sachs, Horizon Research, Inc., USA
Meredith Hayes, Horizon Research, Inc., USA
Sarah Safley, Horizon Research, Inc., USA
Chris Goforth, North Carolina Museum of Natural Sciences, USA
Danielle Scharen, Horizon Research, Inc., USA

Exploring the Complexity of Teacher Development for Adaptive Teaching in Science Education
Jee Kyung Suh*, University of Alabama, USA
Jale Dursun*, University of Alabama, USA
Ercin Sahin, University of Iowa, USA
Brian Hand, University of Iowa, USA
Gavin Fulmer, Northwest Evaluation Association, USA

Supporting Elementary Teachers’ Use of Culturally Responsive Pedagogy with Scenario-Based Performance Tasks
Jamie Mikeska*, ETS, USA
Jessica Tierney, ETS, USA
Niki Kanagaki, ETS, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12):
Characteristics and Strategies
SC-Organized Paper Set
Teachers’ Use of Curricular Resources
20-Mar-24, 1:45 PM-3:15 PM
Location: Directors Row I

The Effect of Intervention Coursework on Science Achievement
Kristin Mansell*, Texas Tech University, USA

Practitioner-reported Needs for Enacting, Implementing, and Adopting OpenSciEd Curriculum Materials
Kevin McElhaney*, Digital Promise, USA
Rochelle Urban, Digital Promise, USA
Danae Kamdar, Digital Promise, USA

Early Career Science and Mathematics Teachers’ Access to and Use of Resources
Robert Idsardi*, Eastern Washington University, USA
Shannon Navy, Kent State University, USA
Julie Luft, University of Georgia, USA
Lisa Borgerding, Kent State University, USA
Ella Yonai, University of Georgia, USA
Emily Hamada, Eastern Washington University, USA
Adepeju Prince, Kent State University, USA
Kelly Kulp, University of Georgia, USA
Elizabeth Ayano, University of Georgia, USA
Jose Pavez, Western Illinois University, USA

Jorge Solís, University of Texas at San Antonio, USA
Janeth Martinez-Cortes, University of Texas at San Antonio, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set
Advancing Assessment Literacy and Pedagogical Practices
20-Mar-24, 1:45 PM-3:15 PM
Location: Governor’s Square 12

Measuring Assessment Literacy of STEM Faculty in Higher Education: A Systematic Review
Mikayla Strasser*, University of Illinois Chicago, USA
Yue Yin, University of Illinois Chicago, USA

Prospective Elementary Teachers’ Written and Pictorial Images Representing Observations and Inferences of a Puzzling Phenomenon
Jaclyn Murray*, Mercer University, USA

Effects of Learning Assistant Facilitation on Student In-the-Moment Learning
Nicole Maggiore*, Tufts University, USA
Ira Caspari-Gnann, Tufts University, USA

Tertiary Engineering Faculty’s Journey to Active Learning Pedagogies through Lesson Study
Cynthia Gibson, University of Texas at San Antonio, USA
Elizabeth McMillan*, University of Texas at San Antonio, USA
Juliet Langman, Kennesaw State University, USA

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set
Developing STEM Identities and Feelings in Informal Learning Contexts
20-Mar-24, 1:45 PM-3:15 PM
Location: Governor’s Square 11

Harnessing the Strengths of Young Black Girl’s Feelings Towards Science from an OST Space
Heather Lavender*, University of Georgia, USA

Future Teachers in the Making: Identity Development through Afterschool STEM Programming
Jasmine Nation*, California Polytechnic State University, San Luis Obispo, USA
Alexandria Hansen, California State University, Fresno, USA
Kristin Bridgeford, California Polytechnic State University, San Luis Obispo, USA
Jess Jensen, California Polytechnic State University, San Luis Obispo, USA
Katie Sinclair*, California Polytechnic State University, San Luis Obispo, USA
Myunghwan Shin, California State University, Fresno, USA
Isabella Contreras, California Polytechnic State University, San Luis Obispo, USA
Claire Gillaspie*, California Polytechnic State University, San Luis Obispo, USA

Engaging in Scaffolded Outdoor Scientific Practices to Build Feelings of Being a Scientist
Kristy Daniel*, Texas State University, USA
Rachel Lincoln Seets, Texas State University, USA  
Carolyn Jess, Texas State University, USA  
Jill Zipperer, Texas State University, USA

Supporting Equitable Practice in Makerspaces: Learnings From Youth Programmes in the Global Makerspaces
Meghna Nag Chowdhuri*, University College London, United Kingdom  
Louise Archer*, University College London, United Kingdom

Strand 7: Pre-service Science Teacher Education Symposium
Teaching Science for Justice: A Case Study of Preparing and Supporting Teachers Across Three Years  
20-Mar-24, 1:45 PM-3:15 PM  
Location: Governor’s Square 15

Teaching Science for Justice: A Case Study of Preparing and Supporting Teachers Across Three Years
Sinead Brien*, University of South Carolina Upstate, USA  
Matthew Adams, Michigan State University, USA  
Taylor Mackenzie, Everett High School, USA  
Katelynn Jackson, Holt High School, USA  
Nicole Hefty, Canal Winchester High School, USA

Strand 8: In-service Science Teacher Education  
SC-Organized Paper Set  
Mentoring and Empowering Teacher Leaders  
20-Mar-24, 1:45 PM-3:15 PM  
Location: Plaza Court 5

Mentor Teachers' Perceptions of Mentoring for Reform-Oriented Science Teaching Before and After Implementing Educative Mentoring
Amanda Hall*, North Carolina State University, USA  
Grace Carroll, North Carolina State University, USA  
Soonhye Park, North Carolina State University, USA  
W. Matthew Reynolds, North Carolina State University, USA  
N. Scott Ragan, North Carolina State University, USA  
Jason Painter, North Carolina State University, USA

Implementation of a Pilot STEMM Planning Institute for K-12 Campus Leadership Teams
Matthew Blank*, Baylor College of Medicine, USA  
Alana Newell, Baylor College of Medicine, USA  
Nancy Moreno, Baylor College of Medicine, USA

Science Instructional Coaches: Characteristics, Contexts, and Community
Emma Refvem*, Durham Public Schools, USA  
M. Jones*, North Carolina State University, USA  
Amber Meeks, North Carolina State University, USA  
Tanzimul Ferdous, North Carolina State University, USA
Strand 8: In-service Science Teacher Education  
SC-Organized Paper Set  
NGSS Practices and Pedagogy  
20-Mar-24, 1:45 PM-3:15 PM  
Location: Plaza Court 4

Leveraging Instructional Routines to Facilitate NGSS Implementation in High School Science  
Elizabeth Chatham*, New Visions for Public Schools, USA  
Angela Kelly, StonyBrook University, USA

Exploring Teachers' Experiences with Implementing Open-ended Inquiry Labs in High School Physics Classes  
Hamideh Talafian*, University of Illinois at Urbana-Champaign, USA  
Maggie Mahmood, University of Illinois at Urbana-Champaign, USA  
Tim Stelzer, University of Illinois at Urbana-Champaign, USA  
Eric Kuo, University of Illinois at Urbana-Champaign, USA  
Morten Lundsgaard, University of Illinois at Urbana-Champaign, USA  
Devyn Shafer, University of Illinois at Urbana-Champaign, USA  
Samuel Engblom, University of Illinois at Urbana-Champaign, USA

Cultural Historical Analysis of Teacher Reflections on Data Investigations of Extreme Weather in Rural Classrooms  
Gili Marbach-Ad, University of Maryland, USA  
Asli Sezen-Barrie*, National Science Foundation, USA  
Josephine Louie, EDC, USA  
Emily Fagan, EDC, USA  
Brian Fitzgerald, Mount Washington, USA  
Kevin Waterman, EDC, USA  
Pam Buffington, EDC, USA

Engaging Student Learning With Models Through the Epistemology of Models  
Anupong Praisri*, Kasetsart University (Bangkhen Campus), Thailand  
Chatree Faikhamta, Kasetsart University (Bangkhen Campus), Thailand  
Akarat Tanakand, Kasetsart University (Bangkhen Campus), Thailand  
Samia Khan, The University of British Columbia, Canada

Strand 10: Curriculum and Assessment  
SC-Organized Paper Set  
Assessing and Enhancing Scientific and Engineering Practices  
20-Mar-24, 1:45 PM-3:15 PM  
Location: Plaza Court 6

Chunking Code, Representation, and Science Content to Enhance Secondary Students' Participation in Computational Science Investigations  
Christopher Lore*, The Concord Consortium, USA  
Hee-Sun Lee, The Concord Consortium, USA  
Amy Pallant, The Concord Consortium, USA  
Jie Chao, The Concord Consortium, USA

Evaluating Singapore Middle School Students' Grasp of Scientific Practices  
Yann Shiou Ong*, Nanyang Technological University, Singapore  
Yew-Jin Lee, Nanyang Technological University, Singapore  
Miechie Leowardy, Nanyang Technological University, Singapore
**Impacts & Moderation of a Model-Based High School Biology Program on Student Outcomes**

Christopher Wilson*, BSCS Science Learning, USA

Cynthia Passmore, University of California Davis, USA

Molly Stuhlsatz, BSCS Science Learning, USA

Cari Herrmann Abell, BSCS Science Learning, USA

Jeffrey Snowden, BSCS Science Learning, USA

Hessan Ghanimi, University of California Davis, USA

Patricia Olson, BSCS Science Learning, USA

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**Strand 11: Cultural, Social, and Gender Issues**

**SC-organized Paper Set**

*Confronting Biases and Affirming Identities Across Machine Learning, Generative AI, and Undergraduate STEM Research*

20-Mar-24, 1:45 PM-3:15 PM

Location: Governor's Square 10

Justice-Centered STEM Education to Address Pressing Societal Challenges

Okhee Lee*, New York University, USA

Justice-focused Community Agency to Transform Classroom Teaching

Marina Alexio, University of Minnesota, USA

Bhaskar Upadhyay*, University of Minnesota, USA

Kamal Koirala, Tribhuvan University, Nepal

Co-Creating With-ness, Vitality, and Axiological Tools for Justice-Oriented Elementary Science Teaching

Andrea Henrie*, Vanderbilt University, USA

Heidi Carlone*, Vanderbilt University, USA

Heather Johnson*, Vanderbilt University, USA

Adam Bell, Vanderbilt University, USA

Tessaly Jen*, Vanderbilt University, USA

Sarah Lee*, Vanderbilt University, USA

Liwei Zhang, Vanderbilt University, USA

Hannah Ziegler, Vanderbilt University, USA

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**A Qualitative Examination of Social and Science Identities Prior to a Post-Baccalaureate Research Program**

Tina Zecher*, Northern Arizona University, USA
Weaving Opportunities for Justice-Centered Science Teaching into a Secondary Science Methods Class
**DelVechio Rich**, Montclair State University, USA
**Delia Furer**, Montclair State University, USA
**Douglas Larkin**, Montclair State University, USA
Preparing Teachers for Rigorous and Equitable Science Instruction in Linguistically Diverse Classrooms
**Alexis Rutt**, University of Mary Washington, USA

An Ethical Imperative: “Working Difference” In Science Teacher Education Through a Posthuman Lens
**Sophia Jeong**, The Ohio State University, USA
**Ashlyn Pierson**, The Ohio State University, USA

Teo Keifert, University of North Texas, USA
**Andrea Henrie**, Vanderbilt University, USA
**Heather Johnson**, Vanderbilt University, USA
**Bethany Daniel**, Vanderbilt University, USA
**Sarah Lee**, Vanderbilt University, USA

Justice-Centered Ambitious Teaching: Where Teachers Chose to Start
**April Luehmann**, University of Rochester, USA
**Yang Zhang**, Northwestern University, USA
**Hannah Cooke**, University of Connecticut, USA
**Todd Campbell**, University of Connecticut, USA
**Déana Scipio**, Islandwood, USA
**Priya Pugh**, Islandwood, USA

**Strand 11: Cultural, Social, and Gender Issues**
**SC-Organized Paper Set**
Pedagogy Matters: Assessing Equitable Instructional Practices and Impacts
**20-Mar-24, 1:45 PM-3:15 PM**
**Location: Governor’s Square 16**

Development and Validation of the BOLD Protocol: Measuring Biology Teachers’ Culturally and Linguistically Responsive Instruction
**Niki Koukoulidis**, University of Florida, USA
**Jinnie Shin**, University of Florida, USA
**Julie Brown**, University of Florida, USA
**Mark Pacheco**, University of Florida, USA

Potency of Culturo-Techno-Contextual Approach in Enhancing Achievement of Senior Secondary School Physics Students in Optics.
**John Ogonenwe**, African Center of Excellence for Innovative and Transformative STEM Education, Nigeria
**Tunde Rahman**, Lagos State University, Nigeria
**Peter Okebukola**, African Center of Excellence for Innovative and Transformative STEM Education, Nigeria

Increasing Active Learning Methods Improves Engineering Mathematics Course Outcomes, Especially for Underrepresented Students in STEM
**Katherine Golway**, University of Louisville, USA
Campbell Bego, University of Louisville, USA
Shannon Derkson, University of Louisville, USA
Jeffrey Hieb, University of Louisville, USA
Marci DeCaro, University of Louisville, USA

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set
Technology in Science Teaching and Learning
20-Mar-24, 1:45 PM-3:15 PM
Location: Governor's Square 14

Differences in ICT TPACK Efficacy Among Science Teachers in Elementary and Middle Schools
Adjoa Mensah*, University of Nevada Las Vegas, USA
Mayra Marquez Mendez, University of Nevada Las Vegas, USA
Tina Vo, University of Nevada Las Vegas, USA

Scaffolding Students’ Co-Construction and Peer-Critiquing of Carbon Cycling Models and Investigating the Effects
Hsin-Yi Chang*, National Taiwan Normal University, Taiwan

Leveraging Learning Experience Design to Foster Cognitive and Behavioral Impact with Embedded Video Questions
Joseph Wong*, University of California, Irvine, USA
Lindsey Richland*, University of California, Irvine, USA
Brad Hughes*, University of California, Irvine, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set
NOS in Pre-Service Teacher Education
20-Mar-24, 1:45 PM-3:15 PM
Location: Plaza Court 3

Improving Preservice Elementary Teachers’ Conceptions of Nature of Science Through Participation in Citizen Science Projects
Mila Rosa Carden*, University of North Texas, USA
Karthigeyan Subramaniam*, University of North Texas, USA
Christopher Long*, University of North Texas, USA
Nazia Khan*, University of North Texas, USA

Exploring Three Secondary Preservice Teachers’ Views of NOS, Beliefs about Teaching NOS, and NOS Teaching
Kelsey Beeghly*, University of Central Florida, USA
Su Gao, University of Central Florida, USA
Jerrid Kruse, Drake University, USA

Investigating Nature of Science Conceptions and Argumentation Components in a Science Methods Course
Rola Khishfe*, American University of Beirut, Lebanon

Exploring Elementary Preservice Teachers’ Scientific Explanations: A Comparative Analysis using NOSE Framework and CER Model
Sahar Alameh*, University of Kentucky, USA
Blake Sampson, University of Kentucky, USA
**Strand 14: Environmental Education and Sustainability**  
SC-Organized Paper Set  
**Building Teachers’ Capacity on Climate Literacy**  
**20-Mar-24, 1:45 PM-3:15 PM**  
**Location: Plaza Court 8**

*Developing Elementary Teachers’ Self-efficacy for Climate Change Teaching and Climate Change Literacy Using Learning Technologies*  
Lauren Wagner*, Florida State University, USA  
Amal Ibourk*, Florida State University, USA  
Khadija Zogheib*, Florida State University, USA

*Watershed Moments: Investigating Teacher Motivation and Benefits to Place-Based Environmental Professional Development Workshops*  
Jessica Stephenson Reaves*, Kennesaw State University, USA  
Rasheda Likely, Kennesaw State University, USA  
Anna Maria Arias, Kennesaw State University, USA

*Building Capacity to Teach and Learn Earth & Environmental Data Science at Smaller Minority Serving Institutions*  
Nathan Quarderer*, CU Boulder/CIRES/ESIIL/Earth Lab, USA  
Emily Ward, CU Boulder/CIRES/ESIIL, USA  
Katherine Halama, CU Boulder/CIRES/ESIIL/Earth Lab, USA  
Jennifer Balch, CU Boulder/CIRES/ESIIL Earth Lab, USA  
Elsa Culler, CU Boulder/CIRES/ESIIL/Earth Lab, USA  
Chelsea Nagy, CU Boulder/CIRES/ESIIL/Earth Lab, USA

**James Sanovia**, CU Boulder/CIRES/ESIIL/AIHEC, USA  
**James Rattling Leaf**, CU Boulder/CIRES/ESIIL/NC CASC, USA  
**Anne Gold**, CU Boulder/CIRES/ESIIL, USA

**Plenary Session**  
**Closing Session**  
**20-Mar-24, 3:30 PM-4:30 PM**  
**Location: Plaza Ballroom ABC/DEF**

**Committee Meeting**  
**NARST Board of Directors Meeting**  
**20-Mar-24, 5:00 PM-10:00 PM**  
**Location: Directors Row E**
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