



NARST

A global organization for improving
science education through research

2020

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CONFERENCE

MARCH 15-18

PORTLAND, OR, USA

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SCIENCE EDUCATION ACROSS PLACES AND CONTEXTS

Science for Your Class, Science In Your Class

NEW

The Educational Leader's Guide to Improvement Science

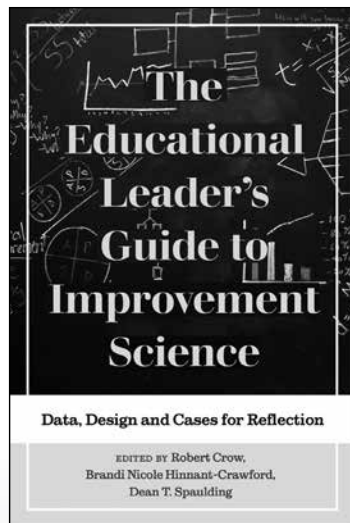
Data, Design and Cases for Reflection

Edited by Robert Crow,
Brandi Nicole Hinnant-Crawford,
and Dean T. Spaulding

The Educational Leader's Guide to Improvement Science is a collection illustrating applied organizational problem-solving using methods of improvement science in educational leadership. This text concentrates on the elements faculty, students, and administrators need, and specific models where improvement science frameworks enhance the reliability and validity of improvement or quality enhancement efforts.

Improvement Science in Education and Beyond Series

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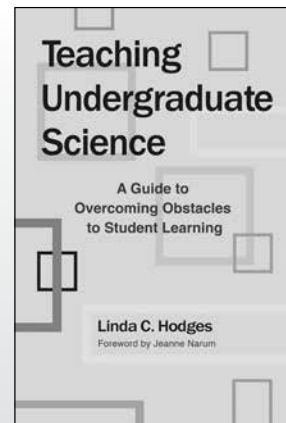
Teaching Undergraduate Science

A Guide to Overcoming Obstacles to Student Learning

Linda C. Hodges

Foreword by
Jeanne Narum

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Teaching Science Online

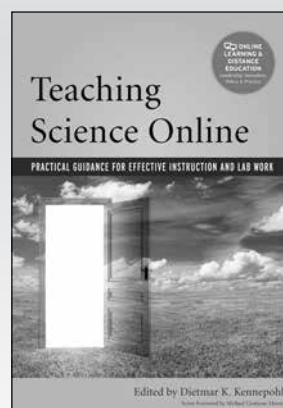
Practical Guidance for Effective Instruction and Lab Work

Edited by
Dietmar Kennepohl

Foreword by
Michael G. Moore

Online Learning and Distance Education Series

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FORTHCOMING TEXT

Improvement Science in Education

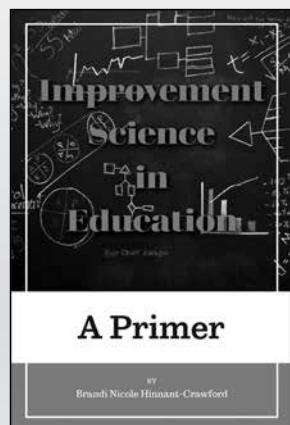
A Primer

Brandi Nicole Hinnant-Crawford

This *Primer* is specifically designed to introduce improvement science to educational audiences. Originally employed in such fields as engineering and health care, it has proven to be a very effective process for improving schools.

Improvement Science in Education and Beyond Series

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June 2020



BESTSELLER

The New Science of Learning

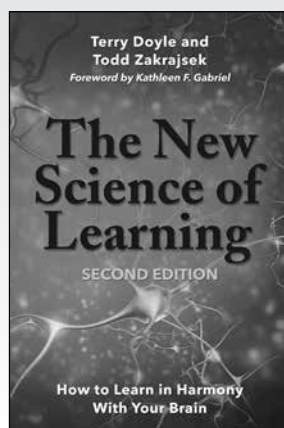
How to Learn in Harmony With Your Brain

SECOND EDITION

Terry Doyle and Todd D. Zakrajsek

Foreword by Kathleen F. Gabriel

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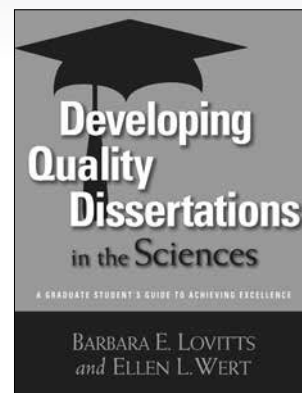
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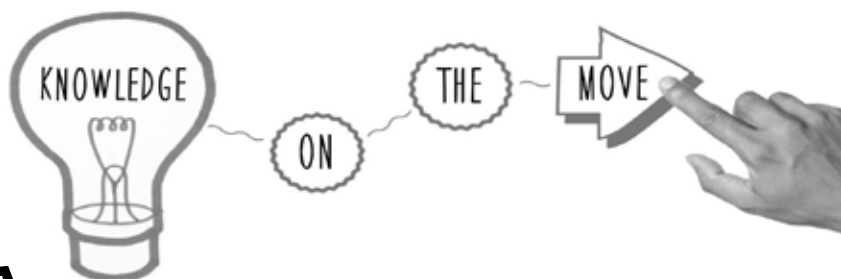
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ACKNOWLEDGMENTS

The following members of the Program Committee helped in preparing and editing the 2020 NARST Annual International Conference Program Book.

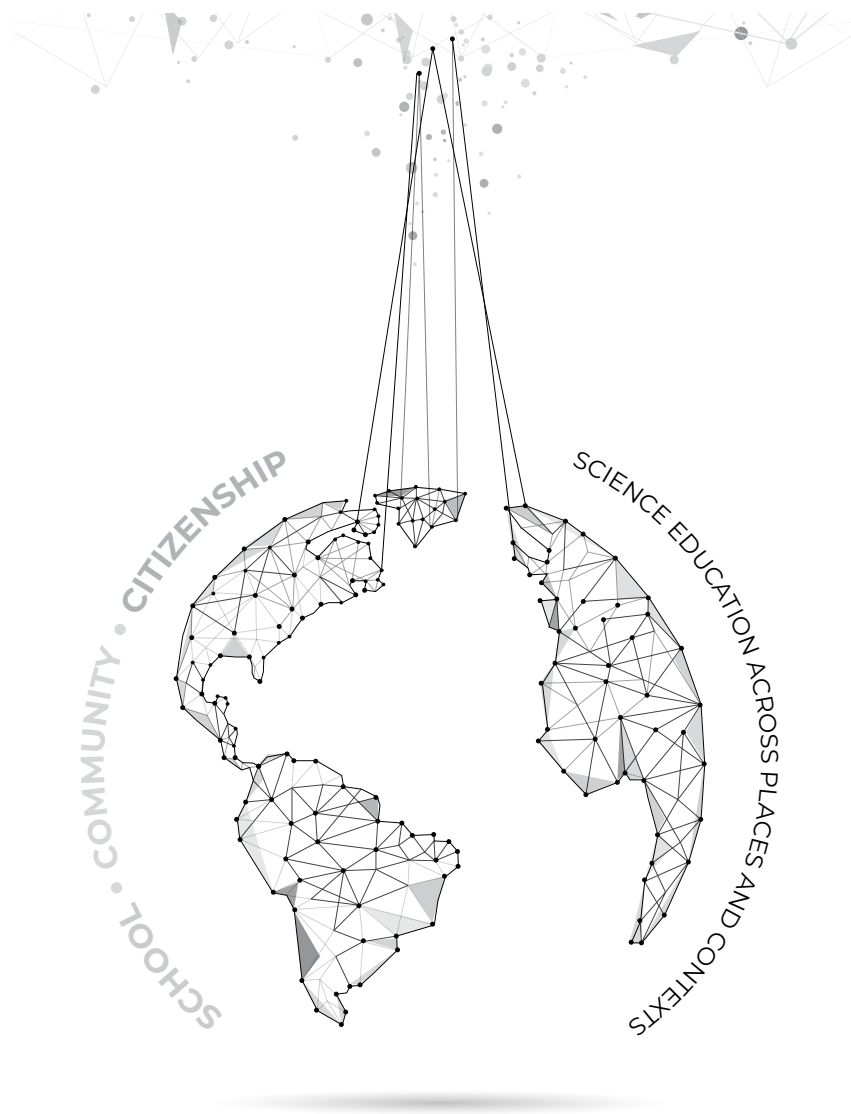
Tali Tal, President and
Program Committee Co-Chair

Eileen Carlton Parsons, President-Elect
and Program Committee Co-Chair

Helen Schneider Lemay
Executive Director

Paul Kemp
Conference Program and Data Coordinator

Tara M. Reddy
NARST Association Manager



Please note that this program is subject to change.

Check the addendum posted at the meeting and on the website for updates and any presentations that have been withdrawn after the program has been published.

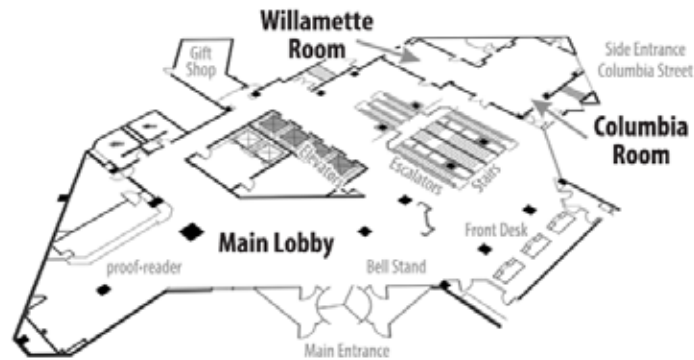


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FLOOR PLAN

LOBBY LEVEL



LOWER LEVEL

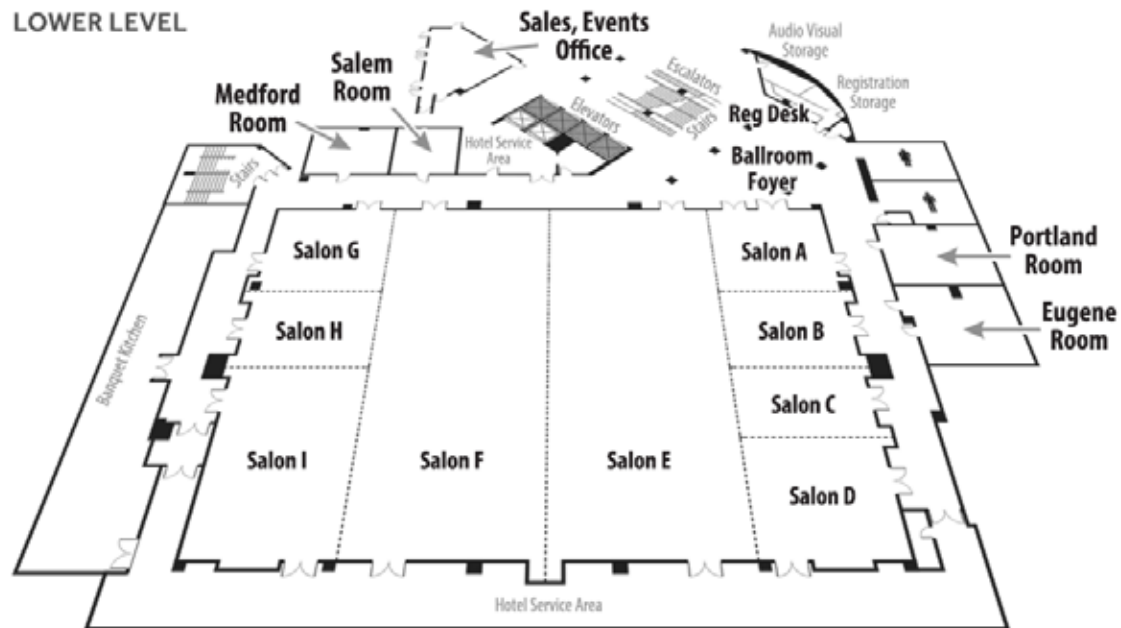
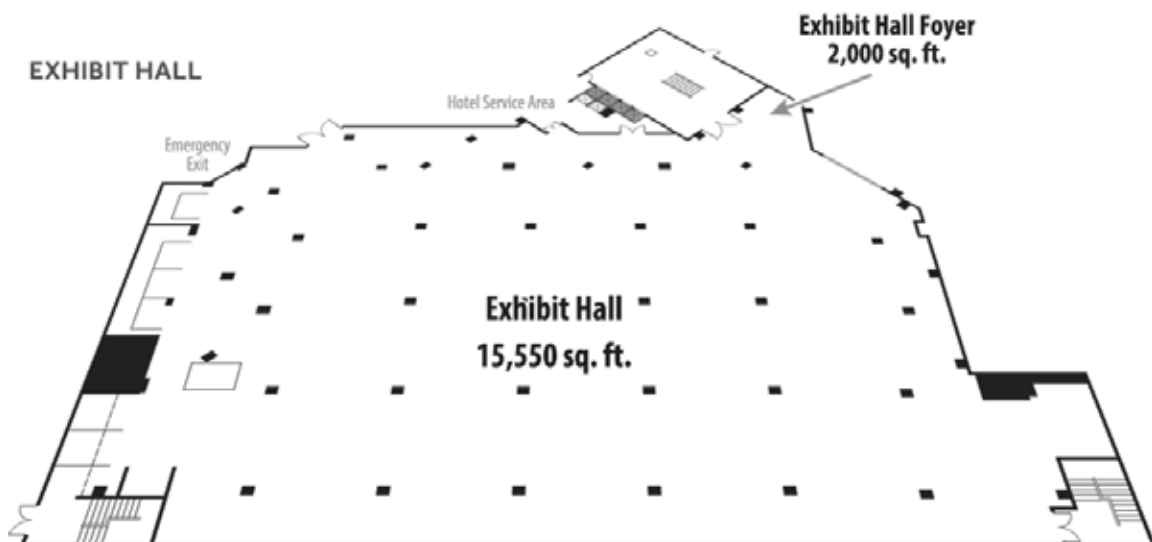


EXHIBIT HALL

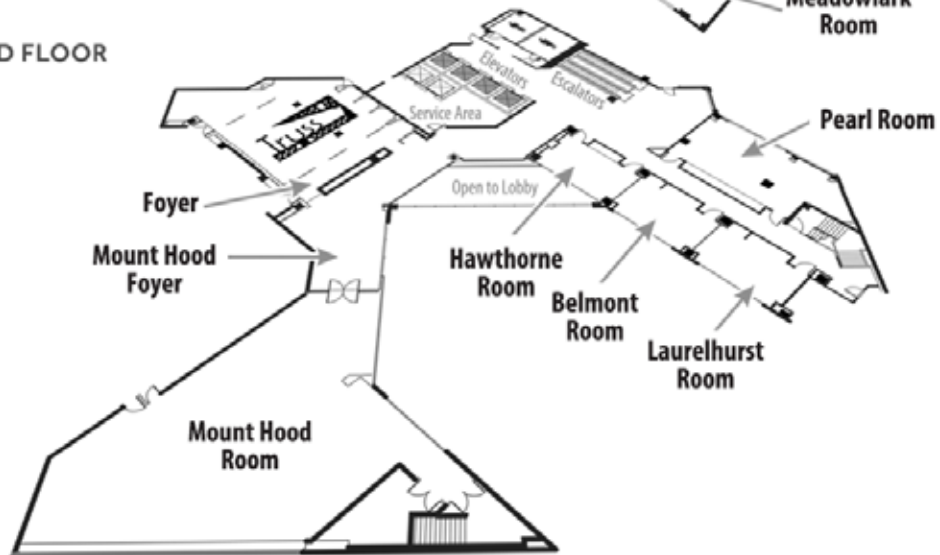


FLOOR PLAN

THIRD FLOOR



SECOND FLOOR



GENERAL INFORMATION

Information about NARST

The National Association for Research in Science Teaching (NARST) was founded in 1928 for the purpose of promoting research in science education at all educational levels and disseminating the findings of this research in such ways as to improve science teaching and learning.

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 worldwide organization for improving science teaching and learning 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 worldwide 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.

To learn more about NARST you may visit the Association's website at <http://narst.org/>.

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 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.

GENERAL INFORMATION

NARST Code of Ethical Conduct

(Revised: 20 September 2018)

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.

GENERAL INFORMATION

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

- AERA Council. (2011). Code of ethics: American Educational Research Association. *Educational Researcher*, 40(3), 145-146.
- American Sociological Association. (1999). Code of ethics and policies and procedures of the ASA committee on professional ethics. Retrieved from <http://www.asanet.org/membership/code-ethics>
- American Psychological Association. (2017). Ethical principles of psychologists and code of conduct. Retrieved from <http://www.apa.org/ethics/code/>

GENERAL INFORMATION

Explanation of Program Session Formats

Paper Sessions Organized by the Program Committee

In a paper session, the presider introduces the presenters and monitors the time used for each presentation. All papers will be allotted 15 minutes for presentation, followed by approximately 5 minutes of questions or discussion. The presider and audience will use any time remaining in the session for additional discussion, general review, and suggestions for further research. Each presenter is expected to have a manuscript for distribution to attendees. The manuscript may be available either via hard copy distribution at the session or via electronic access provided by the author.

Symposium

A symposium involves a panel of experts or stakeholders who examine a specific theme or issue. This format does not involve the presentation of individual papers. Therefore, individual papers and authors will not be listed under this format. Rather, the participants are listed as panel members. The proposer controls presentations, discussion, and questioning with the assistance of the presider or discussant (if designated). Discussion should promote the expression of similar or alternative viewpoints and theoretical positions. The proposer of the symposium is expected to disseminate a paper or a summary with references either via hard copy distribution at the session or via electronic access provided by the proposer.

Related Paper Set

This category accommodates, in a single session, three to five related research papers reporting several studies that originate from a common base of research. This format also allows for common elements of design or approach to be presented once rather than repetitively. The proposer and authors may determine the specifics of the session once it is accepted. For instance, those involved may opt for a formal presentation style or they may conduct their session in a more informal, discussion-oriented style. Each presenter is expected to have a manuscript for distribution to attendees. The manuscript may be available either via hard copy distribution at the session or via electronic access provided by the author.

Poster Session

This format offers presenters the opportunity to display their work graphically on a poster display board. The poster display is 4 ft. wide x 8 ft. long (48 inches x 96 inches) – horizontal orientation.

PLEASE NOTE: We are no longer using the tri-fold boards. Each presenter must set up their poster display prior to the start of the Poster Session and then remove it at the end of the Poster Session. Each presenter is expected to have a manuscript for distribution to attendees. The manuscript may be available either via hard copy distribution at the session or via electronic access provided by the author.

Roundtable Session

Roundtable sessions allow maximum interaction among presenters and attendees. Papers accepted for a roundtable session will be grouped into tables with three papers per table, clustered around shared interests. Each roundtable session will be scheduled for a 60-minute time slot, with each presenter presenting for 12-15 min and the rest dedicated for discussion. We ask that the presenters at each table share the time equally. Presenters wishing to display information may do so from their own laptop computer screens. If you plan to use a laptop, please be sure the battery is charged, as a power source will not be provided. Alternatively, presenters can share printed materials.

Guidelines for Meeting Presenters

- Go to the designated room at least 10 minutes early.
- Greet the presider/discussant.
- NARST provides the LCD and screen in each presentation room. NARST does not provide computers, speakers, microphones, pointers, or other audio/visual equipment. You must have your own computer or you may put your file on a USB flash drive in advance, in case you will be using another presenter's computer for your presentation.
- Check your understanding of the LCD projector and any other audio/visual equipment prior to the session.

GENERAL INFORMATION

- Keep presentation within the designated time limit.
- Invite audience comments and questions.
- If there is no presider assigned for your session, then presenters should keep time for each other.

Guidelines for Presiders and Discussants

We have accommodated most sessions with a presider, whose role is detailed below. For sessions without presiders, we are counting on the presenters to set aside time for discussion so that the audience participants can contribute to a discussion of the papers.

The role of the Presider includes:

- Arrive early at designated room and arrange furniture as per desires of presenters.
- Check and focus LCD projector.
- Check pronunciations of the names of the presenter and their institutions.
- With presenters, make a time plan, retaining the order of presenters in the program.
- Start session promptly.
- Introduce presenters and serve as time-keeper. Alert presenters when they have 5-, 3-, and 1-minute remaining. It is important to end each presentation within the agreed allocated time to ensure fairness to all presenters and in order to end the session on time. One suggestion that may be followed is if someone begins to exceed their allotted time, then it is appropriate to stand up and politely announce to the audience that you invite further discussion directly with the author(s) at the conclusion of the entire session.
- Facilitate discussion, assuring equitable involvement of audience members. Close session on time.

The role of the Discussant includes:

- Read papers before the session and have remarks prepared ahead of time.
- Perform presider duties as detailed above, if there is only a discussant for the session.

- After the presentation, make brief and cogent remarks on each paper with suggestions for future research.

Strand Key

- STRAND 1** – Science Learning: Development of Student Understanding
- STRAND 2** – Science Learning: Contexts, Characteristics, and Interactions
- STRAND 3** – Science Teaching – Primary School (Grades PreK-6): Characteristics and Strategies
- STRAND 4** – Science Teaching – Middle and High School (Grades 5-12): Characteristics and Strategies
- STRAND 5** – College Science Teaching and Learning (Grades 13-20)
- STRAND 6** – Science Learning in Informal Contexts
- STRAND 7** – Pre-service Science Teacher Education
- STRAND 8** – In-service Science Teacher Education
- STRAND 9** – Reflective Practice
- STRAND 10** – Curriculum, Evaluation, and Assessment
- STRAND 11** – Cultural, Social, and Gender Issues
- STRAND 12** – Educational Technology
- STRAND 13** – History, Philosophy, and Sociology of Science
- STRAND 14** – Environmental Education
- STRAND 15** – Policy

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We acknowledge Wiley-Blackwell and their work as publisher of the *Journal of Research in Science Teaching – JRST*

GENERAL INFORMATION

2021 NARST Annual International Conference

The Program Chair invites NARST members and others to participate in the **2021 NARST Annual International Conference** and contribute to the 2021 conference by submitting program proposals.

Venue: Hilton Orlando Hotel, Orlando, FL

Dates: April 7-10, 2021

Theme: Science Education, a Public Good for the Good of the Public? Research to Empower, Evoke, and Revolutionize

Science Education, a public good for the good of the public? Research to empower, evoke, and revolutionize is a fitting call for this era of drastic change (e.g., population shifts, prominence of technology, disappearing economies) and daunting challenges (e.g., increased frequency of life-impacting natural and human-inspired disasters). It is a charge to conduct science education research for a socially just world.

A critical look at outcomes reveals a socially unjust world resistant to transformation. Throughout time, science education has been a public good of great value, but only and fully accessible to those society regarded as worthy. For example, in some countries, agencies identified individuals early in their development and tracked them into educational experiences for a life in the sciences with all its privileges (e.g. esteemed status, monetary benefits). In the United States (U.S.), science education for much of its existence was overtly reserved for whites, especially those of economic means. It was a vehicle to develop intellectual disciplines to solve real-world problems, competencies to ensure privileged positions in society for its participants. A version less valued by society, designed to hone vocational skills and socialize for subservient roles, was later expanded to include the poor and provided in scarcely resourced segregated settings for those classified as non-white.

Fast forward to the present: the intent of past practices to exclude is not overt in some countries, including the U.S., but parity in group outcomes has been slow and the historical structures (e.g., financing of education, allocation of resources, segregation and tracking of students) that contribute to outcome disparities remain largely intact.

For instance, whites exceed their representation in the U.S. general population in science education of high currency (e.g., AP courses, science majors) and in heavily resourced settings where high-quality science education is provided from preschool to postsecondary. When viewed from a systems and group perspective, who gets access to which opportunities has remained mostly unaltered across time.

Substantial progress towards a socially just world in which science education is a public good for the good of the public—a public inclusive of all desiring to partake—is elusive. A call for research to empower, evoke, and revolutionize may be heretical to those who believe western science, one foundation of science education, is a universal, objective body of knowledge immune to the frailties of humans who construct it and the sociopolitical contexts in which it is constructed. It may be unsettling for others who see science education strictly through an individual rather than group and complex systems lens and it may be disconcerting to those who adhere to presentism, an ahistorical view that exclusively attributes current conditions to the here and now. Receptive or not, the drastic changes and daunting challenges at this time demand all hands on deck and warrant an equity- and equality-oriented criticality—an intentional, exacting examination to deconstruct and disrupt the status quo privileging a few in pursuit of a socially just world for the many. The time for research to empower (envision beyond the existing boundaries), evoke (think and act boldly in times of ease and turmoil), and revolutionize (abandon the idea good intentions are enough and institute change to achieve equitable and equal outcomes) is now. It is this kind of research the 2021 conference aims to inspire.

Submission Deadline:

The Program Chair or designate must receive your program proposals for the 2021 Annual International Conference by August 15, 2020. This deadline allows sufficient time for processing, reviewing, and evaluating the many submitted proposals in a fair manner. By early July 2020, the call for program proposals will appear on the NARST website.

Conference Chair: Eileen Carlton Parsons
President-Elect



NARST 94TH ANNUAL INTERNATIONAL CONFERENCE

Science Education, a Public Good for the Good of the Public?

Research to ***Empower, Evoke, and Revolutionize***

Future Meeting Dates for NARST, NSTA, and AERA

2020

NSTA April 2 – 5 | Boston, MA

AERA April 17 – 21 | San Francisco, CA

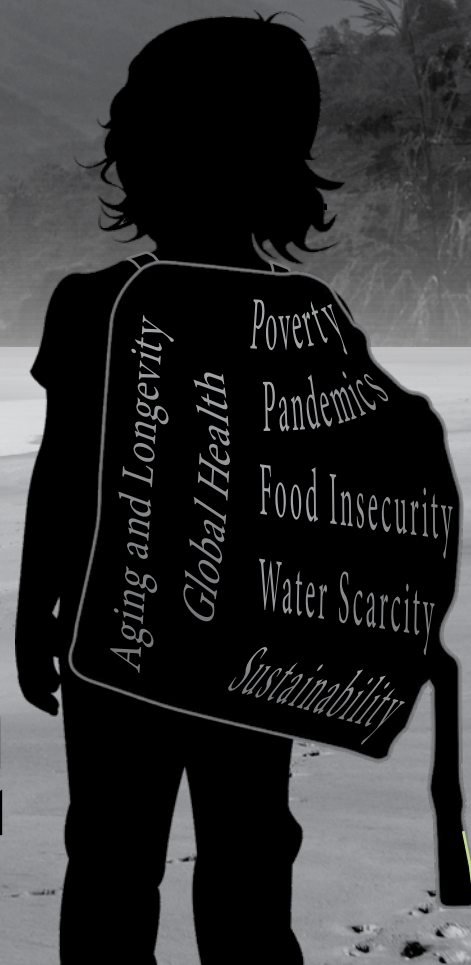
2021

NARST April 7-10 | Orlando, FL

NSTA April 8 – 11 | Chicago, IL

AERA April 9 – 12 | Orlando, FL

April 7-10, 2021
Hilton Orlando Hotel
Orlando, Florida



GENERAL INFORMATION

NARST Sponsored Sessions at NSTA Conferences 2020

THURSDAY, APRIL 2

NARST-SPONSORED SESSION:

Latent Expectancy-Value-Cost Motivation Study of Black/African American Grade 5 Students

8:00 AM – 9:00 AM

Room: Flagship A, Seaport Hotel

Discussion centers on what affects student motivation (and a survey to help determine this). Review a study of expectancy-value-cost motivation categories of 860 Black/African American fifth grade students in an urban school district.

Speaker: David McKinney

Issac Newton Middle School

Session Topic: General Science Education

Session Type: Presentation

NARST-SPONSORED SESSION:

Students as Curriculum Critics, Reframing Issues of Motivation

12:30 PM – 1:30 PM

Room: Flagship A, Seaport Hotel

Both teachers and researchers identify low motivation among students as a problem that prevents meaningful science learning. Emphasis will be placed on learning to look at and make sense of students' willingness to engage.

Speaker: Daniel Morales-Doyle

Assistant Professor

The University of Illinois at Chicago

Session Topic: General Science Education

Session Type: Hands-On Workshop

NARST-SPONSORED SESSION:

An Equity Lens on NGSS-Focused Classroom-Embedded Assessments

2:00 PM – 3:00 PM

Room: Flagship A, Seaport Hotel

This study examined the extent to which culturally relevant science teaching strategies were taken up by middle school science teachers as a result of a two-year professional development explicitly focused on meeting the NGSS.

Speakers: Sheron Mark

University of Louisville

Thomas Tretter

Professor of Science Education

University of Louisville

Session Topic: General Science Education

Session Type: Presentation

FRIDAY, APRIL 3

NARST-SPONSORED SESSION:

Exploring the Potential of Teacher Leadership to Drive STEM Programming in Public Schools

9:30 AM – 10:30 AM

Room: Flagship A, Seaport Hotel

Discuss findings from a research project on the development of STEM programming in schools. Recommendations are provided for approaches to developing STEM programming through teacher leadership initiatives.

Speakers: Gillian Roehrig

Professor

STEM Education Center

Elizabeth Crotty

STEM Education Center

Session Topic: General Science Education

Session Type: Presentation

GENERAL INFORMATION

NARST Sponsored Sessions at NSTA Conferences 2020 (con't)

NARST-SPONSORED SESSION:

Science Across the Spectrum—Including Students with Autism and Intellectual/Developmental Disabilities

12:30 PM – 1:30 PM

Room: Flagship A, Seaport Hotel

Using an original research study, strategies will be shared that guide participants on any modifications that may be needed based on their individual classroom and teaching needs. As the interventions presented will be specific to students with ASD and IDD, few modifications or accommodations should be needed.

Speakers: Jiwon Hwang

California State University
Bakersfield

Jonté Taylor

Assistant Professor, Penn State

Session Topic: General Science Education

Session Type: Presentation

NARST-SPONSORED SESSION:

Teaching STEM Through an Interdisciplinary Approach: An Example of Water Quality and Physical Mix Separation Methods

2:00 PM – 3:00 PM

Room: Flagship A, Seaport Hotel

Take part in the development of the water quality research activity, enabling you to understand how to connect official curriculum standards with a teaching approach that is highly relevant to science education. Discover how to use a research-based teaching model in an eminently practical and interactive way.

Speakers: Norman Lederman

Professor
Illinois Institute of Technology

Radu Bogdan Toma

Session Topic: Physical Science

Session Type: Hands-On Workshop

SATURDAY, APRIL 4

NARST-SPONSORED SESSION:

Clarifying the Role(s) of the Crosscutting Concepts in Science and Engineering Learning

8:00 AM – 9:00 AM

Room: Flagship A, Seaport Hotel

Review outcomes of a 2.5-day NSF-funded workshop held in December 2018 focused on clarifying the roles the crosscutting concepts play in supporting science learning. We will share potential theories-of-action describing how CCCs support science learning and priorities for future research.

Speakers: Jeff Nordine

Deputy Head of Department
Physics Education
Leibniz Institute for Science
and Mathematics Education

Sarah Fick

Research Assistant Professor
of Science Education
University of Virginia

Session Topic: Engineering-Technology-and
the Application of Science

Session Type: Presentation

NARST-SPONSORED SESSION:

Culturally Relevant Virtual Reality (VR) Learning: Bridging Cultures, Content, and Contexts

9:30 AM – 10:30 AM

Room: Flagship A, Seaport Hotel

Review findings from a two-year-long study on the role of culturally relevant virtual reality (VR) science curriculum in teaching and learning. We will cover how the images and videos can be used to introduce students to science within

GENERAL INFORMATION

NARST Sponsored Sessions at NSTA Conferences 2020 (con't)

their local contexts—how sounds and images can offer real-world connectivity—and how students' experiences using VR improved recall as specific images and sounds triggered their prior knowledge.

Speakers: Bryan Brown
Stanford University

Phillip Boda
Graduate Student
Teachers College, Columbia University

Matthew Wilsey
Stanford University

Greses Jöhnk
Stanford University

Kathryn Ribay
Stanford University

Session Topic: Engineering-Technology-and the Application of Science

Session Type: Presentation

Track: Learning Science in All Spaces and Places: Near and Far

NARST-SPONSORED SESSION:
Planning Ambitious Science Lessons, Analyzing and Adapting Curriculum Materials to Better Support Three-Dimensional Teaching and Learning

11:00 AM – 12:00 PM

Room: Flagship A, Seaport Hotel

Review findings from a research study related to some of the challenges elementary preservice teachers experienced as they adapted published science curriculum materials in order to support

students' engagement in ambitious three-dimensional science learning.

Speaker: Carrie-Anne Sherwood
Assistant Professor of Science Education
Southern Connecticut State University

Session Topic: General Science Education

Session Type: Presentation

NARST-SPONSORED SESSION:
Yes! Fourth Graders Can Develop and Use a Scientific Model of Energy

12:30 PM - 1:30 PM

Room: Flagship A, Seaport Hotel

The practice of creating and using models is arguably the central activity of science, but teachers tell us it can be among the most challenging to implement in the classroom. Find out how to use “energy cubes” to track the flow of energy—an abstract and invisible quantity—in a simpler model system.

Speakers: Roger Tobin
Tufts University

Sara Lacy
Senior Scientist
TERC

Sally Crissman
Senior Scientist
TERC

Nick Haddad
Project Director
TERC

Session Topic: Physical Science

Session Type: Hands-On Workshop

GENERAL INFORMATION

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Technion, Israel Institute of Technology

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The University of North Carolina
at Chapel Hill

Dana L. Zeidler (2020)

University of South Florida
—Tampa Bay

Association Management:

Tara M. Reddy

Virtual, Inc.

Website Editor

Paul F. Kemp

2019 – 2020 Strand Coordinators

STRAND 1: Science Learning: Development of Student Understanding

(21) **Sarah J. Fick**

University of Virginia

(20) **Calvin Kalman**

Concordia University

STRAND 2: Science Learning Contexts, Characteristics, and Interactions

(21) **Julia Plummer**

Pennsylvania State University

(20) **David Owens**

University of Missouri

STRAND 3: Science Teaching—Primary School (Grades preK-6)

(21) **Ryan Nixon**

Brigham Young University

(20) **Carrie-Anne Sherwood**

Southern Connecticut State University

STRAND 4: Science Teaching—Middle and High School (Grades 5-12)

(21) **Neta Shaby**

Ben Gurion, University of the Negev

(20) **Justina Ogoto**

Ohio State University

GENERAL INFORMATION

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

- (21) **Lisa Kenyon**
Wright State University
- (20) **Jana Bouwma-Gearhart**
Oregon State University

STRAND 6: Science Learning in Informal Contexts

- (21) **Anton Puvirajah**
University of Western Ontario
- (20) **Nancy Staus**
Oregon State University

STRAND 7: Pre-service Science Teacher Education

- (21) **Michelle Fleming**
Wright State University
- (20) **Shannon Sung**
Concord Consortium

STRAND 8: In-service Science Teacher Education

- (21) **Nidaa Makki**
The University of Akron
- (20) **Tracy Huziak-Clark**
Bowling Green State University

STRAND 9: Reflective Practice

- (21) **Heather Page**
New York University
- (20) **Pei-Ling Hsu**
University of Texas-El Paso

STRAND 10: Curriculum, Evaluation, and Assessment

- (21) **Elon Langbeheim**
The Weizmann Institute of Israel
- (20) **Hun Jin**
Educational Testing Service

STRAND 11: Cultural, Social, and Gender Issues

- (21) **Cesar Delgado**
North Carolina State University
- (20) **Natalie King**
Georgia State University

STRAND 12: Educational Technology

- (21) **Denise M. Bressler**
Rutgers University
- (20) **Jonah Firestone**
Washington State University-Tricity

STRAND 13: History, Philosophy, Sociology, and Nature of Science

- (21) **Alexandria Hansen**
Fresno State University
- (20) **Dina Tsybulsky**
Technion-Israel Institute of Technology

STRAND 14: Environmental Education

- (21) **Idit Adler**
Michigan State University
- (20) **Isis Alkaher Kibbutzim**
College of Education

STRAND 15: Policy

- (21) **Audrey Msimanga**
University of the Witwatersrand South Africa
- (20) **Carrie Allen**
SRI International

GENERAL INFORMATION

Program Proposal Reviewers

Fouad Abd-El-Khalick	Gillian Bayne	Devasmita Chakraverty	Chenchen Ding
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Sule Aksoy	Sarah Boesdorfer	Ying-Ting Chiu	Elizabeth Edmondson
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Paul Bartlett	Emel Cevik	Jessica Dewey	Dionysius Gnanakkan
Kathryn Bateman	Lucia Chacon-Diaz	Michael Dias	Amanda Gonczi

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Day Greenberg
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Jonathon Grooms
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Semiha Gun-Yildiz
Kristin Gunckel
Heesoo Ha
Bobby Habig
Sebastian Habig
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Colin Hennessy Elliott
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Cari Herrmann Abell
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Gary Holliday
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Ana Houseal
Karyn Housh
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Rebecca Matz
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Lucy McClain
William McComas
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Christine McDonald
Justin McFadden
Veronica McGowan
Deb McGregor
Megan McKinley-Hicks
David McKinney
Felicity McLure
Preetha Menon
Felicia Mensah
Alison Mercier
Joi Merritt
Gunkut Mesci
J. Mesiner
Mark Meszaros
Katherine Miller
Emily Miller

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Catherine Milne	Scott Pattison	Kathleen Schenkel	Nancy Staus
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Stella Nicolaou	Anton Puvirajah	Paichi Shein	Deborah Tippins
Jayson Nissen	Arif Rachmatullah	Fan Shi	Preethi Titu
Tara Nkrumah	Jeffrey Radloff	Mary Short	Radu Bogdan Toma
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James Nyachwaya	Umesh Ramnarain	Amanda Siebert-Evenstone	Brit Toven-Lindsey
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Peter Okebukola	Joshua Reid	Christina Siry	Shane Tutwiler
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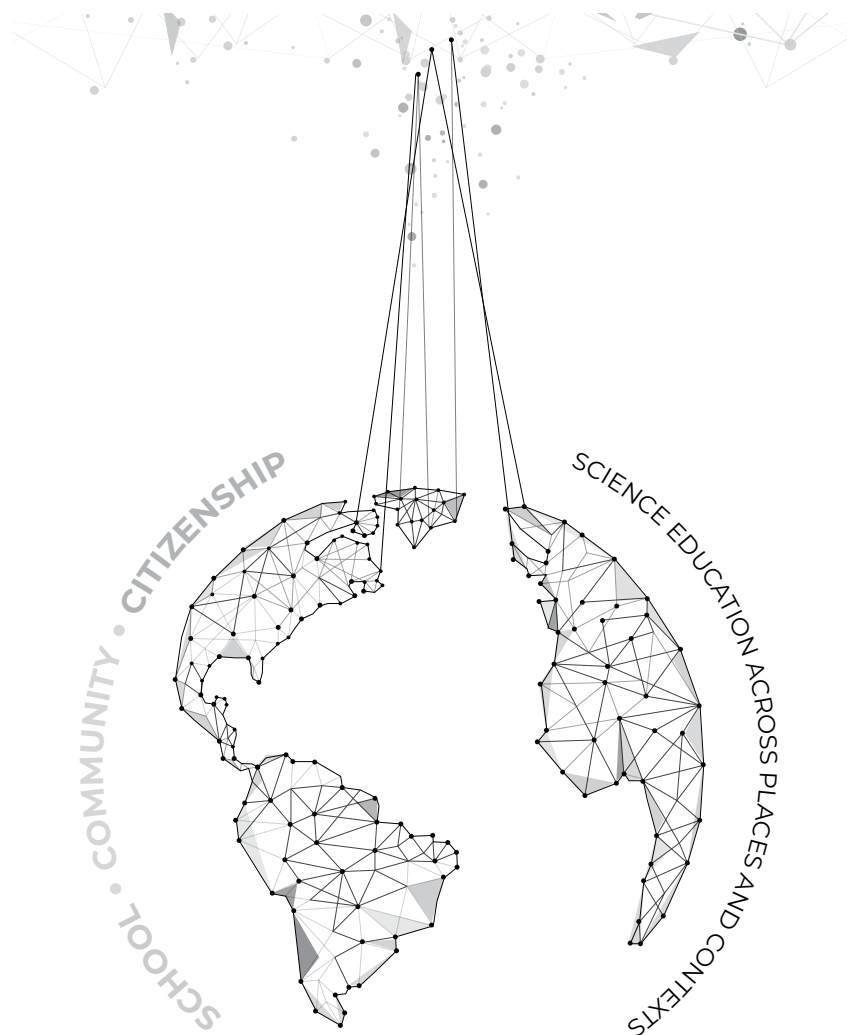
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Kate Walker
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1928	W. L. Eikenberry	1952	Betty Lockwood	1976	Ronald D. Anderson	1999	Joseph S. Krajcik
1929	W. L. Eikenberry	1953	J. Darrell Barnard	1977	O. Roger Anderson	2000	David F. Treagust
1930	W. L. Eikenberry	1954	George G. Mallinson	1978	Roger G. Olstad	2001	Sandra K. Abell
1931	Elliot R. Downing	1955	Kenneth E. Anderson	1979	James R. Okey	2002	Norman G. Lederman
1932	Elliot R. Downing	1956	W. C. Van Deventer	1980	John W. Renner	2003	Cheryl L. Mason
1933	Francis D. Curtis	1957	Waldo W. Blanchet	1981	Stanley L. Helgeson	2004	Charles W. (Andy) Anderson
1934	Ralph K. Watkins	1958	Nathan S. Washton	1982	Stanley L. Helgeson	2005	John R. Staver
1935	Archer W. Hurd	1959	Thomas P. Fraser	1983	Carl F. Berger	2006	James A. Shymansky
1936	Gerald S. Craig	1960	Vaden W. Miles	1984	Ann C. Howe	2007	Jonathan F. Osborne
1937	Walter G. Whitman	1961	Clarence H. Boeck	1985	Ertle Thompson	2008	Penny J. Gilmer
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1939	John M. Mason	1963	Ellsworth S. Obourn	1987	James P. Barufaldi	2010	Richard A. Duschl
1940	Otis W. Caldwell	1964	Cyrus W. Barnes	1988	Linda DeTure	2011	Dana L. Zeidler
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1942	G. P. Cahoon	1966	Milton P. Pella	1990	William G. Holliday	2013	Sharon J. Lynch
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1944	Florence G. Billig	1968	John M. Mason	1992	Russell H. Yeany	2015	Valarie L. Akerson
1945	Florence G. Billig	1969	Joseph D. Novak	1993	Emmett L. Wright	2016	Mary M. atwater
1946	C. L. Thield	1970	Willard D. Jacobson	1994	Kenneth G. Tobin	2017	Mei-Hung Chiu
1947	Earl R. Glenn	1971	Paul D. Hurd	1995	Dorothy L. Gabel	2018	Barbara Crawford
1948	Ira C. Davis	1972	Frank X. Sutman	1996	Barry J. Fraser	2019	Gail Richmond
1949	Joe Young West	1973	J. David Lockard	1997	Thomas R. Koballa, Jr.	2020	Tali Tal
1950	N. Eldred Bingham	1974	Wayne W. Welch	1998	Audrey B. Champagne	2021	Eileen Parsons
1951	Betty Lockwood	1975	Robert E. Yager				

NARST Executive Directors:

(NARST created the position of Executive Secretary in 1975; the title was changed to Executive Director in 2003.)

1975 – 1980	Paul H. Joslin	1990 – 1995	John R. Staver	2002 – 2007	John W. Tillotson
1980 – 1985	William G. Holliday	1995 – 2000	Arthur L. White	2007 – 2018	William C. Kyle Jr.
1985 – 1990	Glenn C. Markle	2000 – 2002	David L. Haury	2018 –	Helen Schneider Lemay

JRST Editors:

1963 – 1966	J. Stanley Marshall	1990 – 1993	Ronald G. Good	2006 – 2010	J. Randy McGinnis and Angelo Collins
1966 – 1968	H. Craig Sipe	1994 – 1999	William C. Kyle, Jr.		
1969	James T. Robinson	1999 – 2001	Charles W. (Andy) Anderson and James J. Gallagher August	2011 – 2015	Joseph S. Krajcik and Angela Calabrese Barton
1970 – 1974	O. Roger Anderson			2016 – 2020	Fouad Abd-El-Khalick and Dana L. Zeidler
1975 – 1979	David P. Butts	2002 – 2005	Dale R. Baker and Michael D. Piburn	2021-2025	Troy Dow Sadler and Felicia Mensah
1980 – 1984	James A. Shymansky				
1985 – 1989	Russell H. Yeany, Jr.				

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Baker, Dale	Hewson, Peter	Nous, Albert	Simonis, Doris
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Bethel, Lowell	Joslin, Paul	Pak, Sung Jae	Thier, Marlene
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Dehaan, Robert	Lemke, Jay	Prather, J.	Williams, Robert
Doran, Rodney	Lindauer, Ivo	Rennie, Leonie	Yore, Larry
Enochs, Larry	Lunetta, Vincent	Riechard, Donald	

NARST Award Recipients

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.

Year	Awardee	Year	Awardee	Year	Awardee
1986	Anton E. Lawson	2002	Audrey B. Champagne	2014	Glen Alkenhead, Richard Gunstone, and Frances Lawrenz
1987	Paul DeHart Hurd	2003	Barry J. Fraser	2015	Richard A. Duschl and Meshach Mobolaji Ogunniyi
1988	John W. Renner	2004	Robert E. Yager and Paul Black	2016	Lynn D. Dierking, John N. Falk, and Dana L. Zeidler
1989	Willard Jacobson	2005	John C. Clement	2017	Avi Hofstein
1990	Joseph D. Novak	2006	David Treagust	2018	Marissa Rollnick, and Jonathan Osborne
1991	Robert L. Shrigley	2007	Kenneth Tobin	2019	Mary M. Atwater and Maria Pilar Jiménez- Aleixandre
1992	Pinchas Tamir	2008	Dorothy Gabel	2020	Judy Dori and Saouma Bou Jaoude
1993	Jack Easley, Jr.	2009	Peter W. Hewson, Leonie Jean Rennie, and Wolff-Michael Roth		
1994	Marcia C. Linn	2010	Reinders Duit and Joseph Krajcik		
1995	Wayne W. Welch	2011	Norman Lederman		
1996	Carl F. Berger	2012	Charles W. (Andy) Anderson and Larry Yore		
1997	Rosalind Driver	2013	Dale R. Baker		
1998	James J. Gallagher				
1999	Peter J. Fensham				
2000	Jane Butler Kahle				
2001	John K. Gilbert				

GENERAL INFORMATION

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.

Year	Awardee	Major Professor	Year	Awardee	Major Professor
1992	Rene Stofflett	Dale R. Baker	2007	Julia Plummer	Joseph S. Krajcik
1993	Julie Gess-Newsome	Norman G. Lederman	2008	Victor Sampson	Douglas Clark
1994	Carolyn W. Keys	Burton E. Voss	2009	Lei Liu	Cindy E. Hmelo-Silver
1995	Jerome M. Shaw	Edward Haertel	2010	Heather Toomey Zimmerman	Phillip Bell
1996	Christine M. Cunningham	William L. Carlsen	2011	Jeffrey J. Rozelle	Suzanne M. Wilson
1997	Jane O. Larson	Ronald D. Anderson	2011	Catherine Eberbach	Kevin Crowley
1998	Kathleen Hogan	Bonnie K. Nastasi	2012	Melissa Braaten	Mark Windschitl
1999	Fouad Abd-El-Khalick	Norman G. Lederman	2013	Lori Fulton	Jian Wang
2000	Danielle Joan Ford	Annemarie S. Palinscar	2014	Daniel Birmingham	Angela Calabrese Barton and Anne-Lise Halvorsen
2001	Iris Tabak	Brian Reiser	2015	Allison Godwin	Geoffrey Potvin
2002	Mark Girod	David Wong	2016	Anna MacPherson	Jonathan Osborne
2003	Hsin-Kai Wu	Joseph Krajcik	2017	Anita Schuchardt	Christian Schunn
2004	David L. Fortus	Ronald Marx and Joseph Krajcik	2018	Katherine Wade-Jaimes	Renée Schwartz
2005	Thomas Tretter	Gail M. Jones	2019	Anita S. Tseng	Jonathan F. Osborne
2006	Stacy Olitsky	Kenneth Tobin	2020	Neta Shaby	Orit Ben Zvi-Assaraf

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.

Year	Awardee	Year	Awardee	Year	Awardee
1993	Wolff-Michael Roth	2002	Alan G. Harrison	2012	Victor Sampson
1994	Deborah J. Tippins	2003	Fouad Abd-El-Khalick	2013	Alandeom W. Oliveira
1995	Nancy B. Songer	2004	Grady J. Venville	2014	Cory Forbes
1996	Mary B. Nakhleh	2005	Randy L. Bell	2015	Benjamin C. Herman
1997	Peter C. Taylor	2006	Heidi Carlone	2016	Richard L. Lamb
1998	J. Randy McGinnis	2007	Bryan A. Brown	2017	Ying-Chih Chen David Stroupe
1999	Craig W. Bowen Gregory J. Kelly	2008	Hsin-Kai Wu	2018	Doug Lombardi
2000	Angela Calabrese Barton	2009	Troy D. Sadler	2019	Hosun Kang Eve Manz
2001	Julie A. Bianchini	2010	Thomas Tretter	2020	Brian Donovan Dana Vedder Weiss
		2011	Katherine L. McNeill		

GENERAL INFORMATION

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.

Year	Awardee	Year	Awardee	Year	Awardee
1974	Donald E. Riechard and Robert C. Olson		Emmett L. Wright	2006	Troy D. Sadler and Dana L. Zeidler
1975	Mary Budd Rowe	1991	E. P. Hart and I. M. Robottom	2007	Jerome Pine, Pamela Aschbacher, Ellen Roth, Melanie Jones, Cameron McPhee, Catherine Martin, Scott Phelps, Tara Kyle, and Brian Foley
1976	Marcia C. Linn and Herbert C. Thier	1992	John R. Baird, Peter J. Fensham, Richard E. Gunstone, and Richard T. White	2008	Christine Chin
1977	Anton E. Lawson and Warren T. Wollman	1993	Nancy R. Romance and Michael R. Vitale	2009	Kihyun Ryoo and Bryan Brown
1978	Dorothy L. Gabel and J. Dudley Herron	1994	E. David Wong	2010	Helen Patrick, Panayota Mantzicopoulos, and Ala Samarapungavan
1979	Janice K. Johnson and Ann C. Howe	1995	Stephen P. Norris and Linda M. Phillips	2011	Daphne Minner, Jeanne Century, and Abigail Jurist Levy
1980	John R. Staver and Dorothy L. Gabel (tie) Linda R. DeTure	1996	David F. Jackson, Elizabeth C. Doster, Lee Meadows, and Teresa Wood	2012	Julie A. Luft, Jonah B. Firestone, Sissy S. Wong, Irasema Ortega, Krista Adams, and EunJin Bang
1981	William C. Kyle, Jr.	1997	C. W. J. M. Klassen and P. L. Linjse	2013	Edys S. Quellmalz, Michael J. Timms, Matt D. Silberglitt, and Barbara C. Buckley
1982	Robert G. Good and Harold J. Fletcher (tie) F. David Boulanger	1998	Julie Bianchini	2014	Joseph Taylor, Susan Kowalski, Christopher Wilson, Stephen Getty, and Janet Carlson
1983	Jack A. Easley, Jr.	1999	Phillip M. Sadler	2015	Matthew Kloser
1984	Marcia C. Linn, Cathy Clement, and Stephen Pulos	2000	Allan G. Harrison, J. Grayson, and David F. Treagust		
1985	Julie P. Sanford	2001	Fouad Abd-El-Khalick and Norman G. Lederman		
1986	Anton E. Lawson	2002	Andrew Gibert and Randy Yerrick		
1987	Russell H. Yeany, Kueh Chin Yap, and Michael J. Padilla	2003	Sofia Kesidou and Jo Ellen Roseman		
1988	Kenneth G. Tobin and James J. Gallagher	2004	Jonathan Osborne, Sue Collins, Mary Ratcliffe, Robin Millar, and Richard Duschl		
1988	(tie) Robert D. Sherwood, Charles K. Kinzer, John D. Bransford, Jeffrey J. Franks, and Anton E. Lawson	2005	Jonathan Osborne, Sibel Erduran, and Shirley Simon		
1989	Glen S. Aikenhead				
1990	Richard A. Duschl and				

GENERAL INFORMATION

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.

Year	Awardee	Year	Awardee	Year	Awardee
1975	John J. Koran	1990	Patricia L. Hauslein, Ronald G. Good, and Catherine Cummins	2004	Joanne K. Olson (tie) Sharon J. Lynch, Joel Kuipers, Curtis Pyke, and Michael Szesze
1976	Anton E. Lawson	1991	Nancy R. Romance and Michael Vitale	2005	Chi-Yan Tsui and David Treagust
1977	NO AWARD	1992	Patricia Heller, Ronald Keith, and Scott Anderson	2006	Leema Kuhn and Brian Reiser
1978	Rita Peterson	1993	Wolff-Michael Roth	2007	Eugene L. Chiappetta, Tirupalavanam G. Ganesh, Young H. Lee, and Marianne C. Phillips
1979	Linda R. DeTure	1994	Wolff-Michael Roth and Michael Bowen	2008	Guy Ashkenazi and Lana Tockus-Rappoport
1980	M. James Kozlow and Arthur L. White	1995	Wolff-Michael Roth	2009	Jrene Rahm
1981	William Capie, Kenneth G. Tobin, and Margaret Boswell	1996	Nancy J. Allen	2010	Mark W. Winslow, John R. Staver, and Lawrence C. Sharmann
1982	F. Gerald Dillashaw and James R. Okey	1997	NO AWARD	2011	Matthew Kloser
1983	William C. Kyle, Jr., James A. Shymansky, and Jennifer Alport	1998	Wolff-Michael Roth, Reinders Duit, Michael Komorek, and Jens Wilbers	2012	Shelly R. Rodriguez and Julie Gess-Newsome
1984	Darrell L. Fisher and Barry J. Fraser	1999	Lynn A. Bryan	2013	Edward G. Lyon
1985	Hanna J. Arzi, Ruth Ben-Zvi, and Uri Ganiel (tie) Russell H. Yeany, Kueh Chin Yap, and Michael J. Padilla	2000	Joseph L. Hoffman and Joseph S. Krajcik	2014	Ying-Chih Chen, Soonhye Park, and Brian Hand
1986	Barry J. Fraser, Herbert J. Walberg, and Wayne W. Welch (tie)	2001	Allan G. Harrison	2015	Lori M. Ihrig, Michael P. Clough, and Joanne K. Olson
1987	Robert D. Sherwood	2002	Carolyn Wallace Keys, Eun-Mi Yang, Brian Hand, and Liesl Hohenshell		
1988	Barry J. Fraser and Kenneth G. Tobin	2003	Wolff-Michael Roth		
1989	James J. Gallagher and Armando Contreras				

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.

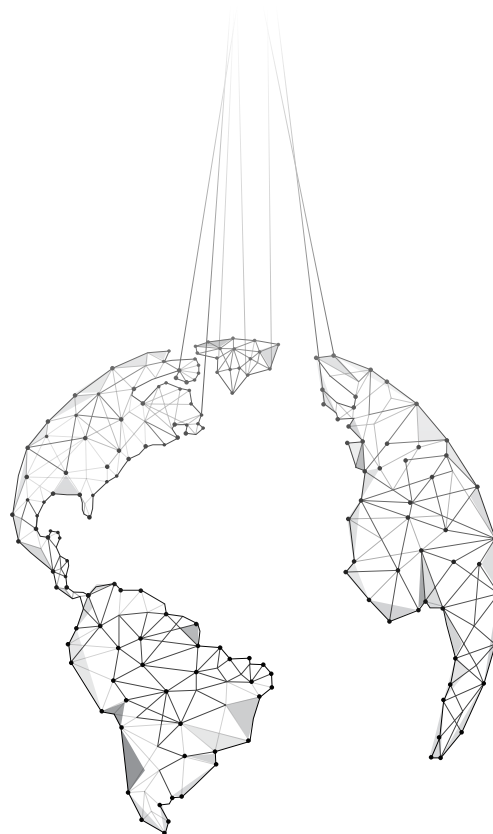
Year	Awardee	Major Professor
1995	Moreen K. Travis	Carol L. Stuessy
1996	Lawrence T. Escalada	Dean A. Zollman
1997	C. Theresa Forsythe	Jeffrey W. Bloom
1998	Renee D. Boyce	Glenn Clark
1999	Andrew Gilbert	Randy K. Yerrick
2000	Rola Fouad Khishfe	Fouad Abd-El-Khalick
2002	Laura Elizabeth Slocum	Marcy Hamby Towns

GENERAL INFORMATION

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.

Year	Awardee	Year	Awardee	Year	Awardee
1980	(Five Equal Awards) Livingston S. Schneider and John W. Renner Heidi Kass and Allan Griffiths Ramona Saunders and Russell H. Yeany Joe Long, James R. Okey, and Russell H. Yeany M. James Kozlow and Arthur L. White	1984	(Four Equal Awards) Mary Westerback, Clemencia Gonzales, and Louis H. Primavera Kenneth G. Tobin, Hanna J. Arzi, Ruth Ben-Zvi, and Uri Ganiel Charles Porter and Russell H. Yeany	1987	Dorothy L. Gabel, V. K. Samuel, Stanley L. Helgeson, Saundra McGuire, Joseph D. Novak, and John Butzow
1981	(Four Equal Awards) Dorothy L. Gabel, Robert D. Sherwood, and Larry G. Enochs Wayne Welch, Ronald D. Anderson, and Harold Pratt Mary Ellen Quinn and Carolyn Kessler P. Ann Miller and Russell H. Yeany	1985	(Three Equal Awards) Dan L. McKenzie and Michael J. Padilla Margaret Walkosz and Russell H. Yeany Kevin C. Wise and James R. Okey	1988	Uri Zoller and Ben Chaim
1982	(Four Equal Awards) Louise L. Gann and Seymour Fowler Dorothy L. Gabel and Robert D. Sherwood Thomas L. Russell Joseph C. Cotham	1986	(Four Equal Awards) Sarath Chandran, David F. Treagust, and Kenneth G. Tobin Darrell L. Fisher and Barry J. Fraser Dorothy L. Gabel, Stanley L. Helgeson, Joseph D. Novak, John Butzow, and V. K. Samuel Linda Cronin, Meghan Twist, and Michael J. Padilla	1989	James D. Ellis and Paul J. Kuerbis
1983	Robert D. Sherwood, Larry G. Enochs, and Dorothy L. Gabel			1990	Dale R. Baker, Michael D. Piburn, and Dale S. Niederhauser
				1991	David F. Jackson, Billie Jean Edwards, and Carl F. Berger



GENERAL INFORMATION

Elections Committee

Immediate Past President (Ex Officio)

2020	Gail Richmond	Michigan State University
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Board Member Liaison

2021	Alejandro Gallard	Georgia Southern University
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Representative from Ethics and Equity Committee

2020	Catherine Quinlan	Howard University
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Representative from the International Committee

2020	Hye-Eun Chu	Macquarie University
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Co-Chairs

2020	Leon Walls (Chair)	University of Vermont
2021	Regina Suriel (Co-Chair)	Valdosta State University

Members

2020	Ornit Spektor-Levy	Bar Ilan University
2021	Ibrahim Delen	Usak University
2022	Mary Atwater	University of Georgia
2022	Nazan U. Bautista	Miami University
2022	Bridget Mulvey	Kent State University

Equity and Ethics Committee

Final Year Board Liaison

2020	Femi Otulaja	University of the Witwatersrand
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Chairs of Subcommittees

2020	Catharine Quinlan	Howard University
2021	Sara Raven	Texas A&M University
2020	Irasema Ortega	University of Alaska – Anchorage

Members

2020	Lillian H. Degand	Illinois Institute of Technology
2020	Sheron Mark	University of Louisville
2021	Tara Monique Nkrumah	University of South Florida

GENERAL INFORMATION

Equity and Ethics Committee Members (continued)

2021	Danielle Dani	Ohio University
2021	James Nyachwaya	North Dakota State University
2022	Seema Rivera	Clarkson University
2022	Justina Ogoto	The Ohio State University
2022	April Holton	Arizona State University
2022	María González-Howard	The University of Texas at Austin

External Policy and Relations Committee

Final Year Board Liaison

2022	Senay Purzer	Purdue University
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Chair

2021	Stefanie Marshall	Michigan State University
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Members

2020	Sharon Lynch	George Washington University
2020	Stacy Olitsky	Saint Joseph's University
2020	Margaret M Lucero	Santa Clara University
2021	Kadir Demir	Georgia State University
2021	Sarah Carrier	North Carolina State University
2022	Tom Bielik	The Weizmann Institute
2022	Eugene Judson	Arizona State University
2022	Remy Dou	Florida International University

Graduate Student Committee

Final Year Board Liaison

2020	Judith Lederman	Illinois Institute of Technology
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Chair

2021	Christa Haverely	Northwestern University
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Members

2020	Emmanuel Jaff	Morgan State University
2020	Ayca Karasahinoglu	University of Georgia
2020	Margaretann Connell	Illinois Institute of Technology
2021	Kathryn E Green	North Carolina State University
2021	Harini Krishnan	Florida State University

GENERAL INFORMATION

Graduate Student Committee Members (continued)

2021	Preethi Titu	University of Minnesota
2021	Sina Joshua Fakoyede	University of Witwatersrand
2021	Melanie Kinskey	University of South Florida
2021	Star Sharp	Penn State University
2021	Theila Smith	University of Groningen

International Committee

Final Year Chair — International Coordinator

2022	Sonya Martin	University of Groningen, Netherlands
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Members

2020	Andri Christodoulou	University of Southampton, UK
2020	Hye-Eun Chu	Macquarie University
2020	Ravinder Koul	The Pennsylvania State University
2020	Rea Lavi	Technion
2021	Peter Wulff	Leibniz Institute, Kiel University
2022	Saramma Chandy	University of Mumbai
2022	Jing Lin	Beijing Normal University
2022	Sara Wilmes	University of Luxemburg
2022	Allison Gonsalves	McGill University

Membership Committee

Final Year Board Liaison

2020	Judith Lederman	Illinois Institute of Technology
2022	Baskhar Upadhyay	University of Minnesota

Chairs

2020	Brooke Whitworth	Northern Arizona University
2021	Selina Bartels	Valparaiso University

Members

2020	Gary Holliday	University of Akron
2020	Amanda Peel	University of Missouri
2021	Alison Riley Miller	Bowdoin College
2021	Felicia Moore Mensah	Teachers College, Columbia University

GENERAL INFORMATION

Membership Committee Members (continued)

2022	Shirly Avargil	Technion
2022	Reanna S Roby	Michigan State University
2022	Knut Neuman	Leibniz Institute for Science and Mathematics Education at the University of Kiel

Program Committee

Co-Chairs

Tali Tal (Chair)	Technion-Israel Institute of Technology
Eileen Parsons (Co-Chair)	University of North Carolina at Chapel Hill

Members (Strand Co-Coordinator(s))

Strand 1: Science Learning: Development of Student Understanding

(21) Sarah J. Fick	University of Virginia
(20) Calvin Kalman	Concordia University

Strand 2: Science Learning Contexts, Characteristics, and Interactions

(21) Julia Plummer	Pennsylvania State University
(20) David Owens	University of Missouri

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

(21) Ryan Nixon	
(20) Carrie-Anne Sherwood	Southern Connecticut State University

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

(21) Neta Shaby	Ben-Gurion University of the Negev
(20) Justina Ogodo	Ohio State University

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

(21) Lisa Kenyon	Wright State University
(20) Jana Bouwma-Gearhart	Oregon State University

Strand 6: Science Learning in Informal Contexts

(21) Anton Puvirajah	University of Western Ontario
(20) Nancy Staus	Oregon State University

Strand 7: Pre-service Science Teacher Education

(21) Michelle Fleming	Wright State University
(20) Shannon Sung	Spelman College

GENERAL INFORMATION

Program Committee Members (continued)

Strand 8: In-service Science Teacher Education

(21) Nidaa Makki	The University of Akron
(20) Tracy Huziak-Clark	Bowling Green State University

Strand 9: Reflective Practice

(21) Heather Page	New York University
(20) Pei-Ling Hsu	University of Texas-El Paso

Strand 10: Curriculum, Evaluation, and Assessment

(21) Elon Langbeheim	The Weizmann Institute of Israel
(20) Hun Jin	Educational Testing Service

Strand 11: Cultural, Social, and Gender Issues

(21) Cesar Delgado	North Carolina State University
(20) Natalie King	Georgia State University

Strand 12: Educational Technology

(21) Denise M. Bressler	Rutgers University
(20) Jonah Firestone	Washington State University-Tricity

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

(21) Alexandria Hansen	Fresno State University
(20) Dina Tsybulsky	Technion-Israel Institute of Technology

Strand 14: Environmental Education

(21) Idit Adler	Michigan State University
(20) Isis Alkaher	Kibbutzim College of Education

Strand 15: Policy

(21) Audrey Msimanga	University of the Witwatersrand South Africa
(20) Carrie Allen	SRI International

Ex Officio:

Helen Schneider Lemay

GENERAL INFORMATION

The Publications Advisory Committee

Final Year Board Liaison

2020	Christina Siry	University of Luxembourg
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Research for Practitioners and Policymakers Sub Committee

2020	Hayat Alhokayem (Co-Chair)	Texas Christian University
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Scholarship Sub Committee

2020	Justin McFadden (Co-Chair)	University of Louisville
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Pre-Conference Workshop and Sponsored Symposium Sub Committee

2021	Heidi Carlone (Co-Chair)	University of North Carolina, Greensboro
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Members

2020	Greses Perez Gonzalez	Stanford University
2021	Amanda (Mandi) Berry	Monash University
2021	Jeanne Brunner	University of Massachusetts, Amherst
2021	Deena Gould	Arizona State University
2022	Allison Antink-Meyer	Illinois State University
2022	Kyungjin Cho	Pennsylvania State University
2022	Shuly Kapon	Technion, Israel Institute of Technology
2022	Ibrahim Yeter	Purdue University

Research Committee

Final Year Board Liaison

2022	Jennifer D. Adams	University of Calgary
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Chairs

2020	Ryan Summers (Chair)	University of North Dakota
2021	Tina Vo (Co-Chair)	University of Nebraska-Lincoln

Members

2020	Vanashri Nargund	New Jersey City University
2020	Joe Taylor	BSCS Science Learning
2021	Abdi Warfa	University of Minnesota
2021	Carina Rebello	Purdue University

GENERAL INFORMATION

Research Committee Members (continued)

2021	Banu Avsar Erumit	Recep Tayyip Erdogan University (Turkey)
2021	Patricia Patrick	Columbus State University
2020	George Turner	Auburn University
2020	Jennifer Parrish	University of Northern Colorado
2021	Kelsey Lipsitz	University of Missouri, Exploratorium
2022	Li Ke	University Of North Carolina, Greensboro
2022	Ling L. Liang	La Salle University
2022	Yann Shiou Ong	National Institute of Education Nanyang Technological University
2022	Asli Sezen-Barrie	University of Maine
2022	Marcus Kubsch	Kiel University
2022	S. Selcen Guzey	Purdue University

Website Committee

Final Year Board Liaison

Greg Kelly (Ex Officio)	Pennsylvania State University
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Chairs

2020	Scott McDonald (Chair)	Penn State University
2021	Katherine Wade-James (Co-Chair)	University of Memphis

Members

2020	Jennifer Weible	Central Michigan University
2020	Jennifer Oramous	University of Arkansas
2021	Sandhya Krishnan	University of Georgia
2022	Nazihan Ursavas	Erdogan University Turkey
2022	Lisa Lundgren	North Carolina State University
2022	Minjung Ryu	Purdue University

SCHEDULE AT A GLANCE

2020

93RD ANNUAL
INTERNATIONAL
CONFERENCE

MARCH 15–18

PORTLAND, OR, USA

Portland Marriott
Downtown Waterfront

SCHEDULE AT A GLANCE

SATURDAY, MARCH 14		
8:00 AM - 5:00 PM	NARST Executive Board Meeting #1	Meadow Lark/ Douglas Fir 3rd Floor
2:00 PM - 5:00 PM	Conference Registration	Ballroom Foyer - Lower Level
SUNDAY, MARCH 15		
7:30 AM - 4:30 PM	Conference Registration	Ballroom Foyer - Lower Level
8:00 AM - 11:45 AM	NARST Executive Board Meeting #1 <i>(continued)</i>	Meadow Lark/ Douglas Fir 3rd Floor
8:00 AM - 11:45 AM	PRE-CONFERENCE WORKSHOPS NOTE: You MUST register for Pre-Conference Workshops with you advance conference registration. You may only register for ONE Workshop.	
8:00 AM - 10:00 AM	Pre-Conference Workshop #1: Membership Committee <i>Cost: Free Maximum attendance: 50</i>	Salon C - Lower Level
	Title: Early Career Faculty Forum	
	Presenters: Brooke Whitworth , University of Mississippi Alison Miller , Bowdoin College Shirly Avargil , Technion - Israel Institute of Technology	
8:00 AM - 11:45 AM	Pre-Conference Workshop #2: Research Committee <i>Cost: Free Maximum attendance: 30</i>	Salon A - Lower Level
	Title: Next Generation Labs for Next Generation Science Standards: Mobile Sensing as an Example	
	Presenters: Charles Xie Shannon Sung Xudong Huang Guanhua Chen	
8:00 AM - 11:45 AM	Pre-Conference Workshop #3: Membership Committee <i>Cost: Free Maximum attendance: 60</i>	Salon B - Lower Level
	Title: Writing in Community: NARST Membership Committee Writing Retreat	
	Presenters: Knut Neuman , Leibniz Institute for Science Education Felicia Mensah , Columbia University Shirly Avergil , Technion - Israel Institute of Technology	

SCHEDULE AT A GLANCE

8:00 AM - 11:45 AM	Pre-Conference Workshop #4: Research Committee <i>Cost: Free Maximum attendance: 60</i>	Salon D - Lower Level
Title:	How to Access Learners' Connections Across Nature of Science Aspects: Using Card Sorts and Epistemic Network Analysis	
Presenters:	Bridget K. Mulvey Jennifer C. Parrish Erin Peters-Burton	
8:00 AM - 11:45 AM	Pre-Conference Workshop #5: Equity and Ethics Committee <i>Cost: Free Maximum attendance: 100</i>	Salon I - Lower Level
Title:	Equity and Ethics Pre-conference Workshop	
Presenters:	Sara Raven Danielle Dani Seema Rivera Sheron Mark Saiqa Azam Jordan Henley	
8:00 AM - 11:45 AM	Pre-Conference Workshop #6: Research Committee <i>Cost: Free Maximum attendance: 30</i>	Salon G - Lower Level
Title:	An Observation Protocol for Integrated STEM Instruction in K-12 Science and Engineering Classes	
Presenters:	Emily A. Dare , Assistant Professor of Science Education at Florida International University Joshua A. Ellis , Assistant Professor of Science Education at Florida International University Elizabeth A. Ring-Whalen , Assistant Professor of Education, Coordinator for the EcoSTARS and Elementary STEM Certificate programs, and Director of the National Center for STEM Elementary Education at St. Catherine University Gillian H. Roehrig , Professor of STEM Education at the University of Minnesota–Twin Cities	
8:00 AM - 11:45 AM	Pre-Conference Workshop #7: Research Committee <i>Cost: Free Maximum attendance: 50</i>	Salon H - Lower Level
Title:	Clarifying the Role(s) of the Crosscutting Concepts in Science and Engineering Learning	
Presenters:	Sarah J. Fick Jeffrey Nordine	

SCHEDULE AT A GLANCE

10:00 AM - 11:00 AM	Pre-Conference Workshop #8: National Science Foundation <i>Cost: Free / Maximum attendance: 50</i>	Salon C - Lower Level
	Title: Work at the National Science Foundation as a Rotater/IPA/Program Officer. Is it right for me?	
	Presenters: Rob Ochsendorf Sharon Lynch Monica Cardella Gavin Fulmer	
11:45 AM - 1:00 PM	Lunch	On Your Own
1:00 PM - 2:15 PM	Conference Welcome & Plenary Session 1	Salon E & F - Lower Level
	Title: Migrating Birds Know No Boundaries: The Scientific and Educational Dimension	
	Speaker: Dr. Yossi Leshem, Tel Aviv University	
2:15 PM - 2:40 PM	Networking Break	
2:40 PM - 4:10 PM	CONCURRENT SESSION #1	Concurrent Session Rooms
4:20 PM - 5:50 PM	CONCURRENT SESSION #2	Concurrent Session Rooms
6:00 PM - 7:00 PM	Mentor/Mentee Nexus	Mt. Hood
6:00 PM - 7:00 PM	Research Interest Group (RIG) Meetings	
	Continental and Diasporic Africa in Science Education (CADASE) RIG	Salon I - Lower Level
	Contemporary Methods for Science Education Research RIG	Salon H - Lower Level
7:00 PM - 9:30 PM	Award Ceremony and Presidential Reception <i>Light appetizers will be served. Cash bar.</i>	Salon E & F Lower Level/Ballroom Foyer
MONDAY, MARCH 16		
6:00 AM - 7:15 AM	Mind and Sole <i>This event is not sponsored or endorsed by NARST</i>	Off-site
8:00 AM - 4:30 PM	Conference Registration	Ballroom Foyer - Lower Level
8:30 AM - 10:00 AM	CONCURRENT SESSION #3	Concurrent Session Rooms
10:00 AM - 10:30 AM	Networking Break	
10:30 AM - 12:00 PM	CONCURRENT SESSION #4	Concurrent Session Rooms
12:00 PM - 1:45 PM	Committee Meetings	Concurrent Session Rooms
12:00 PM - 1:45 PM	Lunch	On Your Own

SCHEDULE AT A GLANCE

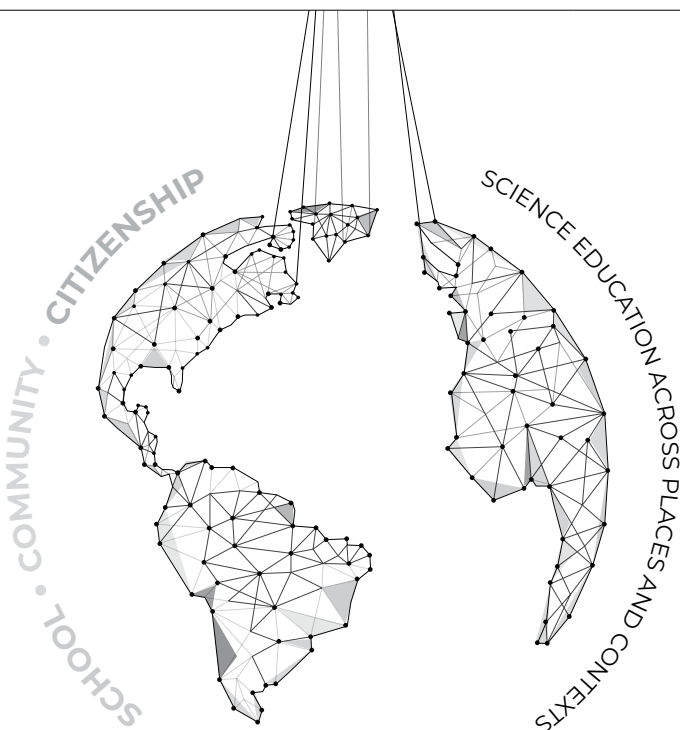
1:45 PM - 3:15 PM	CONCURRENT SESSION #5	Concurrent Session Rooms
3:15 PM - 3:45 PM	Networking Break	
3:45 PM - 4:45 PM	CONCURRENT SESSION #6A: Roundtable Session	Exhibit Hall
4:45 PM - 5:45 PM	CONCURRENT SESSION #6B: Poster Session	Exhibit Hall
5:45 PM - 7:15 PM	Graduate Student Forum	Salon F - Lower Level
6:00 PM - 8:30 PM	JRST Editorial Team Meeting/Dinner <i>Sponsored by: Wiley-Blackwell (by invitation only)</i>	Portland - Lower Level
6:00 PM - 7:30 PM	Research Interest Group (RIG) Meetings	
	Latino/a RIG	Salon B - Lower Level
	Engineering Education RIG	Salon C - Lower Level
	Indigenous Science Knowledge (ISK) RIG	Salon H - Lower Level

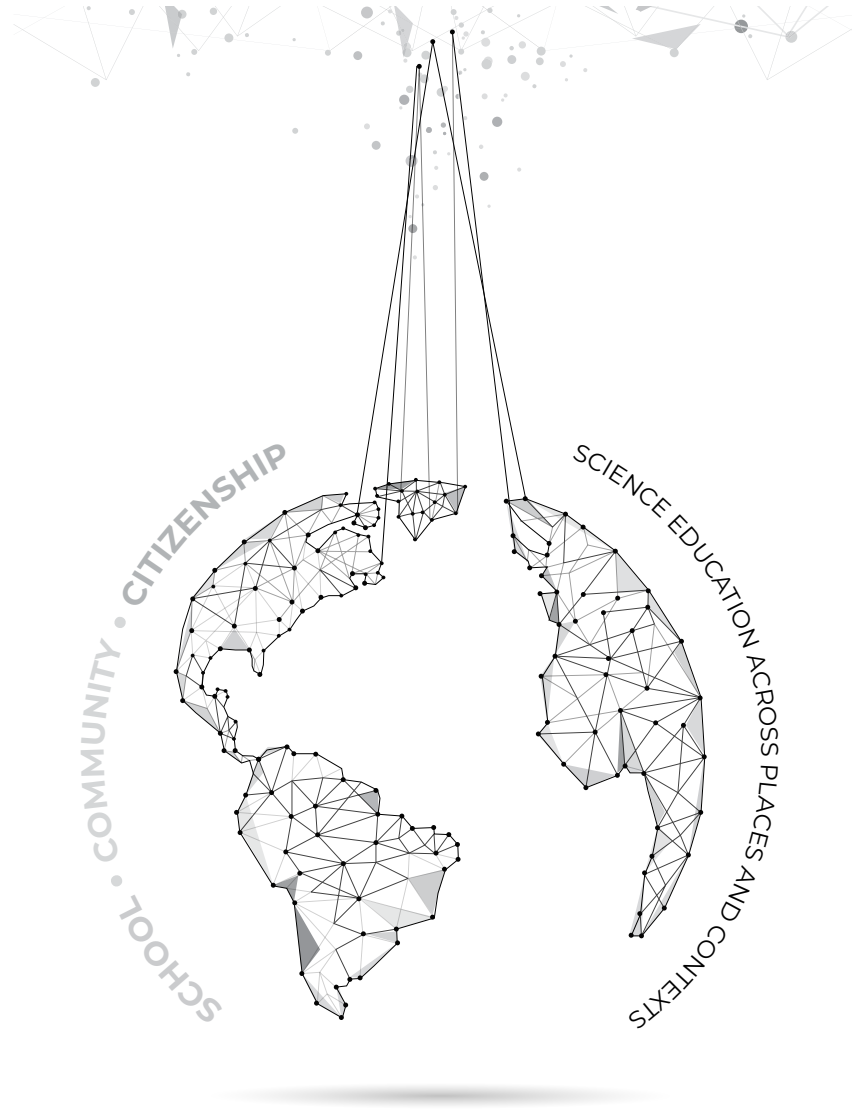
TUESDAY, MARCH 17

7:30 AM - 4:30 PM	Registration	Ballroom Foyer - Lower Level
8:00 AM - 9:30 AM	CONCURRENT SESSION #7	Concurrent Session Rooms
9:30 AM - 10:00 AM	Networking Break	
10:00 AM - 11:30 AM	CONCURRENT SESSION #8	Concurrent Session Rooms
11:30 AM - 12:30 PM	NARST Annual Membership Meeting	Salon I - Lower Level
11:30 AM - 12:30 PM	Lunch	On Your Own
12:30 PM - 1:45 PM	Announcement of 2021 Venue & Passing the Gavel & Plenary Session 2	Salon E & F - Lower Level
	Title: Making Science Education Matter in a Damaged and Unjust World	
	Speaker: Philip Bell , University of Washington	
2:00 PM - 3:30 PM	CONCURRENT SESSION #9	Concurrent Session Rooms
3:30 PM - 3:45 PM	Networking Break	
3:45 PM - 5:15 PM	CONCURRENT SESSION #10	Concurrent Session Rooms

SCHEDULE AT A GLANCE

5:15 PM - 6:15 PM	STRAND Meetings	Concurrent Session Rooms
6:30 PM - 9:30 PM	Equity & Ethics Dinner Boarding is at 6:30 PM (Maximum attendance: 75) Dinner, including tax and gratuity, is \$58 . Please note: You must register for this event with your Advance Conference Registration. Tickets purchased for this event are not refundable. NOTE: The Spirit of Portland departs from the Salmon Springs Dock, approximately three blocks from the hotel. Transportation services will not be provided.	Off-site: Spirit of Portland Dinner Cruise Salmon Street Springs Dock
WEDNESDAY, MARCH 18		
8:00 AM - 11:00 AM	Registration	Ballroom Foyer - Lower Level
8:30 AM - 10:00 AM	CONCURRENT SESSION #11	Concurrent Session Rooms
10:00 AM - 10:30 AM	Networking Break	
10:30 AM - 12:00 PM	CONCURRENT SESSION #12	Concurrent Session Room
12:00 PM - 1:00 PM	Lunch	On Your Own
1:00 PM - 2:30 PM	CONCURRENT SESSION #13	Concurrent Session Room
4:00 PM - 9:00 PM	NARST Board Meeting #2	Pearl - 2nd Floor





PROGRAM

2020

93RD ANNUAL
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MARCH 15–18

PORTLAND, OR, USA

Portland Marriott
Downtown Waterfront

SATURDAY, MARCH 14, 2020

NARST Executive Board Meeting #1

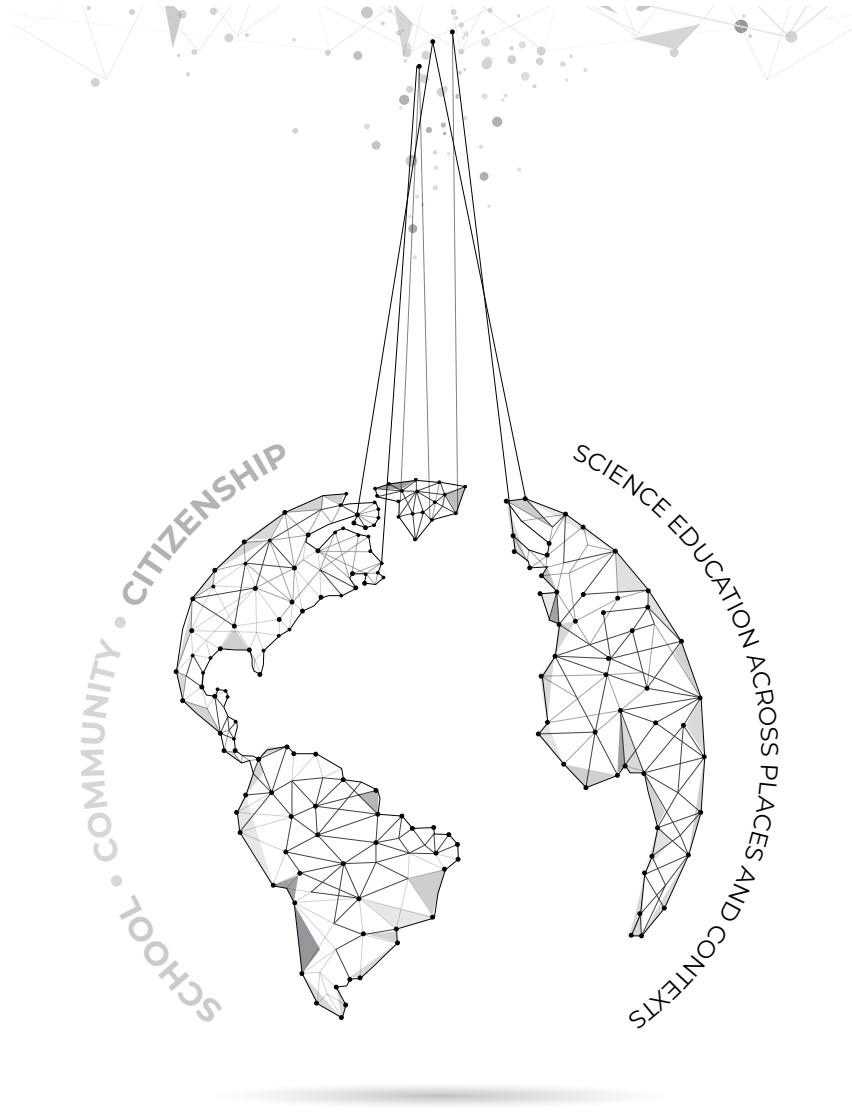
7:30 AM – 5:00 PM

Meadow Lark/Douglas Fir
– 3rd Floor

Conference Registration

2:00 PM – 5:00 PM

Ballroom Foyer
Lower Level



PROGRAM

2020

93RD ANNUAL
INTERNATIONAL
CONFERENCE

MARCH 15–18

PORTLAND, OR, USA

Portland Marriott
Downtown Waterfront

SUNDAY, MARCH 15, 2020

Conference Registration
7:30 AM – 4:30 PM
Ballroom Foyer – Lower Level

NARST Executive Board Meeting #1
(continued)

8:00 AM – 11:45 AM
Meadow Lark/Douglas Fir – 3rd Floor – 3rd Floor

PRE-CONFERENCE WORKSHOPS

8:00 AM – 11:45 AM

NOTE: You MUST register for Pre-Conference Workshops with you advance conference registration. You may only register for ONE Workshop.

Pre-Conference Workshop #1:
Membership Committee

Salon C – Lower Level

Early Career Faculty Forum

Presenters:

Brooke Whitworth, University of Mississippi

Alison Miller, Bowdoin College

Shirly Avargil, Technion - Israel Institute of Technology

Pre-Conference Workshop #2:
Research Committee

8:00 AM – 11:45 AM
Salon A – Lower Level

Next Generation Labs for Next Generation Science Standards: Mobile Sensing as an Example

Presenters:

Charles Xie

Shannon Sung

Xudong Huang

Guanhua Chen

Pre-Conference Workshop #3:
Membership Committee

8:00 AM – 11:45 AM
Salon B – Lower Level

Writing in Community:
NARST Membership Committee
Writing Retreat

Presenters:

Knut Neuman, Leibniz Institute for Science Education

Felicia Mensah, Columbia University

Shirly Avergil, Technion - Israel Institute of Technology

Pre-Conference Workshop #4:
Research Committee

8:00 AM – 11:45 AM
Salon D – Lower Level

How to Access Learners' Connections Across Nature of Science Aspects: Using Card Sorts and Epistemic Network Analysis

Presenters:

Bridget K. Mulvey

Jennifer C. Parrish

Erin Peters-Burton

Pre-Conference Workshop #5:
Equity and Ethics Committee

8:00 AM – 11:45 AM
Salon I – Lower Level

Equity and Ethics Pre-conference Workshop

Presenters:

Sara Raven

Danielle Dani

Seema Rivera

Sheron Mark

Saiqa Azam

Jordan Henley

PRE-CONFERENCE WORKSHOPS**8:00 AM – 11:45 AM (con't)****Pre-Conference Workshop #6:
Research Committee****8:00 AM – 11:45 AM
Salon G – Lower Level*****An Observation Protocol for
Integrated STEM Instruction in K-12
Science and Engineering Classes***

Presenters:

Emily A. Dare, Assistant Professor
of Science Education at Florida
International University**Joshua A. Ellis**, Assistant Professor
of Science Education at Florida
International University**Elizabeth A. Ring-Whalen**, Assistant
Professor of Education, Coordinator for
the EcoSTARS and Elementary STEM
Certificate programs, and Director of the
National Center for STEM Elementary
Education at St. Catherine University**Gillian H. Roehrig**, Professor of STEM
Education at the University of Minnesota
-Twin Cities**Pre-Conference Workshop #7:
Research Committee****8:00 AM – 11:45 AM
Salon H – Lower Level*****Clarifying the Role(s) of the
Crosscutting Concepts in Science
and Engineering Learning***

Presenters:

Sarah J. Fick**Jeffrey Nordine****Pre-Conference Workshop #8:
National Science Foundation****10:00 AM – 11:00 AM
Salon C – Lower Level****Title: *Work at the National Science
Foundation as a Rotater/IPA/Program
Officer. Is it right for me?***

Presenters:

Rob Ochsendorf**Sharon Lynch****Monica Cardella****Gavin Fulmer****LUNCH****11:45 AM – 1:00 PM
On Your Own****Conference Welcome & Plenary Session 1****1:00 PM – 2:15 PM
Salon E & F – Lower Level**

Speaker:

Dr. Yossi Leshem
Tel Aviv UniversityYossi Leshem is a Professor
Emeritus in the School of
Zoology, Faculty of Life Sciences
at Tel Aviv University, and
founder of the International
Center for the Study of BirdMigration. In 1971, he began his career at the Society
for the Protection of Nature in Israel and was CEO
(1991-1995) and chair of its public council.Prof. Leshem has been researching bird migra-
tion and raptor breeding ecology for 5 decades. His
doctoral research at Tel Aviv University, conducted
in cooperation with the Israel Air Force, reduced air-
craft-bird collisions by 76%, thus saving the national
budget \$1.5 billion. Yossi developed an educational
online science program (www.birds.org.il) that is
currently taught at approximately 450 schools. He
spearheaded the national effort to use barn owls as
biological pest control agents in agriculture, signifi-
cantly reducing the use of pesticides, and led an
extensive research project in cooperation with the

Max Planck Institute at Radolfzell to track migrating storks, using satellite transmitters. To this project joined the Ministry of Education in Israel, who financed the program to promote STEM learning by tracking the Migrating Storks on-line.

Since 2002, Prof. Leshem has initiated a host of successful joint projects with the Jordanians and Palestinians using Barn Owls as biological pest control agents in agriculture, combining education, research, and nature conservation. The project became a national and regional project with 4,500 nesting boxes dramatically reducing the use of pesticides in the region. Currently, Prof. Leshem leads a trilateral project with Cyprus, Greece and Israel on the subject. In parallel, he works with the Chief of General Staff's office to implement the "Nature Defense Forces – Commanders Take Responsibility for their Environment" project. This initiative consists of 60 projects with an educational emphasis.

Prof. Leshem received Lifetime Achievement Award for Environmental Protection, from the Minister for Environmental Protection (2008); Bruno H. Schubert Foundation Award for World Nature Conservation (2012); Lifetime Achievement Award of The Israel Society of Ecology and Environmental Sciences (2017); Honorary Fellowship of the Technion Board of Governors (2017); Honorary Membership, Israel Zoological Society (2018), The award of "Significant Contribution to Israel Aviation", from the Israeli Airline Pilots Association (2019) and an appreciation medal from the the Israeli Air Force commander.

Prof. Leshem is the author of 11 books, many scientific articles, and hundreds of popular articles. He is father to five, and grandfather to eight.

Migrating Birds Know No Boundaries: The Scientific and Educational Dimension

During thousands of years of history, the Middle East, located at the junction of three continents – Europe, Asia and Africa – has been a focus for tension, conflicts and wars which continue to these days. On the other hand, the Middle East comprises a bottleneck of international importance for bird migration, one of the most important worldwide. Over 500 million birds migrate over the region twice a year. The diversity of species is also exceptional, 540 species of birds can be observed in Israel.

In my talk, I will present a unique effort to use the outstanding phenomenon of bird migration for science and peace education. The educational and conservation programs are designed for formal school systems, informal settings and the

broad public and the Israel Defense Forces. The programs are based on research in several fields in the past five decades. The birds and migration constitute a platform for learning on the unique nature phenomenon, developing inquiry-learning and developing interest in the subject that combines activities in the class, and in the field. Birds and their migration were used for joint learning between Israelis, Jordanians and Palestinians, known more about the geopolitical conflict. The emphasis is that birds and nature are a connecting tool between people and religions regardless of politics and boundaries.

Based on the joint research of Tel-Aviv University and Max Planck Institute in Radolfzell, Germany, funded by the German Ministry of the Environment, satellite transmitters were attached to 120 German Storks and students from Israel, Jordan and the Palestinian Authority followed the migration using a website (www.birds.org.il), whilst also understanding key questions like the effect of the weather. In addition the students could track the data of the joint research with the Israeli Air Force, which suffered many collisions from migrating birds, and is based on the data that was gathered from a ground-network of bird-watchers, radars, a motorized-glider and UAV's. A joint research and activity was developed in cooperation with farmers in Jordan, Palestine Authority, Cyprus and Greece, in which Barn Owls are used as biological pest-control agents in order to significantly reduce the use of pesticides. An educational program was developed in which students could follow data from 5,000 nesting boxes in the Middle East and track the cameras in the nesting boxes, whilst also taking part field-trips in the areas of the nesting boxes.

Other initiatives I'll describe encourage the Israeli Defense Forces to integrate nature conservation education.

Currently, 550 schools from all Israeli sectors (Jewish, Arab and Druse) teach about birds and their uniqueness in the Middle East.

Funded by the government, a network of seven birding centers were established that constitutes an educational hubs and research and nature protection centers for students and the public, led by the Society for the Protection of Nature in Israel (NGO).

NETWORKING BREAK

2:15 PM – 2:40 PM

Concurrent Session 1

2:40 PM – 4:10 PM

Equity and Ethics Committee

Admin Symposium-Addressing Issues of Equity and Justice across Places and Context in Science

2:40 PM – 4:10 PM
Mt Hood

Organizers:

Catherine Quinlan, Howard University
Ying-Ting Chiu, The Ohio State University
María González-Howard, The University of Texas at Austin
Stephanie Eldridge, The University of Georgia
James Nyachwaya, North Dakota State University

Presenters:

Christopher Atchison, University of Cincinnati
Ashley Eaton, The University of Vermont
Sami Kahn, Princeton University
Shari Watkins, American University
Brittany Garvin-Hudson, Duke University

STRAND 1: Science Learning: Development of Student Understanding

Learning and Teaching Evolution in High School: Challenges and Possible Remedies

2:40 PM – 4:10 PM
Salmon

Discussant:

Kostas Kampourakis, University of Geneva

Presider:

Anat Yarden, Weizmann Institute of Science

High School Students' Types of Teleological Explanations: Implications for Item Development and for Teaching-Learning Strategies

Janina Jördens, Münster University

Marcus Hammann, Münster University

Experiencing the Development of Antibiotics Resistant Bacteria: Students' Understanding of the Nature of Evolution

Bat-Shahar Dorfman, Weizmann Institute of Science

Orna Dahan, Weizmann Institute of Science

Amir Mitchell, University of Massachusetts Medical School

Anat Yarden, Weizmann Institute of Science

Plant Blindness—What German High School Students and In-service Biology Teachers

Daniela Fiedler, IPN, Leibniz Institute for Science and Mathematics Education, Kiel, Germany

Isabell Rösberg, IPN, Leibniz Institute for Science and Mathematics Education, Kiel, Germany

Marc Rodemer, IPN, Leibniz Institute for Science and Mathematics Education, Kiel, Germany

Birgit Heyduck, IPN, Leibniz Institute for Science and Mathematics Education, Kiel, Germany

Ute Harms, Leibniz Institute for Science and Mathematics Education (IPN)

Capturing Instructional Strategies of Pre-service Biology Teachers to Counter Misconceptions about Evolution by the SCRBio

Julian Fischer, Leibniz Institute for Science and Mathematics Education

Nils Machts, Department of Educational Psychology (IPL), Kiel University

Jens Möller, Department of Educational

Psychology (IPL), Kiel University

Ute Harms, Leibniz Institute for Science and Mathematics Education (IPN)

Kostas Kampourakis, University of Geneva

STRAND 2:
**Science Learning: Contexts,
Characteristics and Interactions**

Language & Learning Science

2:40 PM – 4:10 PM

Hawthorne/Belmont/Laurelhurst

Presider:

Katherine Carr Chapman, Vanderbilt University

Hispanic Student Perceptions toward Spanish, Learning Science, and Attitudes

Angela Chapman, University of Texas Rio Grande Valley

Anthony Bailey, University of Texas Rio Grande Valley

Amy Weimer, Texas State University

Shania Pintor, University of Texas Rio Grande Valley

Stephany Pinales, University of Texas Rio Grande Valley

Languages of Modeling, Modeling in Languages: Integrating Science and Translanguaging

Ashlyn Pierson, Vanderbilt University

Douglas B. Clark, University of Calgary

Corey E. Brady, Vanderbilt University

The Effects of Language and other Home Factors on Lebanese Students' Performance in TIMSS

Rayya Younes, University of Balamand

Sara Salloum, University of Balamand

Maya Antoun, University of Balamand

STRAND 2:
**Science Learning: Contexts,
Characteristics and Interactions**

The Chemistry Learning Environment

2:40 PM – 4:10 PM

Meadow Lark/Douglas Fir – 3rd Floor

Presider:

Jonathon Grooms, George Washington University

Why do Students Choose a Context? Students' Reasons For Choosing a Learning Task in Chemistry

Helena Van Vorst, University of Cologne
Hatice Aydogmus

High School Student's Understanding of Molecular Representations in a Chemistry Context-Based Learning Environment

Ran Piorko, Technion-Israel Institute of Technology

Shirly Avargil, Technion-Israel Institute of Technology

Impact of Earth Science Integration on Student Learning in a High School Chemistry Course

Jonathon Grooms, George Washington University

Kevin J. Fleming, George Washington University

Alan R. Berkowitz, Cary Institute of Ecosystem Studies

Mary Ellen Wolfinger, George Washington University

Bess Caplan, Cary Institute of Ecosystem Studies

Chelsea McClure, Cary Institute of Ecosystem Studies

STRAND 3:
Science Teaching—Primary School
(Grades PreK-6): Characteristics
and Strategies

*Teacher Knowledge, Beliefs, & Use
of Science Practices with Students*

2:40 PM – 4:10 PM
Medford

Presider:
Joi Merritt, James Madison University

*An Exploratory Comparative Video-study of
Scientific Modeling in Elementary/Primary
Classrooms in the U.S. and Germany*

Florian Böschl, University of Leipzig
Kim Lange-Schubert, University of Leipzig
Cory T. Forbes, University of Nebraska–
Lincoln

*Examining the Relationship between
Preschool Teachers' attitudes and Beliefs
towards Science and Children's Science
Achievement*

Elica B Sharifnia, University of Miami
Alexandra Alexander, University of Miami
Silvia Niño, University of Miami

*Ms. Bernina's Knowledge of Her Students'
Knowledge and of Science Teaching*

Ashley N. Kookan, West Virginia University
Melissa J. Luna, West Virginia University

*Using Digital Simulated Classrooms
to Examine Elementary Teachers'
Ability to Engage Students in Scientific
Argumentation*

Jamie N. Mikeska, Educational Testing
Service (ETS)
Pamela S. Lottero-Perdue, Towson
University
Debra Brockway, Educational Testing
Service

Andrew Finnegan, Educational Testing
Service

Jonathan Steinberg, Educational Testing
Service

Heather Howell, Educational Testing Service

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

STEM Integration across Disciplines

2:40 PM – 4:10 PM
Salon D

Presider:
David McKinney, University of Nevada,
Las Vegas

*Comparison of Academic and Attendance
Outcomes between an Integrated STEM
High School and Comparison Schools*

Carla C. Johnson, North Carolina State
University
Toni A. Sondergeld, Drexel University

*Science and Literacy Integration by
Secondary Science and English Language
Arts Teachers*

Laura E. Robertson, East Tennessee State
University

ChihChe Tai, East Tennessee State
University

Renee Rice Moran, East Tennessee State
University

Karin Keith, East Tennessee State University

*Semantic Patterns of an Integrated STEM
Curriculum and its Enactment*

Chelsey A. Dankenbring, Purdue University
Selcen Guzey, Purdue University
Lynn A. Bryan, Purdue University

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

*Frameworks of TA learning and
Development as Educators*

**2:40 PM – 4:10 PM
Salon C**

Presider:
Kübra Özmen, Baskent University

*Cognitive Demand of Curricular Activities
and Content-Situated Professional
Development Influence Teaching Assistants'
Teaching Practices*

Jenna Hicks, University of Minnesota
Jessica Dewey, University of Minnesota
Michael Abebe, University of Minnesota
Anita Schuchardt, University of Minnesota

*Eliciting Students' Ideas: An Exploratory
Study of Biology Teaching Assistant
Learning*

Anna S. Grinath, Idaho State University
Sherry A. Southerland, Florida State
University

*Laboratory Teaching Assistants' Learning
to Develop Ambitious Teaching Practices*

Ryan Coker, Florida State University
Miray Tekkumru Kisa, Florida State
University

*Training for Culturally Responsive Science
Teaching in Undergraduate Science Impacts
Teaching Assistants' Practice*

Hillary A. Barron, University of Minnesota–
Twin Cities
Julie C. Brown, University of Florida
Lorelei E. Patrick, Fort Hays State University
Sehoya Cotner, University of Minnesota

**STRAND 6:
Science Learning in Informal Contexts**

*Admin Symposium-Igniting
Informal Science*

**2:40 PM – 4:10 PM
Salon E & F**

Igniting Informal Science

Nancy L. Staus, Oregon State University
Anton Puvirajah, University of Western
Ontario
Neta Shaby, Oregon State University
Dana Vedder-Weiss, Ben-Gurion University
of the Negev, Israel
Todd Campbell, University of Connecticut
Scott A. Pattison, TERC
Geeta Verma, University of Colorado Denver
Michael Dias, Kennesaw State University
John Pecore, Temple University
Smirla Ramos-Montañez, Oregon Museum
of Science and Industry

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

*Building Knowledge through
Asset-Based Pedagogy*

**2:40 PM – 4:10 PM
Salon A**

Presider:
Julianne A. Wenner, Boise State
University

*A Critical Examination of the Deficit
Perspective in Science Education
Pre-service Teacher Knowledge Studies*

Ron Gray, Northern Arizona University
David Stroupe, Michigan State University
Scott McDonald, Pennsylvania State
University

Pre-service Science Teachers' Engagement with Asset-Based Pedagogies in a University Science Methods Course

Rachael M. Gordon, University of Michigan

Access Points that Facilitate Pre-service Teachers' Sense-making about Systemic Issues within a Field Experience

Victor Káspér, Florida State University

Lama Jaber, Florida State University

Shannon G. Davidson, Florida State University

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

Pre-service Teachers' Self-Efficacy in Engineering

2:40 PM – 4:10 PM

Salon B

Presider:

Jing Yang, Indiana University

Sources of Engineering Teaching Self-Efficacy in a STEAM Methods Course for Elementary Pre-service Teachers

Donna L. Webb, George Fox University

Keelan P. LoFaró, Portland State University

Pre-service Teachers' Self-Efficacy Beliefs about Scientific Practices: Validation of the Science and Engineering Self-efficacy Instrument

Fatma Kaya, Kent State University

Lisa A. Borgerding, Kent State University

Shannon Navy, Kent State University

Effects of Informal versus School-Based Field Experience on Elementary Pre-service Teachers' Self-Efficacy for Teaching Science

Nicole Hesson, York College of Pennsylvania

Jason Forsyth, James Madison University

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

Assessment to Support NGSS Implementation

2:40 PM – 4:10 PM

Pearl

Presider:

Kerri Wingert, University of Colorado at Boulder

A 'Levels of Engineering Design' Rubric for Science Teachers Incorporating NGSS

Sarah B. Boesdorfer, Illinois State University

Characterizing Multi-Dimensional, Teacher-Designed, Science Assessments: Dimensions, Integration, and Cognitive Demand

Laura Zeller, University of Illinois at Chicago

Donald J. Wink, University of Illinois at Chicago

Impact of Scoring the Illinois Science Assessment on K-12 Science Teachers' Practices

Senetta F Bancroft, Southern Illinois University Carbondale

Harvey Henson, Southern Illinois University

Daniel L. Brown, Illinois State Board of Education

Angela D. Box, Southern Illinois University-Carbondale

Yanyan Sheng, Southern Illinois University-Carbondale

Jennifer Rhodes, Southern Illinois University-Carbondale

Interpreting Teacher Understanding of 5D Science: A Vision Survey

Kerri Wingert, University of Colorado at Boulder

Melissa R. Campanella, CU Boulder

William R. Penuel, University of Colorado

Kris Kilibarda, Iowa Department of Education

STRAND 10: Curriculum, Evaluation, and Assessment

Automated Assessment of Argumentation in School Science: Developments and Challenges

2:40 PM – 4:10 PM

Columbia

Selected Response Item Formats: Addressing the Practice of Arguing from Evidence in Science

Linda Morell, University of California, Berkeley

Sara J. Dozier, Stanford University

Weeraphat Suksiri, University of California, Berkeley

Jonathan Francis Osborne, Stanford Graduate School of Education

Mark R. Wilson, University of California, Berkeley

Using Automated Analysis to Assess Middle School Students' Competence with Scientific Argumentation

Christopher Wilson, BSCS

Molly Stuhlsatz, BSCS

Brian M. Donovan, BSCS

Zoe E. Buck Bracey, BSCS

April L. Gardner, Biological Science Curriculum Study

Automated Real-Time Argument-Text and Model-Interaction Feedback to Support Secondary School Students' Revision of Scientific Arguments

Hee-Sun Lee, The Concord Consortium

Gey-Hong Gweon, Physics Front

Amy R. Pallant, The Concord Consortium

Exploring Bias in Automated Scoring of Student Argumentation

Zoe E. Buck Bracey, BSCS

Molly Stuhlsatz, BSCS

Tina Cheuk, Stanford University

Marisol Mercado

Christopher Wilson, BSCS

Jonathan Francis Osborne, Stanford Graduate School of Education

Kevin C. Haudek, Michigan State University

Brian M. Donovan, BSCS

April L. Gardner, Biological Science Curriculum Study

STRAND 10: Curriculum, Evaluation, and Assessment

Teachers' Understanding and Use of Science Curriculum and Assessment

2:40 PM – 4:10 PM

Salon I

Presider:

Lisa M. McDonald, Columbia University

"We Get to See What Works": Teacher Commitment to Curriculum within a Research Practice Partnership

Jayma Koval, Georgia Institute of Technology

Jessica Gale, Georgia Institute of Technology –CEISMC

Meltem Alemdar, Georgia Institute of Technology

Sabrina Grossman, Georgia Institute of Technology–CEISMC

Marion Usselman, Georgia Institute of Technology

How Teachers Understand the Curriculum and Frameworks They Use

Kristin N. VanWyngaarden, University of Nebraska Omaha

Michelle Friend, University of Nebraska at Omaha

Teacher Decision-Making in High School Biology Curriculum Co-Design: A Critical Incidents Analysis

Elizabeth Chatham, New Visions for Public Schools

Kiran D. Purohit, New Visions for Public Schools

Using Hybrid Online/Face-to-Face Courses to Support Teachers' Development and Use of 3D Performance Assessments

Jill Wertheim, Stanford Center for Assessment, Learning, and Equity

STRAND 11: Cultural, Social, and Gender Issues

Creating Space for the Inclusion of Social Justice within Engineering Learning Environments

2:40 PM – 4:10 PM

Salon G

Discussant:

Bryan Brown, Stanford University

An Identity Resources Approach for Supporting Teachers-of-Engineering for Minoritized Young People

Christopher G. Wright, Drexel University

Bryan A. Brown, Stanford University

Rasheda Likely,

Mikhail Miller, Drexel University

Design Problems in Context: A Longitudinal Examination of Students' Design Considerations in a Course about Engineering Culture, Diversity, and Equity

Greses Pérez, Stanford University

Shannon Gilmartin, Stanford University

Carol Muller, Stanford University

Patrick Danner, Stanford University

Sherri Sheppard, Stanford University

Becoming Part of an Engineering Community of Practice: How Students Across Lines of Difference Find Their Place in a Makerspace

Eric Reynolds, Stanford University

My Life's Work: Re-engineering Education for Black Boys

James Holly, Jr., Wayne State University

Design Justice in Humanitarian Engineering Education

Brandon Reynante, Stanford University

STRAND 11: Cultural, Social, and Gender Issues

Exploring the Experiences and STEM Identity Development of Black Students and Teachers

2:40 PM – 4:10 PM

Salon H

Presider:

Reanna S. Roby, Michigan State University

A Narrative Inquiry into the Making of an Urban Science Teacher: Felicia's Story

Lisa Marco-Bujosa, Villanova University

Examining Factors Influencing African American Students' Scientific Identity in STEM

Lezly Taylor, Virginia Polytechnic Institute and State University

Brenda R. Brand, Virginia Tech University

Takumi Sato, Virginia Polytechnic Institute & State University

Anza Mitchell, Virginia Tech University

Exploring Discursive Performance of Race in Advanced Placement Biology Classrooms

Deborah J. Tippins, University of Georgia

Sophia (Sun Kyung) Jeong, University of Georgia

Identity Formation in Science During Adolescence: How do Future Possible Selves Take Shape For Diverse Students of Color?

Ross Anderson, Inflexion

Ed Madison, University of Oregon

Niki Derosia, University of Oregon

**STRAND 12:
Educational Technology**

Technology Tools to Support Scientific Thinking

**2:40 PM – 4:10 PM
Portland**

Presider:

Kit Martin, Northwestern University

Blending Drama and Computer Supported Collaborative Learning for Socioscientific Argumentation

Aysegul Oguz Namdar, Recep Tayyip Erdogan University

Bahadır Namdar, Recep Tayyip Erdogan University

Impacts of Sequential Experience with Agent-Based Modeling and System Dynamics Modeling on Students' Ability to Link Across Levels in Reasoning about Complex Phenomena

Jie Chao, The Concord Consortium

Carolyn Staudt, The Concord Consortium

Daniel Wendel, Massachusetts Institute of Technology

Much.Matter.in.Motion: 7th Grade Students Learn Chemistry through Constructing Computational Models of Complex Systems

Janan Saba, University of Haifa

Sharona T. Levy, University of Haifa

Elon Langbeheim, The Weizmann Institute of Science

Hagit Hel-Or, University of Haifa

**STRAND 14:
ENVIRONMENTAL EDUCATION**

Environmental Education—Educator's Perspective

**2:40 PM – 4:10 PM
Eugene**

Presider:

Iris Alkaher, Kibbutzim College of Education

Framing Differences Reveal Argumentation Complexities in Education for Sustainability—The Case of Natural-Gas Distribution

Hagit Shasha Sharf, The Technion–Israel Institute of Technology

Tali Tal, Technion

How do Faculty at a Business School Conceptualize Environmental Issues and Incorporate these Issues in their Classrooms?

Hamza Malik, University of Massachusetts Dartmouth

Stephen B. Witzig, University of Massachusetts Dartmouth

Population Growth: Do Teachers Perceive It As A Problem And What Are Their Concerns About Including It In Their Teaching?

Iris Alkaher, Kibbutzim College of Education
Nurit Carmi, Tel Hai Academic College

Pre-service Secondary Teachers' Emotional Sense-Making of Learning to Teach Climate Change

Elizabeth Hufnagel, University of Maine
Anica Miller-Rushing, University of Maine

Concurrent Session 2
4:20 PM – 5:50 PM

STRAND 1:
Science Learning, Understanding and Conceptual Change

Recent Trends in Genetics Education Research

4:20 PM – 5:50 PM
Salmon

Presider:
Kostas Kampourakis, University of Geneva

Mechanistic Reasoning about Gene Environment Interactions

Michal Haskel-Ittah, Weizmann Institute of Science

Ravit Golan Duncan, Rutgers University
Anat Yarden, Weizmann Institute of Science

High School Students' Causal Attributions of Features of the Body and the Mind: Genes, Environment and Individual Will

Marcus Hammann, Münster University

Supporting the Development of Genomics Literacy Could Significantly Reduce Cognitive Forms of Racial Prejudice During Adolescence

Monica Weindling, BSCS Science Learning
Brae Salazar, BSCS Science Learning
Brian M. Donovan, BSCS

Measuring Students' Teleological and Essentialist Conceptions in the Context of Genetics: A Comparison of Explicit and Implicit Measures

Florian J. Stern, University of Geneva
Kostas Kampourakis, University of Geneva
Marine Delaval, University of Geneva
Andreas Mueller, JUFE, University of Geneva

Defining Epigenetic Literacy for School Biology—A Delphi Study

Niklas M. Gericke, Department of Environmental and Life Sciences
Birgitta McEwen, Department of Environmental and Life Sciences, Karlstad University
Karin Thörne, Department of Environmental and Life Sciences, Karlstad University

STRAND 2:
Science Learning: Contexts, Characteristics and Interactions

Improving Guidance for Classroom Argumentation in Science Inquiry

4:20 PM – 5:50 PM
Mt Hood

Discussant:
Marcia Linn, University of California, Berkeley

Changes in Classroom Argumentation Practices in Elementary Science during Teachers' Participation in a Year-long Professional Development Program

Coralie F. Delhaye, Stanford University
Matthew Wilsey, Stanford University
Emily Reigh, Stanford
Hilda Borko, Stanford University
Jonathan Francis Osborne, Stanford Graduate School of Education

Supporting Student-Directed Discussion in Elementary Science: A Case Study of One Teacher's Instructional Change

Emily Reigh, Stanford
Florencia Gomez Zaccarelli, Facultad de Educación, Pontificia Universidad Católica de Chile
Hilda Borko, Stanford University
Jonathan Francis Osborne, Stanford Graduate School of Education

Learning to Revise: Using Annotation to Model Integrated Revision of Explanations

Libby Gerard, University of California, Berkeley, Graduate School of Education
Marcia C. Linn, University of California, Berkeley

Impact of Autoscored Student Data Reports on Teacher Customizations and Students' Science Learning

Jennifer King-Chen

Supporting Teachers to Customize Science Curriculum for Self-directed Learning Impacts Both Teacher and Student Learning

Allison Bradford, University of California, Berkeley
Libby Gerard, University of California, Berkeley, Graduate School of Education

**STRAND 2:
 Science Learning: Contexts,
 Characteristics and Interactions**

Interest, Identity, & Empathy

4:20 PM – 5:50 PM

Hawthorne/Belmont/Laurelhurst

Presider:
Ying-Ting Chiu, The Ohio State University

Using Argument-Based Inquiry to Teach Nutrition in Animals—Impact on Students' Achievement and Interest

Festus Osasumwen Idighe, University of Benin
Christiana Nkechi Omoifo, University of Benin

The Role of Children's Racial Identity and its Impact on Their Science Education

Lisa M. McDonald, Teachers College, Columbia University
Felicia Moore Mensah, Teachers College, Columbia University

Everyday Engineers: An Analysis of Youth's Everyday Engineering Practices and Identities Across Settings

Veronica McGowan, University of Washington
Philip L. Bell, University of Washington

Development of the Scientific Empathy Index

Heesun Yang, University of British Columbia
Seong-Joo Kang, Korea National University of Education
David Anderson, University of British Columbia

STRAND 2:
**Science Learning: Contexts,
 Characteristics and Interactions**

*Socioscientific Reasoning,
 Decision-Making, & Discourse*

4:20 PM – 5:50 PM

Meadow Lark/Douglas Fir – 3rd Floor

Presider:

Jean-Philippe Ayotte-Beaudet,
 Université De Sherbrooke

*Multimodal Coherence-Seeking in Global
 Socioscientific Issues-Based Discourse*

Mary E. Short, The George Washington
 University

*'I Wouldn't Want to be the Animal nor
 the Patient'—Students' Decision-Making
 on Animal Testing*

Carola Garrecht, IPN–Leibniz Institute for
 Science and Mathematics Education

Ute Harms, IPN–Leibniz Institute for Science
 and Mathematics Education

*Students' Context-Specific Epistemic
 Justifications, Prior Knowledge,
 Engagement and Socioscientific Reasoning
 in a Mobile Augmented Reality Learning
 Environment*

Hsin-Yi Chang, National Taiwan Normal
 University

Jyh-Chong Liang, National Taiwan Normal
 University

Chin-Chung Tsai, National Taiwan Normal
 University

*The Effects of Critique-driven Inquiry (CDI)
 Teaching on Elementary and Secondary
 School Students' Tendency of Critical
 Thinking and Scientific Competency*

Ying-Yan Lu, National Sun Yat-Sen
 University

Zuway-R Hong, National Sun Yat-sen
 University/Australian Catholic University

Huann-Shyang Lin, National Sun Yat-Sen
 University/Australian Catholic University

Hsin-Hui Wang, Australian Catholic
 University

Hsiang-Ting Chen, National Sun Yat-sen
 University

Kuay-Keng Yang, National Pingtung
 University

Yi-Ting Pan, National Sun Yat-sen University

STRAND 3:
**Science Teaching—Primary School
 (Grades PreK-6): Characteristics
 and Strategies**

*Supporting Elementary & Early
 Childhood STEM Learning*

4:20 PM – 5:50 PM

Medford

Presider:

Justin McFadden, University of
 Louisville

*Promoting Elementary Students STEM
 Learning by Employing Engineering
 Design Process in the Inquiry-Based
 Science Activity*

Kuay-Keng Yang, National Pingtung
 University

Zuway-R Hong, National Sun Yat-Sen
 University

Huann-Shyang Lin, National Sun Yat-Sen
 University

*Prospective Elementary Teachers Plan
 STEAM Lessons Focused on Science
 & Engineering*

Jaclyn K. Murray, Augusta University

Teacher Scaffolding to Support Student Learning in an NGSS-Aligned Unit Integrating Science and Engineering

Sarah Lilly, University of Virginia
Sarah J. Fick, University of Virginia
Anne McAlister, The University of Virginia
Jennifer Chiu, University of Virginia
Kevin W. McElhaney, SRI International

Teaching STEM Concepts in Elementary School with Biomechanics

Michelle Friend, University of Nebraska at Omaha
Anne Karabon, University of Nebraska at Omaha
Amelia Lanier Knarr, University of Nebraska at Omaha
Kota Takahashi, University of Nebraska at Omaha
Neal Grandgenett, University of Nebraska at Omaha

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

Teacher Knowledge and Implementation

4:20 PM – 5:50 PM

Salon D

Presider:
Lucia Chacon-Diaz, The Ohio State University

Changing Teacher Practice at Scale through Instructional Routines: Findings from a Field Test of High School Materials

Kiran D. Purohit, New Visions for Public Schools
Dora E. Kastel, New Visions for Public Schools
Elizabeth Chatham, New Visions for Public Schools

Science Teachers' Integration of Knowledges and Skills in Enacted Pedagogical Content Knowledge in their Teaching

Imran Tufail, University of Waikato
Chris Eames, University of Waikato
Cathy Bunting, University of Waikato
Maurice M. W. Cheng, University of Waikato

The Development of an Instrument to Measure Teachers' Perceptions of STEM Practices

Anthony Sparks, Southern Methodist University
Elizabeth L. Adams, Southern Methodist University
Lindsey Perry, Southern Methodist University
Leanne R. Ketterlin-Geller, Southern Methodist University

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

Postsecondary Educators' Perceptions, Planning, and Practices

4:20 PM – 5:50 PM

Salon C

Presider:
Joshua Reid, Middle Tennessee State University

Classroom Discourse Patterns of Biology Instructors in Undergraduate STEM Classrooms

Petra Kranzfelder, University of California, Merced
Jennifer L. Bankers-Fulbright, Augsburg University
Marcos E. Garcia-Ojeda, University of California, Merced
Marin Melloy, University of Minnesota
Sagal Mohammed, University of Minnesota
Abdirizak M. Warfa, University of Minnesota

Investigating the Conceptualization and Implementation of Quantitative Reasoning (QR) Skills in Introductory Undergraduate Biology Courses

Ann Cleveland, Maine Maritime Academy
Asli Sezen-Barrie, University of Maine
Gili Marbach-Ad, University of Maryland

Pre-service Early Childhood Teachers' Difficulties in Planning and Implementing STEM-based Lessons

Mustafa S. Topcu, Yildiz Technical University
Ayşe Ciftci, Mus Alparslan University

The Effects of Flipping STEM Classrooms on Instructional Practices

Robert Idsardi, Eastern Washington University
Ivy Tietz, Eastern Washington University
Jennifer Mancinelli, Eastern Washington University

STRAND 6:
Science Learning in Informal Contexts
Educating Informal Science Educators

4:20 PM – 5:50 PM
Salon E & F

Presider:
Brenda L. Carpenter, Lower Columbia College

Analyzing Contradictions in Project-Based Learning Internships from the Cultural—Historical Activity Theory Perspective

Pei-Ling Hsu, University of Texas at El Paso

How does a STEM Outreach Event Impact Scientists' Communication Objectives?

Stephanie D. Teeter, NC State University
Jacqueline H. Cole, NC State University

iPCK: Developing a Framework for Pedagogical Content Knowledge for Informal Science Educators

K. C. Busch, North Carolina State University
Mwenda Kudumu, NC State University
Soonhye Park, North Carolina State University

Teacher Learning through Participation in an Outreach Program to Link Field Trips with Classroom Curriculum

Alexandria Muller, University of California at Santa Barbara
Victor Corona, University of California at Santa Barbara
Ron Skinner, MOXI, The Wolf Museum of Exploration + Innovation
Tarah Connolly, MOXI, The Wolf Museum of Exploration + Innovation
Danielle Boyd Harlow, University of California at Santa Barbara

STRAND 7:
Pre-service Science Teacher Education
Accessing Funds of Knowledge to Enhance Instruction

4:20 PM – 5:50 PM
Salon A

Presider:
Sibel Erduran, University of Oxford

Pre-service Science Teachers' Understanding of Instruction for Diverse Learners: A Focus on Funds of Knowledge

Stacey L. Carpenter, University of California, Santa Barbara
Erik Arevalo, University of California, Santa Barbara
Meghan Macias, University of California, Santa Barbara

Alexandria K. Hansen, Fresno State University

Leslie Bushong, University of California, Riverside

Susann Pinter, University of California, Davis

Elisa M. Stone, University of California, Berkeley

Julie A. Bianchini, University of California, Santa Barbara

***Funds of Knowledge in Making:
Re-envisioning Maker Education in STEM
Teacher Preparation***

Myunghwan Shin, California State University, Fresno

Jane J. Lee, Michigan State University

***Attention to Students' Cultural Funds of
Knowledge within Pre-service Teachers'
Lesson Plans***

Kirby Whittington, Florida State University

Miray Tekkumru Kisa, Florida State University

Sherry A. Southerland, Florida State University

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

***Pre-service Teachers' Identities
and Beliefs***

4:20 PM – 5:50 PM

Salon B

Presider:

Ryan Coker, Florida State University

***"More than I thought I would"—Effect of
an NGSS-aligned Biology Content Course
on Pre-service Elementary Teachers'
Self-Efficacy and Related Self-Perceptions***

Darcy M. Ronan, Sacred Heart University

***Pre-service Elementary Teachers' Science
Teacher Science Teaching Beliefs:
Influence of Science Learning and
Teaching Experiences***

Saiqa Azam, Memorial University of Newfoundland

Deepika Menon, Towson University

***Exploring How Early Classroom Teaching
Experiences Help Develop a Teacher
Identity in Undergraduate Science Students***

Megan Beckam, University of Nevada, Reno

Mandi Collins, University of Nevada, Reno

Elizabeth X. De Los Santos, University of Nevada, Reno

***Pre-service Elementary Teachers' Identity
Development in Learning to Teach Science:
A Multi-site Case Study***

Deepika Menon, Towson University

Saiqa Azam, Memorial University of Newfoundland

**STRAND 8:
In-service Science Teacher Education
Engineering Practices to Support NGSS**

4:20 PM – 5:50 PM

Pearl

Presider:

Nidaa Makki, The University of Akron

***A Mixed Methods Study of the Impact
of Engineering PD on Teachers' Motivation
& Practices***

Nidaa Makki, The University of Akron

Kristin L. Koskey, The University of Akron

Wondimu Ahmed, The University of Akron

Tania Jarosewich,

Donald P. Visco, The University of Akron

Nicholas Garafolo, The University of Akron

Fourth Grade Feelings—Elementary Teachers' Affective Experiences in Authentic Engineering Tasks

Merredith D. Portsmore, Tufts University
Jessica Watkins, Vanderbilt University
Rebecca D. Swanson, Tufts University

NGSS Teacher Professional Development to Implement Engineering Practices in Science Instruction

Kimberly B. Christian, Stony Brook University
Angela M. Kelly, Stony Brook University
Monica F. Bugallo, Stony Brook University

STRAND 8:
In-service Science Teacher Education
Professional Development to Support Curriculum Design

4:20 PM – 5:50 PM
Columbia

Presider:
Gayle Nelson Evans, University of Florida

Storytelling for Collaborative STEM Curriculum Development: Negotiating Discourses of Play and Learning

Charlene L. Ellingson, Mankato State
Sue Staats, University of Minnesota
Gillian H. Roehrig, University of Minnesota

Supporting Teachers' Vision of Science Instruction through Professional Development for Reform-Based Curriculum Materials

Katherine L. McNeill, Boston College
Renee Affolter, University of Massachusetts, Amherst
Benjamin R. Lowell, Boston College
Casandra Gonzalez, Boston College
Kevin Cherbow, Boston College

PD for Middle School Science Teachers for Integration of 3D Learning using NASA Education Resources

SoonChun Lee, Wichita State University
Daniel Bergman, Wichita State University
Greg Novacek, Wichita State University
Cathy Durano, Wichita State University

STRAND 10:
Curriculum, Evaluation, and Assessment

Novel Approaches to Science Assessment

4:20 PM – 5:50 PM
Salon I

Presider:
Xiaoming Zhai, Michigan State University

A Framework to Conceptualize Machine Learning-based Science Assessments

Xiaoming Zhai, Michigan State University
Kevin C. Haudek, Michigan State University
Lehong Shi, East Lansing
Ross H. Nehm, Stony Brook University, SUNY
Mark Urban-Lurain, Michigan State University

Accessible NGSS Assessment: Technology-Based Innovative Methodologies for Multidimensional Teaching and Learning

Heather K. Harkins
Laura J. Wright
Rebecca Kopriva
Linda Malkin
Blake Myers
Ellyssa Eiring, University of Wisconsin, Madison

Designing Crosscutting Concepts Assessments to Support NGSS Teaching and Learning

Lei Liu, Educational Testing Service
 Dante Cisterna, Educational Testing Service
 Cindy E. Hmelo-Silver, Center for Research on Learning & Technology
 Abeera Rehmat
 Karyn Housh, Indiana University
 Shu-Kang Chen, ETS
 Peter van Rijn
 Aurora Edith Graf, Educational Testing Service

Understanding External Expert Review of Design Artifacts in Design-Based Research: A Guide for the Perplexed

Gary Weiser, WestEd
 Brian D. Gane, University of Illinois at Chicago
 Christopher J. Harris, WestEd
 James Pellegrino
 Sania Z. Zaidi, University of Illinois at Chicago

**STRAND 11:
 Cultural, Social, and Gender Issues**
Establishment and Maintenance of Black STEM Community Institutions
4:20 PM – 5:50 PM
Salon H

Establishing a Black STEM Expert Community during the 20th Century

Charnell Long, University of Wisconsin, Madison

Exploring STEM Afro-Futurites through the Narratives of HBCU Educated Black Women Scientists

Reanna S. Roby, Michigan State University

And Her Name is Me: Insight Behind the Meaning of Being a Black Woman in Undergraduate STEM Education

Terrell R. Morton, University of Missouri, Columbia

Creating a Culturally Relevant Digital Sphere for Black and Brown Youth

Justin Shaifer, Columbia University

**STRAND 11:
 Cultural, Social, and Gender Issues**
Renegotiating Multiculturalism & Multilingualism in Science Education

4:20 PM – 5:50 PM
Salon G

Presider:
 Bhaskar Upadhyay, University of Minnesota

Addressing Cultural Validity in Science Assessments for English Learners: A Guiding Framework

Preetha K. Menon, Stanford University

An Apprenticeship Model for Culturally Responsive STEM Research in Pacific Island Cultures

Tobias Irish, University of Hawaii at Hilo
 Joseph Genz, University of Hawaii at Hilo
 Cheryl Sanguenza, University of Guam
 Marata Tamaira, University of Hawaii at Hilo
 Dwayne Anefal, University of Hawaii at Hilo
 Yubee Isaac, University of Hawaii at Hilo

An Asset-Based Introduction to Multilingualism: Effects on Student Attitudes and Beliefs about Science

Catherine Lemmi, California State University, Chico

Formative Interventions for Expansive Teacher Learning in Multilingual Science Education: Change Laboratories for Practice Transformation

Sara Salloum, University of Balamand
 Saouma B. Boujaoude, American University of Beirut
 May Antoun, University of Balamand

**STRAND 13:
 History, Philosophy, Sociology, and Nature of Science**

Learning of NOS
4:20 PM – 5:50 PM
Portland

Presider:
 Isha DeCoito, Western University

International Collaborative Investigation of Third Grade Students' Understandings of Scientific Inquiry

Judith S. Lederman, Illinois Institute of Technology
 Norman G. Lederman, Illinois Institute of Technology
 Selina L. Bartels, Valparaiso University
 Juan Jimenez, Illinois Institute of Technology

Talk is Cheap: Could Changing our Metaphors of Teaching and Learning Actually Help Enhance our Teaching?

Glenn Dolphin, University of Calgary

Undergraduates' Grounded Critique of Knowledge Claims in Socioscientific Decision Making

Won Jung Kim, Michigan State University
 Alicia C. Alonzo, Michigan State University

**STRAND 14:
 Environmental Education**

Environmental Education—Learner's Perspective

4:20 PM – 5:50 PM
Eugene

Presider:
 Alexandra T. Gillis, Brooklyn College

Developing Socioscientific Perspective Taking

Mark H. Newton, East Carolina University
 Dana L. Zeidler, University of South Florida

Environmental Education as a Chance to Foster the Motivation Towards Learning Science?

Mona L. Schönfelder, University of Bayreuth
 Franz X. Bogner, University of Bayreuth

Student Agency and Climate Science: Legitimacy, Saliency, and Credibility in Place Based Education

Alexandra T. Gillis, Brooklyn College
 Jennifer Adams, University of Calgary
 Brett Branco, Brooklyn College

Synergizing Science Communities in Project X: Curriculum X for Public Health Citizenship

Katherine R. Bruna, Iowa State University
 Lyric Bartholomay, University of Wisconsin, Madison

Mentor/Mentee Nexus

6:00 PM – 7:00 PM
Mt. Hood

Research Interest Group (RIG) Meetings

6:00 PM – 7:00 PM

*Continental and Diasporic Africa
in Science Education (CADASE) RIG*

Salon I – Lower Level

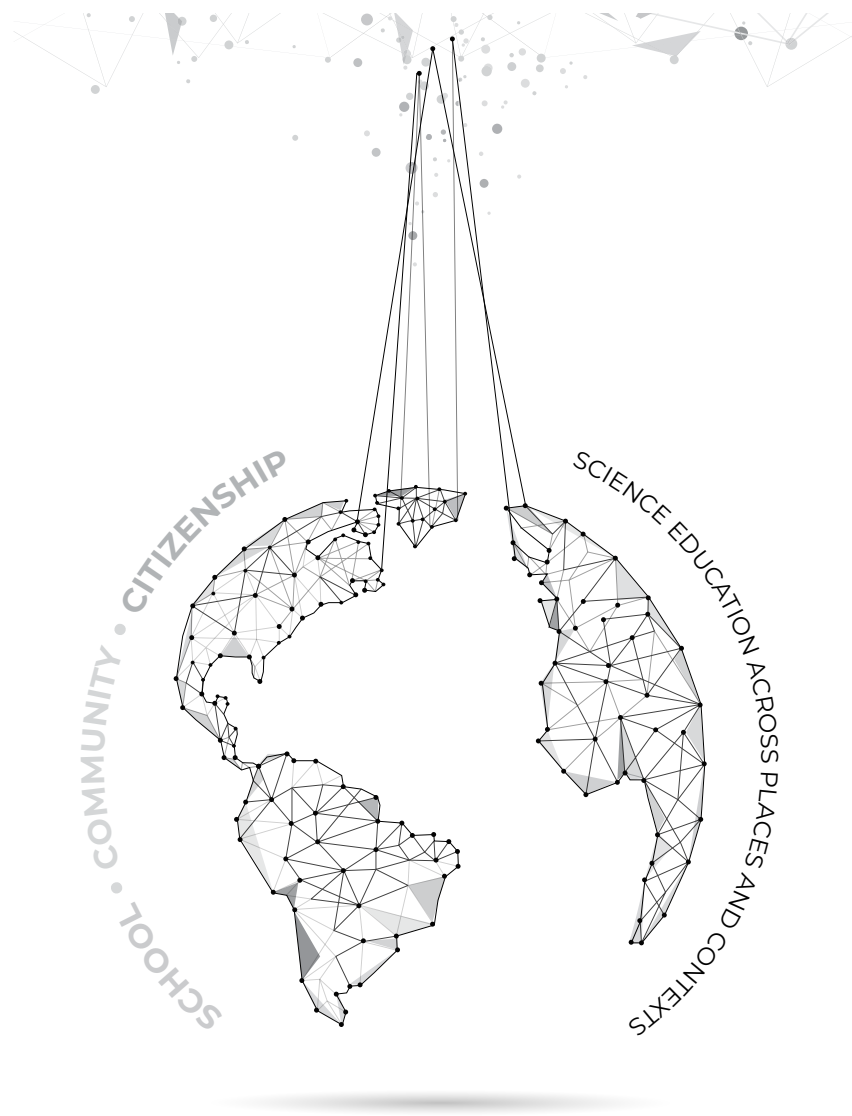
*Contemporary Methods for Science
Education Research RIG*

Salon H – Lower Level

Award Ceremony & Presidential Reception

7:00 PM – 9:30 PM
Salon E & F – Lower Level/Ballroom
Foyer

Light appetizers will be served. Cash bar.



PROGRAM

2020

93RD ANNUAL
INTERNATIONAL
CONFERENCE

MARCH 15–18

PORTLAND, OR, USA

Portland Marriott
Downtown Waterfront

MONDAY, MARCH 16, 2020

Mind and Sole
6:00 AM – 7:15 AM
Off-site

This event is not sponsored or endorsed by NARST

Conference Registration
8:00 AM – 4:30 PM
Ballroom Foyer – Lower Level

Concurrent Session 3
8:30 AM – 10:00 AM

External Policy And Relations Committee

Admin Symposium-Research Practice Partnerships: Collaborations toward Equitable STEM Education Research, Reform, and Implementation

8:30 AM – 10:00 AM
Mt Hood

Research Practice Partnerships: Collaborations toward Equitable STEM Education Research, Reform, and Implementation

Stefanie Marshall, University of Minnesota
Deb Morrison, University of Washington
Philip L. Bell, University of Washington
André E DeLeón, Nevada Department of Education
Jamie Ramage, Oregon Department of Education

STRAND 1:
Science Learning: Development of Student Understanding

Admin Symposium-Developing Science Literacy and the Potential for Conceptual Change

8:30 AM – 10:00 AM
Salmon

Developing Science Literacy and the Potential for Conceptual Change

Keri-Anne Croce, Towson University
Marcia J. Watson-Vandiver, Towson University

Huili Hong, Towson University

Renee Rice-Moran, East Tennessee State University

Bridget T. Miller, University of South Carolina

Christie Martin, University of South Carolina

Richard Lamb, East Carolina University

Etopio Etopio, University of Buffalo

Jonah B. Firestone, Washington State University Tri-Cities

Calvin S. Kalman, Concordia University

STRAND 1:
Science Learning: Development of Student Understanding

Supporting Understanding with Mathematics and Computational Thinking

8:30 AM – 10:00 AM
Columbia

Presider:
Kathryn Green, University of Georgia

Effective Algebraic Problem-Solving in Physics Through Activation of Prior-Mathematical Knowledge

Süleyman Tursucu, Radboud University Nijmegen

Erik Barendsen, Radboud University & Open University

Intertwining Three Dimensions: Levels of Performance for Computational Thinking While Using Models of Hydrologic Systems

Kristin L. Gunckel

Daniel L. Moreno, University of Arizona

Beth A. Covitt, University of Montana, SpectrUM Discovery Area

Bess Caplan, Cary Institute of Ecosystem Studies

Judith A. Cooper-Wagoner, University of Arizona

John C. Moore, Colorado State University

Alan R. Berkowitz, Cary Institute of Ecosystem Studies

Multiple Representations in Computational Thinking: A Study of Second Grade Students

Kristina M. Tank, Iowa State University

Tamara J. Moore, Purdue University

Seeing the Forest through the Trees using Network Analysis: Exploring Student Responses to Physics Problems

Mihwa Park, Texas Tech University

**STRAND 2:
Science Learning: Contexts,
Characteristics and Interactions
Modeling and Model-Based Teaching**

8:30 AM – 10:00 AM

Hawthorne/Belmont/Laurelhurst

Presider:

Ryan Coker, Florida State University

Modes and Transfer of Authority: Cultural Historical Activity Theory Analysis of Modeling Activities

Hyun-Jung Cha, Seoul National University

YoonJoo Shin, Seoul National University

Chan-Jong Kim, Seoul National University

Model-Based Science Teaching: Effects on Confidence, Interest, and Attitudes of Female High School Students

Grant Williams, St. Thomas University

John J. Clement, University of Massachusetts

Duy Pham, University of Massachusetts Amherst

Using the Preschool Scientific and Engineering Practices (PreSEP) Instrument to Explore Preschoolers' Engagement with Elements of Modeling Practice

Alison R. Miller, Bowdoin College

**STRAND 3:
Science Teaching—Primary School
(Grades PreK-6): Characteristics
and Strategies**

Analyses of Elementary Pre-service and Inservice Teachers' Use of Crosscutting Concepts in Plans and Enactments

8:30 AM – 10:00 AM

Meadow Lark/Douglas Fir – 3rd Floor

Discussant:

Deborah Hanuscin, Western Washington University

Elementary Pre-service Teachers' Use of the CCCs in Lesson Plans in Two Practice-Based Science Methods Courses

Carrie-Anne Sherwood, Southern Connecticut State University

Amanda Benedict-Chambers, Missouri State University

Deborah L. Hanuscin, Western Washington University

Investigating Elementary Pre-service Teachers' Implicit use of CCC's Overtime through Lesson Planning

Tina Vo, University of Nevada, Las Vegas
Nicole Thomas, University of Nevada, Las Vegas

Inservice Teachers' Use of Crosscutting Concepts in Planning for 3D Elementary Learning

Anna Maria Arias, Kennesaw State University
Brendan E. Callahan, Kennesaw State University
Michael Dias, Kennesaw State University
Karen Kuhel, Kennesaw State University

Reference to CCCs in Conversation Supporting an Integrated STEM Elementary Unit

Sarah J. Fick, University of Virginia
Jennifer Chiu, University of Virginia
Kevin W. McElhaney, SRI International

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

Secondary Science Teaching in the US: Current Status, Trends over Time, and Factors Affecting Instruction

8:30 AM – 10:00 AM
Salon E

Secondary Science Teaching in the US: Current Status, Trends over Time, and Factors Affecting Instruction

Eric R. Banilower, Horizon Research, Inc.
Peggy J. Trygstad, Horizon Research, Inc.
Laura M. Craven
Patrick S. Smith, Horizon Research, Inc.

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

Affordances for Students' Literacy and Engagement in Postsecondary Biology

8:30 AM – 10:00 AM
Salon D

Presider:
Andy Cavagnetto, Washington State University

Case Study Pedagogy and Learning Outcomes: A Framework for Teaching Biology with Narratives

Ally Hunter, University of Massachusetts, Amherst
Melissa Zwick, Stockton University

Developing Learning Progression for Botanical Literacy and Measuring Learning Gains: Construct Modeling Approach

Pongprapan Pongsophon, Kasetsart University, Bangkok, Thailand
Artitaya Jituafoa, Suratthani Rajabhat University, Suratthani, Thailand

Exploring Approaches to Engaging Undergraduates in Research: Differential Impacts on Students' Self-efficacy and Science Skills

Kelly M. Schmid, Syracuse University
Jason R. Wiles, Syracuse University

Exploring Peer Learning Assistants' Impact on Student Performance and Perceptions in an Undergraduate Biology Course

Brittney A Ferrari, University of Georgia
Jonathan Dees, University of Georgia
Norris Armstrong, University of Georgia
Kristen Miller, University of Georgia
Julie M. Kittleson, University of Georgia

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

Investigating Faculty Change

8:30 AM – 10:00 AM

Salon C

Presider:

Jana L. Bouwma-Gearhart, Oregon
State University

A Close Look at Change: Understanding Factors that Shape Instructor Evolution during Instructional Reform Efforts

Katelyn Southard, University of Arizona
Jonathan Cox, University of Arizona
Young Ae Kim, University of Arizona
Jazmin Jurkiewicz, University of Arizona
Lisa Elfring, University of Arizona
Paul Blowers, University of Arizona
Vicente A. Talanquer, University of Arizona

Are Faculty Changing? Sampling Effects on Measures of Instructor Adoption of Evidence-based Teaching Practices

Justin A. Goodridge, Stony Brook University
Lucy H. Gordon, Stony Brook University
Ross H. Nehm, Stony Brook University, SUNY
Gena C. Sbeglia, Stony Brook University

Re-thinking Notions of Change and Learning as Ontological Work in College Instructors' Professional Development

Sophia (Sun Kyung) Jeong, University of
Georgia
Paula Lemons, University of Georgia

STRAND 6: Science Learning in Informal Contexts

Family Engagement in Informal Science Experiences

8:30 AM – 10:00 AM

Salon F

Presider:

Scott A. Pattison, TERC

"I have a Gut Feeling about this" Adult Engagement with SSI in Daily Life

Keren E. Dalyot, Technion Israel Institute
of Technology
Ayelet Baram-Tsabari, Technion-Israel
Institute of Technology

Building the Cultural Wealth of Parents to Support Science Career Aspirations of Youth

Megan Ennes, University of Florida
M. Gail Jones, North Carolina State
University
Emily M. Cayton, Campbell University
Katherine Chesnutt, North Carolina State
University
Pamela Huff, North Carolina State University

Family Matters: A Mixed-Methods Study of Everyday Science Talk and STEM Identity Development

Remy Dou, Florida International University
Heidi Cian, Florida International University

Using Question Prompts to Support Families' Embodied Sensemaking and Reasoning in a Water Quality Workshop

Lucy R. McClain, Pennsylvania State
University
Yu-Chen Chiu, Pennsylvania State University
Heather Toomey Zimmerman, Pennsylvania
State University

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

Context-Dependent Approaches to Partnering with Mentor Teachers: Supporting Novice Teachers Ambitious Science Teaching

**8:30 AM – 10:00 AM
Salon A**

Discussant:

Matthew Kloser, University of Notre Dame

Presider:

Todd Campbell, University of Connecticut

Context-Dependent Approaches to Partnering with Mentor Teachers: Supporting Novice Teachers Ambitious Science Teaching

Todd Campbell, University of Connecticut

Jessica J. Thompson, University of Washington

David Stroupe, Michigan State University

Mark Windschitl, University of Washington

Scott McDonald, Pennsylvania State University

April Lynn Luehmann, University of Rochester

Lisa Lundgren, University of Connecticut

J. Brian Hancock, Alma College

Sara Hagenah, Boise State University

Matthew Kloser, University of Notre Dame

**STRAND 7:
Pre-service Science Teacher Education**
Retaining Pre-service Physics Teachers

**8:30 AM – 10:00 AM
Salon B**

Presider:

Angela Fitzgerald, University of Southern Queensland

What Matters? Influence of Quality and Quantity of Learning Opportunities in Pre-service Physics Teacher Education

Dustin Schiering, Leibniz Institute for Science and Mathematics Education (IPN Kiel)

Stefan Sorge, Leibniz Institute for Science and Mathematics Education (IPN Kiel)

Knut Neumann, Leibniz Institute for Science and Mathematics Education (IPN Kiel)

Engaging in the Science Practices: Pre-service Elementary Teachers' Experiences and Lesson-Planning in a Physics Course

Adam Bennion, University of Michigan

Elizabeth A. Davis, University of Michigan

Creating Coherent Connections to Support STEM: Utilizing Design in a Teacher Education Program

Ibrahim Delen, Usak University

Consuelo J. Morales, Michigan State University CREATE for STEM Institute

Joseph S. Krajcik, Michigan State University

Choosing to Teach Physics: Faculty and Student Perspectives

Lauren Madden, The College of New Jersey

Susan C. Eriksson, Virginia Tech

Nathan Magee, The College of New Jersey, Physics Department

AJ Richards, The College of New Jersey

Marissa E. Bellino, The College of New Jersey

Desaree Vaughan, The College of New Jersey

STRAND 8:
In-service Science Teacher Education
Context in Professional Development

8:30 AM – 10:00 AM
Pearl

Presider:
Casandra Gonzalez, Boston College

Bring Your Own Context: Personalization of High-School Science Teachers' Professional Development

Ron Blonder, The Weizmann Institute of Science

Bat-Shahar Dorfman, Weizmann Institute of Science

Bronwyn Terrill, Garvan Institute of Medical Research

Kate Patterson, Garvan Institute of Medical Research

Anat Yarden, Weizmann Institute of Science

Examining Elementary Teachers' Pedagogical Perspectives and Agency to Teach Science Through School-Based Science Professional Development

Jessica Lee Chen, Teachers College, Columbia University

The Complexity of Responsiveness: How Professional Development Providers Shape their work with Elementary Science Teachers

Patricia S. Bills, Oakland University

Madhura Kulkarni, Center for Integrative Natural Science & Mathematics, Northern Kentucky University

What Kind of Active Learning? Examining Intersections of Learner Positioning and Engagement in Professional Development

Patrick J. Enderle, Georgia State University

Jennifer Schellinger, Florida State University

Claudia Hagan, Georgia State University

Ozlem Akcil Okan, Florida State University

Ellen M. Granger, Florida State University

Todd Bevis, Florida State University

STRAND 11:
Cultural, Social, and Gender Issues

Critical Views of Science Education Research in Linguistically and Culturally Diverse Contexts

8:30 AM – 10:00 AM
Salon I

Discussant:
Maria Varelas, University of Illinois at Chicago

Presider:
Sara E. Wilmes, University of Luxembourg

Critical Views of Science Education Research in Linguistically and Culturally Diverse Contexts

Helen Douglass, University of Tulsa

Semiha Gun-Yildiz, University of Massachusetts, Dartmouth

Minjung Ryu, Purdue University

Sara Salloum, University of Balamand

Christina Siry, University of Luxembourg

Mavreen Rose S. Tuvilla, Purdue University

Geeta Veerma, University of Colorado Denver

Sara E. Wilmes, University of Luxembourg

Casey E Wright, Purdue University

Maria Varelas, University of Illinois at Chicago

STRAND 11: Cultural, Social, and Gender Issues

*Exploring Science Identities through
the Lenses of Possible Selves*

8:30 AM – 10:00 AM
Salon H

***“Now I Actually Enjoy Teaching Science!”
Exploring the Emerging Science Identity
of a Veteran Elementary Teacher***

Terrance Burgess, Syracuse University

***What Makes Science Careers Possible
for Undergraduate Science Majors?
Understanding the Roles of Science
Capital and Science Outreach***

Allison J. Gonsalves, McGill University

Hailey Iacono, McGill University

Alexandre Soares Cavalcante, McGill
University

Emily Sprowls, McGill University

***Enacting Identities, Imagining Worlds:
How Visions of Possible Selves Shape
Science Teacher Planning and Persistence***

Stacy Olitsky, Saint Joseph's University

***Negotiating, Resisting and Aligning
Narratives about the Future: An
Ethnographic Study of Higher Education
Science Students' Possible Selves***

Katia Kromann, University of Copenhagen

Henriette T. Holmegaard, University
of Copenhagen

STRAND 11: Cultural, Social, and Gender Issues

*Persistence & Retention Strategies for
Underrepresented Populations in STEM*

8:30 AM – 10:00 AM
Salon G

Presider:

Gillian U. Bayne, Lehman College
of CUNY

***New Majority Students' Challenges in
STEM Education and their Coping Strategies
to Thrive***

Mojtaba Khajeloo, University of Missouri,
Columbia

Joinee Taylor, University of Missouri,
Columbia

Terrell R. Morton, University of Missouri,
Columbia

Marcelle Siegel, University of Missouri,
Columbia

Johannes Schul, University of Missouri,
Columbia

Charles Nilon, University of Missouri,
Columbia

***The Effect of Peer Mentoring and
Achievement Goals on Persistence for
Female Undergraduate STEM Majors***

Jennifer Gatz, Stony Brook University

Angela M. Kelly, Stony Brook University

Monica Bugallo, Stony Brook University

***The Role of Resilience in the STEM Identities
of Post-Secondary Students: A Qualitative
Metasynthesis***

Karen Benn Marshall, Oakwood University

Sylvia M. James, National Science
Foundation

Two-Year STEM Pathways and Transitions across Minority Serving Destinations

Felisha Herrera, San Diego State University

Victoria Rodriguez-Operana, San Diego State University

Marlena Wolfram, Claremont Graduate University/San Diego State University

STRAND 13: History, Philosophy, Sociology, and Nature of Science

Nature of Scientific Practices

**8:30 AM – 10:00 AM
Portland**

Presider:
Sibel Erduran, University of Oxford

Establishing a Framework for the Culture of Scientific Research and Application to Course-based Undergraduate Research

Jessica Dewey, University of Minnesota

Anita Schuchardt, University of Minnesota

Nature of Science and The Nature of The Scientist—Socialization in Scientific Communities

Ashwin Krishnan Mohan, Pennsylvania State University

Gregory J. Kelly, Pennsylvania State University

The Nature of Scientific Explanation (NOSE): A Philosophically-Guided Framework Examining the Nature and Quality of Scientific Explanations

Sahar Alameh, University of Illinois at Urbana, Champaign

Fouad Abd-El-Khalick, University of North Carolina at Chapel Hill

David E. Brown, University of Illinois

STRAND 14: Environmental Education

Place-Based and Community-Based Education

**8:30 AM – 10:00 AM
Eugene**

Presider:
Scott Byrd, Maine Mathematics and Science Alliance

Added Value of Contextualizing Learning about Living Organisms in Schools' Immediate Surroundings

Jean-Philippe Ayotte-Beaudet, Université de Sherbrooke

Pierre Chastenay, Université du Québec à Montréal

Alain Paquette, Université du Québec à Montréal

Michael Giamellaro, Oregon State University - Cascades

Fatima Bousadra, Université de Sherbrooke

Marie-Claude Beaudry, Université de Sherbrooke

Kassandra L'Heureux, Université de Sherbrooke

Estelle Desjarlais, Université du Québec à Montréal

Sophie Perron, Université de Sherbrooke

Co-Constructing a Trans-Systemic Place-Based Environmental Education Model

Meena M. Balgopal, Colorado State University

Deepti Bhatt, Dakshin Foundation

Karishma Modi, Dakshin Foundation

Vani Sreekanta, Dakshin Foundation

Mythreyi Kumaraswamy, Dakshin Foundation

Kartik Shanker, Dakshin Foundation

Naveen Namboothri, Dakshin Foundation

Fostering Relationships between Elementary Students and the More-than-Human World: A Nature Center/School/University Collaboration

Sarah R. Stapleton, University of Oregon
Kathryn Lynch, University of Oregon

Middle School Science Teachers' Motivations to Implement Place-based Education Curricula about Local Wildlife

Diane Susan Wright, Colorado State University
Meena M. Balgopal, Colorado State University

Science Practice Pathways in Community-Based Environmental Education

Scott Byrd, Maine Mathematics and Science Alliance
Ruth Kermish-Allen, Maine Mathematics and Science Alliance
Alexandria Brasili, Maine Mathematics and Science Alliance

NETWORKING BREAK

10:00 AM – 10:30 AM

Concurrent Session 4
10:30 AM – 12:00 PM

Presidential Symposium

Admin Symposium-Citizen Science—An International and Integrative Look at a Scientific and Educational Method

10:30 AM – 12:00 PM
Meadow Lark/Douglas Fir – 3rd Floor

Citizen Science—an International and Integrative Look at a Scientific and Educational Method

Ayelet Baram-Tsabari, Technion–Israel Institute of Technology

Joseph L. Polman, University of Colorado, Boulder

Justin Dillon, University of Exeter

Heidi Ballard, University of California Davis

Tali Tal, Technion

Arjen E. J. Wals, Wageningen University, NL

Deborah Tippins, University of Georgia

STRAND 1:
Science Learning: Development of Student Understanding

Engineering Framework

10:30 AM – 12:00 PM
Salmon

Presider:
Helen Semilarski, University of Tartu

Assessing Student Learning of Core Ideas and Practices from Participating in an Integrated Engineering Framework

Lawrence Chu, The University of Texas at Austin

Victor D. Sampson, University of Texas at Austin

Todd L. Hutner, The University of Alabama

Richard H Crawford, The University of Texas at Austin

María González-Howard, University of Texas at Austin

Christina L. Baze, University of Texas at Austin

Catherine Rieggle-Crumb, University of Texas at Austin

Kindergartners' Engagement in two Epistemic Practices of Engineering: Making Trade-offs and Applying Science

Pamela S. Lottero-Perdue, Department of Physics, Astronomy & Geosciences
Towson University

Ming Tomayko, Department of Mathematics
Towson University

Promoting and Evaluating Conceptual Development in Early Elementary Science Using Engineering Design and Multimodal Assessment

Christine McGrail, University of Massachusetts Amherst

Eliciting Students' Abstract and Multidisciplinary Thinking in a Design Review

Jenny P. Quintana Cifuentes, Purdue University

Senay Purzer, Purdue University

**STRAND 2:
Science Learning: Contexts,
Characteristics and Interactions**

Characterizing computational thinking in the context of technology-enhanced multilevel system modeling

**10:30 AM – 12:00 PM
Mt Hood**

A Framework for Computational Thinking in the Context of System Modeling

Daniel N. Damelin, The Concord Consortium
Joseph S. Krajcik, Michigan State University

Relationship between Students' Understanding and Multi-Level System Modeling Capability through the Lens of Computational Thinking

Israel Tuitou, Michigan State University
Emil Eidin, Michigan State University

Tom Bielik, Michigan State University
Namsoo Shin,
Joseph S. Krajcik, Michigan State University

Characterizing Progression of Computational Thinking Practices as Students Build and Revise Dynamic Models

Tom Bielik, Michigan State University
Emil Eidin, Michigan State University
Israel Tuitou, Michigan State University
Joseph S. Krajcik, Michigan State University

Structural Aspects of Student Dynamic Models

A. Lynn Stephens, The Concord Consortium
Steve Roderick, The Concord Consortium

**STRAND 2:
Science Learning: Contexts,
Characteristics and Interactions
Motivation & Self-Efficacy**

**10:30 AM – 12:00 PM
Hawthorne/Belmont/Laurelhurst**

Presider:
Elizabeth Hufnagel, University of Maine

Motivational and Instructional Factors Predicting Performance in Science: A Machine Learning Approach

Wondimu Ahmed, The University of Akron

The Relationships Between Hormones and the Motivation of Adolescents to Learn Science

David L. Fortus, Weizmann Institute of Science
Ella Ofek-Geva, Weizmann Institute of Science
Michal Vinker, Samson Assuta Ashdod Hospital
Tevie Mehlman, Weizmann Institute of Science

Alexander Brandis, Weizmann Institute of Science

Yonatan Yeshayahu, Samson Assuta Ashdod Hospital

Self-Assessment and Underrepresentation in AP Physics 1

Marta R Stoeckel, University of Minnesota

Tales of Learning Science in and Out of School Between Ages 9-13

Ella ofek-Geva, Weizmann Institute of Science

David L. Fortus, Weizmann Institute of Science

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

Critical Factors for Effective and Equitable NGSS Science Teaching Practices

**10:30 AM – 12:00 PM
Salon E**

Teachers' Variable Subject Matter Knowledge and Inquiry-based Instruction

Lyrica Lucas, University of Nebraska, Lincoln

Elizabeth Hasseler, University of Nebraska, Lincoln

Amy Tankersley, University of Nebraska, Lincoln

Elizabeth B. Lewis, University of Nebraska, Lincoln

Brandon Holding, Boulder Learning, Inc.

NGSS-aligned Science Lesson Exemplars

Elizabeth Hasseler, University of Nebraska, Lincoln

Elizabeth B. Lewis, University of Nebraska, Lincoln

Lyrica Lucas, University of Nebraska, Lincoln

Amy Tankersley, University of Nebraska, Lincoln

Connections between Teacher and Classroom Variables and Use of NGSS Scientific Practices

Amy Tankersley, University of Nebraska, Lincoln

Lyrica Lucas, University of Nebraska, Lincoln

Elizabeth B. Lewis, University of Nebraska–Lincoln

Elizabeth Hasseler, University of Nebraska, Lincoln

Science Teachers' Professional Development and its Effect on Inquiry-Based Instruction

Elizabeth B. Lewis, University of Nebraska, Lincoln

Amy Tankersley, University of Nebraska, Lincoln

Elizabeth Hasseler, University of Nebraska, Lincoln

Lyrica Lucas, University of Nebraska, Lincoln

Brandon Holding, Boulder Learning, Inc.

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

Socioscientific Issues in the Science Classroom

**10:30 AM – 12:00 PM
Salon D**

Presider:

Heidi Cian, Florida International University

Exploring Science Teachers' Pedagogical Design Capacity for Citizenship

Ineke Henze-Rietveld, Delft University of Technology

Durdane Bayram-Jacobs, Department of Science Education, Radboud University, Nijmegen, The Netherlands

Erik Barendsen, Radboud University & Open University

Secondary Science Teachers Implementation of a Curricular Intervention when Teaching with Global Climate Models

Kimberly Carroll Steward, University of Nebraska, Lincoln

Devarati Bhattacharya, University of Nebraska

Cory T. Forbes, University of Nebraska, Lincoln

Mark Chandler, NASA-GISS Columbia University

The Influence of Context: Comparing High School Students' Socioscientific Reasoning by Socioscientific Topic

Heidi Cian, Florida International University

What Factors Do Secondary Students Consider when Making Decisions across Multiple Socioscientific Issue Topics

Dawnne M. LePrete, Illinois Institute of Technology

Norman G. Lederman, Illinois Institute of Technology

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

Fostering Students' Communication and Argumentation

10:30 AM – 12:00 PM

Salon C

Presider:

Jessica Karch, University of Massachusetts Boston

Discourse Remixed: Using Interdependency to Shift Science Learning through Talk

Joshua Premo, Utah Valley University

Andy Cavagnetto, Washington State University

Larry Collins, Washington State University

William B. Davis, Washington State University

Erika Offerdahl, Washington State University

Self-efficacy in Scientific Oral Communication: Exploratory Study with Postsecondary Science Students

Caroline Cormier, Cégep André-Laurendeau

Simon Langlois, Cégep Marie-Victorin

The Effect of Argumentative Writing to Promote Nonscience Major Students' Learning in an Chemistry Course

Claudia P. Aguirre-Mendez, Emporia State University

Ying-Chih Chen, Arizona State University

Takeshi Terada, Arizona State University

The Use of Problem Typology for the Promotion of Argumentation Among Undergraduate Engineers

Randy K. Yerrick, University at Buffalo

Andrew Olewnik, University at Buffalo

Yonghee Lee, University at Buffalo

Amanda Simmons, University at Buffalo

Brian Stuhlmiller, University at Buffalo

STRAND 6: Science Learning in Informal Contexts

Museum participant experiences

10:30 AM – 12:00 PM

Salon F

President:
Katherine Carr Chapman, Vanderbilt University

A New Generation of Science Educators and Communicators: Unexpected Career Aspirations in Museum Program Participants

Kathryn Rende, North Carolina State University
Gail Jones, North Carolina State University
Emma J. Refvem, North Carolina State University
Megan Ennes, University of Florida
Pamela Huff, North Carolina State University

CoP at a Museum to Support Early Childhood Teachers' Identities as Teachers of Science

Jenny D. Ingber, American Museum of Natural History
Jacqueline Horgan, American Museum of Natural History
Veena Vasudevan, American Museum of Natural History

Embodied Interaction in a Science Museum

Neta Shaby, Ben-Gurion University of the Negev, Israel
Dana Vedder-Weiss, Ben-Gurion University of the Negev, Israel

Impacts of Museum Tour Interpretation on Visitors' Post-Visit Marine Conservation Behaviors and Transformative Learning

Yi Ting Pan, Institute of Education, National Sun Yat-sen University
Kuay-Keng Yang, National Pingtung University

Zuway-R Hong, National Sun Yat-Sen University

Huann-Shyang Lin, National Sun Yat-Sen University

STRAND 7: Pre-service Science Teacher Education

Building Pre-service Teacher Capacity through Stakeholders

10:30 AM – 12:00 PM

Salon A

President:
Frackson Mumba, University of Virginia

The Elementary Science Partnership: An Evolving School-University Collaboration Around a Pre-service Science Methods Course

Jerome M. Shaw, University of California, Santa Cruz
Samuel Severance, University of California, Santa Cruz

Shifting Teacher Preparation for NGSS: Using a Networked Improvement Community to Promote Change Across Contexts

Michelle L. Sinapuelas, California State University, East Bay
Corinne H. Lardy, California State University, Sacramento

Using Expectation Violation Theory to Determine the Three Stakeholders' Expectations from the Teaching Experience Course based on Clinical Supervision Model

Tugba Yuksel, Recep Tayyip Erdogan University
Banu Avsar Erumit, Recep Tayyip Erdogan University

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

Pre-service Teaching Practices

10:30 AM – 12:00 PM

Salon B

Presider:
Michelle Forsythe, Texas State University

*Using Rehearsals with Teacher Educator
Feedback to Support Pre-service Teachers'
Vision of Ambitious Science Teaching*

Amanda Benedict-Chambers, Missouri
State University

*Probing The Myth: Are Cognitive Abilities
And Modeling Processes Really Related?*

Maximilian Göhner, Freie Universität Berlin
Moritz Krell, Freie Universität Berlin

*An Investigation of Pre-service Elementary
Teachers Reaction to Integrating
Computational Thinking in Their Teaching*

Diane Jass Ketelhut, University of Maryland
Randy McGinnis, University of Maryland
Kelly M. Mills, University of Maryland
Merijke Coenraad, University of Maryland
Lautaro Cabrera, University of Maryland,
College Park
Heather Killen, University of Maryland
College Park

*Impact of a Phenomenon-Based Science
Workshop on Prospective Elementary
Teachers' Science Content Knowledge*

Martha M. Canipe, Northern Arizona
University
Lucas Mulcahy, Northern Arizona University
Maggie Reid, Northern Arizona University

**STRAND 8:
In-service Science Teacher Education**
*Meeting the Content Needs of STEM
Educators*

10:30 AM – 12:00 PM

Pearl

Presider:
Kathryn N. Hayes, California State
University, East Bay

*A Needs Assessment of Central California
Science Teachers: Professional Development
Challenges & Opportunities*

Alexandria K. Hansen, Fresno State
Quinn Camara, Fresno State University
Prabhjot Kaur, Fresno State University
Anahi Martinez

*Adapting Professional Development for
Urban Science Teachers by Foregrounding
the Educator's Perspective*

Darrin A Collins, University of Illinois
at Chicago
Julio Mendez, University of Illinois
at Chicago
Jennifer Olson, University of Illinois
at Chicago
Miiri Kotche, University of Illinois at Chicago

Construction of STEM literacy and Chinese Teachers' Understanding

Xiao Huang, Zhejiang Normal University
Sibel Erduran, University of Oxford
Kang Kang Luo, Zhejiang Normal University
Sa Piao Zhang, Zhejiang Normal University

Retaining Science Teachers: A Mixed—Methods Study on the Relationship between Professional Development and Retention

Kathryn N. Hayes, California State University, East Bay
Linda Preminger, Teacher, San Lorenzo District
Christine L Bae, Virginia Commonwealth University

**STRAND 10:
Curriculum, Evaluation, and Assessment**

Socio-scientific Issue and Model Based Learning (SIMBL): Advances in Research to Inform Practice and Theory

**10:30 AM – 12:00 PM
Columbia**

Discussant:
Vaile Dawson, University of Western Australia

Co-Designed Socio-Scientific Issues-Based Curriculum Unit Implementation: A Case of Secondary Science Teacher Learning

Patricia J. Friedrichsen, University of Missouri–Columbia
Li Ke, University of North Carolina, Greensboro

Troy D. Sadler, University of North Carolina at Chapel Hill

Laura Zangori, University of Missouri
Vaile M. Dawson, University of Western Australia

Students' Perceptions of Socio-Scientific Issue-Centered Learning and their Appropriation of Epistemic Tools for Systems Thinking

Li Ke, University of North Carolina, Greensboro
Troy D. Sadler, University of North Carolina at Chapel Hill
Patricia J. Friedrichsen, University of Missouri–Columbia
Laura Zangori, University of Missouri

Developing Systems Thinking through Modeling in the Context of Socio-Scientific Issues among Elementary Learners

Laura Zangori, University of Missouri
Li Ke, University of North Carolina, Greensboro
Troy D. Sadler, University of North Carolina at Chapel Hill

Supporting Socio-Scientific Issues Teaching and Learning with Computational Thinking

Amanda N. Peel, Northwestern University
Patricia J. Friedrichsen, University of Missouri–Columbia
Troy D. Sadler, University of North Carolina at Chapel Hill

STRAND 11: Cultural, Social, and Gender Issues

Grappling with Coming Closer to Equity and Justice in Science Education: Students and Teachers Pondering Identities, Engaging in Multimodal Representations, and Pursuing Critical Hope

**10:30 AM – 12:00 PM
Salon I**

Presider:
Maria Varelas, University of Illinois at Chicago

Grappling with Coming Closer to Equity and Justice in Science Education: Students and Teachers Pondering Identities, Engaging in Multimodal Representations, and Pursuing Critical Hope

Maria Varelas, University of Illinois at Chicago

David Segura, Beloit College

Eli Tucker-Raymond, TERC

Christopher G. Wright, Drexel University

Rebecca Kotler, University of Illinois at Chicago

Brezhnev Batres, University of Illinois at Chicago

Nina Hike, University of Illinois at Chicago

Darrin Collins, University of Illinois at Chicago

Tiffany Childress Price, University of Illinois at Chicago

James Klock, University of Illinois at Chicago

STRAND 11: Cultural, Social, and Gender Issues

Promoting Inclusion in Culturally and Linguistically Diverse Science Classrooms

**10:30 AM – 12:00 PM
Salon G**

Presider:
Charnell Long, University of Wisconsin-Madison

"When the Learning Experience is Fun and Sometimes a Challenge, that Intrigues Me": Affirming Science Experiences in a STEM-Focused Urban High School

Noemi Waight, University at Buffalo

Jennifer Tripp, University at Buffalo

Lorenda Chisolm, University at Buffalo

A Critical Discourse Analysis of Disability in a Science Teacher Education Textbook: Implications for Equity

Teresa Shume, North Dakota State University

Case Study of Physics Coursetaking, Contextual Characteristics, and Physics Achievement in Urban Schools

Martin F. Palermo, Stony Brook University

Robert Krakehl, Stony Brook University

Angela M. Kelly, Stony Brook University

Keith Sheppard, Stony Brook University

R is for Resilience and Retention: The Role of Sociocultural Awareness and Affirming Attitudes towards Students

Maria S. Rivera Maulucci, Barnard College

Lisa M. McDonald, Teachers College, Columbia University

Shane Coleman, Teachers College, Columbia University

STRAND 11: Cultural, Social, and Gender Issues

Spaces of Agency: Centering Teacher Agency and Expanding Contexts for Equitable Science Teaching and Learning

10:30 AM – 12:00 PM

Salon H

Discussant:

Felicia Mensah, Teachers College, Columbia University

Applying Strength-Based Approaches and Re-positing Emergent Bilingual/Multilingual Learners as Epistemic Agents

Shakhnoza Kayumova, University of Massachusetts Dartmouth

Akira Harper, University of Massachusetts Dartmouth

Examining Relational Agency to Understand Teacher Educators' Professional Growth within the Individual/Collective Dialectic

Christina Siry, University of Luxembourg

Sara Wilmes, University of Luxembourg

Kerstin te Heesen, University of Luxembourg

Sandy Heinericy, University of Luxembourg

Nora Kneip, University of Luxembourg

Spaces of Agency for Pre-service Teachers: Capitalizing on Out-of-School to Develop Culturally-Sustaining Professional Identities

April Luehmann, University of Rochester

Yang Zahng, University of Rochester

Heather Boyle, University of Rochester

Dutch-Caribbean Students' Formation of Agentic Science Identities through Their Participation in an After-School Program

Theila Smith, University of Groningen, NL

Lucy Avraamidou, University of Groningen, NL

Jennifer Adams, University of Calgary, Canada

Teacher as Bricoleur: Spaces of Agency around Resources and Informal Science Practices

Jennifer Adams, University of Calgary, Canada

LaToya Strong, The Graduate Center, City University of NY

Atasi Das, The Graduate Center, City University of NY

Susan McCullough, Queens College, CUNY

STRAND 13: History, Philosophy, Sociology, and Nature of Science

Nature of Engineering

10:30 AM – 12:00 PM

Portland

Presider:

Ryan Summers, University of North Dakota

Development of a Nature of Engineering Instrument: Results from Field Tests

Jacob Pleasants, Keene State College

Joanne K. Olson, Texas A&M University

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

Kristina M. Tank, Iowa State University

Engineering Professional Development with Robotics and Assessment of K-12 Teachers' Understandings of Nature of Engineering

Hasan Deniz, University of Nevada Las Vegas

Ezgi Yesilyurt, University of Nevada, Las Vegas

Erdogan Kaya, University of Nevada, Las Vegas

Science Teachers' Nature of Engineering Knowledge and Instructional Planning

Allison Antink-Meyer, Illinois State University

Anna Maria Arias, Kennesaw State University

STRAND 15: Policy

Understanding and Supporting STEM Education Improvement Efforts Within Schools and Districts

**10:30 AM – 12:00 PM
Eugene**

Presider:
Carrie D. Allen, University of North Texas

Principals as Policy Players: How Leadership Practices Impact Science Instruction

Kathryn M. Bateman, Temple University
Scott McDonald, Pennsylvania State University

An Emerging Model of Instructional Change Teams

Ntiana (Diana) Sachmpazidi, Western Michigan University
Alice Olmstead, Texas State University
Charles R. Henderson, Western Michigan University
Andrea Beach, Western Michigan University

Making Sense of Reform: Hybridizing Local and Ideal Instructional Practices

William E. Lindsay, University of Colorado, Boulder

Science Professional Development and Barriers to Elementary Science Education in a High Need School District

Kathleen D. Johnson, Boston University
Peter S. Garik, Boston University
Bruce Anderson, Boston University
Donald DeRosa, Boston University
Caleb Farny, Boston University
Melissa Kaufman, Boston University
Evangeline Stefanakis, Boston University

LUNCH

**12:00 PM – 1:45 PM
On Your Own**

Concurrent Session 5 1:45 PM – 3:15 PM

Publications Advisory Committee

Admin Symposium-Publishing, Reviewing and Writing for the Journal of Research in Science Teaching: Lessons Learned and New Visions

**1:45 PM – 3:15 PM
Mt Hood**

Publishing, Reviewing and Writing for the Journal of Research in Science Teaching: Lessons Learned and New Visions

Fouad Abd-El-Khalick, University of North Carolina at Chapel Hill
Dana L. Zeidler, University of South Florida
Troy Sadler, University of North Carolina at Chapel Hill
Felicia Moore-Mensah, Teachers College, Columbia University
Elizabeth C. Niswander, University of Illinois at Urbana, Champaign

STRAND 1: Science Learning: Development of Student Understanding

Modeling

**1:45 PM – 3:15 PM
Salmon**

Presider:
Cesar Delgado, North Carolina State University

Fostering Students' Understanding of Iconic Model Comprehension

Veronika Bille, University of Duisburg Essen
Maria Opfermann, Ruhr-Universität Bochum
Julian Roelle, Ruhr-Universität Bochum
Stefan Rumann, University of Duisburg, Essen

How Modeling can Help Students Condense Meaning Within Language

Daniel K. Capps, University of Georgia
Jonathan Shemwell, The University of Alabama
Ayca K. Fackler, The University of Georgia
Carlson H. Coogler, The University of Alabama
Hong T. Tran, The University of Georgia

Identifying Large Scale Scientific Modeling Practices That Can Organize Scaffolding Strategies for Whole Class Discussions

Maria Cecilia Nunez-Oviedo, University of Concepcion
John J. Clement, University of Massachusetts

The Affordances of Integrating Crosscutting Concepts and Modeling: Improving Science Learning With a Connective Structure

Ayca K. Fackler, The University of Georgia
Carlson H. Coogler, The University of Alabama
Daniel K. Capps, The University of Georgia
Jonathan Shemwell, The University of Alabama
Hong T. Tran, The University of Georgia

STRAND 2: Science Learning: Contexts, Characteristics and Interactions

Moves in Teaching & Discourse

1:45 PM – 3:15 PM

Hawthorne/Belmont/Laurelhurst

Presider:
Luiz Gustavo Franco Silveira,
 Universidade Federal de Minas Gerais

Gender, Power, and Positioning: Examining Discourse in Middle School Students' Small Group Engineering Interactions

Jeanna R. Wieselmann, Southern Methodist University
Khomson Keratithamkul, University of Minnesota
Emily A. Dare, Florida International University
Elizabeth A. Ring-Whalen, St. Catherine University
Gillian H. Roehrig, University of Minnesota

Characterizing the Teaching Moves of Engineering Outreach Ambassadors

Karen Miel, Tufts University
Elizabeth Moison, Tufts University
Merredith D. Portsmore, Tufts University
Kelli Paul, Indiana University
Euisuk Sung, Indiana University
Adam V. Maltese, Indiana University

Tracing Links Between Teacher Moves, Student Framing, and Student Learning in a Middle School Classroom

Sherry A. Southerland, Florida State University
Jennifer Schellinger, Florida State University
Lama Jaber, Florida State University
Harini Krishnan, Florida State University

STRAND 3:
Science Teaching—Primary School
(Grades PreK-6): Characteristics
and Strategies

Elementary Science Instruction in the US: Warning Signs and Ways Forward

1:45 PM – 3:15 PM
Meadow Lark/Douglas Fir – 3rd Floor

Trends in Elementary Science Instruction From 2012 to 2018

Eric R. Banilower, Horizon Research, Inc.

Novice Elementary Science Teachers

Peggy J. Trygstad, Horizon Research, Inc.

Factors that Predict the Extent to Which Elementary Teachers' Engage Students in the Science Practices

Laura M. Craven, Horizon Research, Inc.

Differences Between Self-Contained and Non-Self-Contained Elementary Science Classes

Patrick S. Smith, Horizon Research, Inc.

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

Teaching for Science Literacy at Scale

1:45 PM – 3:15 PM
Salon E

Discussant:

Joseph Krajcik, Michigan State University

Presider:

Charles W. Anderson, Michigan State University

Designing Curriculum to Support the Literacy Aspects of Science Literacy

Kirsten D. Edwards, Michigan State University

Charles W. Anderson, Michigan State University

Utilizing Three-Dimensional Science Learning and Situated Instruction to Increase the Adoption of Sustainable Knowledge and Practice Among Rural Agriscience Students

Craig Kohn, Michigan State University

Factors Affecting Students' Learning about [name of project]

Qinyun Lin, Michigan State University

Ken Frank, Michigan State University

Charles W. Anderson, Michigan State University

Classroom Discourse and Its Connections to Student Learning

Beth A. Covitt, University of Montana

Christie Morrison Thomas, Michigan State University

Qinyun Lin, Michigan State University

Elizabeth X de los Santos, University of Nevada, Reno

Charles W. Anderson, Michigan State University

Teacher Orientations and Contexts: Making Connections to Classroom Discourse and Student Learning

Christie Morrison Thomas, Michigan State University

Qinyun Lin, Michigan State University

Stefanie Marshall, University of Minnesota

J. Brian Hancock, Alma College

Elizabeth Tompkins, Michigan State University

Charles W. Anderson, Michigan State University

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

Teacher Learning, Efficacy and Practice

1:45 PM – 3:15 PM

Salon D

Presider:

Kathryn Green, University of Georgia

Learning Against All Odds: A Case Study of an Out-of-Field Science Teacher in a Small Rural School

Harleen Singh, University of Georgia

Elana B. Worth, University of Georgia

Julie A. Luft, University of Georgia

Finding One's Professional Self: Navigating Teacher Identity in the Figured Worlds of Schools

Gail Richmond, Michigan State University

Kraig A. Wray, Michigan State University

Teachers' Pre-Emptive Instructional Adjustments Based on Awareness of Student Ideas Highlighted in a Learning Progression

Julia Christensen, Michigan State University

Alicia Alonzo, Michigan State University

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

Student Metacognition and Systems Thinking

1:45 PM – 3:15 PM

Salon C

Presider:

FangFang Zhao, University of Minnesota

Impacts of Inquiry-Based Teaching on Undergraduate Students' Contextualized Problem-solving through the Lens of Systems Thinking

Ya-Chun Chen, National Sun Yat-sen University; Australian Catholic University

Zuway-R Hong, National Sun Yat-sen University; Australian Catholic University

Huann-Shyang Lin, Australian Catholic University; National Sun Yat-sen University

Socio-Hydrologic Systems Thinking: An Analysis of Undergraduate Students' Operationalization and Modeling of Coupled Human-Water Systems

Diane Lally, University of Nebraska–Lincoln

Cory T. Forbes, University of Nebraska–Lincoln

Supporting Student Generalizable Metacognitive Frameworks for Stem Learning

Regina Barber DeGraaff, Western Washington University

Gabriel Critquit-Matos, Western Washington University

Thanh K. Le, Western Washington University

Perceptions of STEM Students and Alumni on Developing 21st Century Skills

Judy Yehudit Dori, Technion-Israeli Institute of Technology

Rea Lavi, Technion- Israeli Institute of Technology

Marina Tal, Technion- Israeli Institute of Technology

**STRAND 6:
Science Learning in Informal Contexts**

Informal Science in Afterschool Programs

1:45 PM – 3:15 PM

Salon F

Presider:

Ying-Ting Chiu, The Ohio State University

Authentic STEM Research, Practices of Science, and Interest Development in an Informal Science Education Program

Bobby Habig, American Museum of Natural History; Queens College, City University of New York

Preeti Gupta, American Museum of Natural History

Burmese Youths' Enactment of Critical STEM Literacy Practices in an Afterschool Program

Minjung Ryu, Purdue University

Shannon M. Daniel, Vanderbilt University

Mavreen Rose S. Tuvilla, Purdue University

Casey E Wright, Purdue University

Investigating Productive Science Engagement in an Afterschool Science Program for Resettled Burmese Refugee Youth

Mavreen Rose S. Tuvilla, Purdue University

Minjung Ryu, Purdue University

Casey E. Wright, Purdue University

Shannon M. Daniel, Vanderbilt University

Student Use of Evidence in Constructing Socioscientific Arguments in an Elementary After School Program

Melissa M. Cieto, University of Massachusetts Dartmouth

Stephen B. Witzig, University of Massachusetts Dartmouth

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

English Learners and Literacy Integration

1:45 PM – 3:15 PM

Salon A

Presider:

Xiaoxin Lyu, Teachers College Columbia University

The Impact of a Teacher Preparation Intervention on Secondary Pre-service Teachers Beliefs Toward Teaching Science to English Learners with Language and Literacy Integration

Edward G. Lyon, Sonoma State University

Promoting the Discourse of English Learners During the Enactment of Cognitively Demanding Work

Walter Aminger, University of California, Santa Barbara

Learning to Integrate Science-Specific Literacy in Science Teaching: A Study of Elementary Pre-service Teachers

Regina P. McCurdy, University of Central Florida

Su Gao, University of Central Florida

Vassiliki ("Vicky") I. Zygoris-Coe, University of Central Florida

Katherine Cruz-Dieter, University of Central Florida

Rebeca A Grysko, University of Central Florida

STRAND 7: Pre-service Science Teacher Education

Science Education and Cultural Access

1:45 PM – 3:15 PM

Salon B

Presider:

Pamela S. Lottero-Perdue, Towson University

Supporting Pre-service Community Teachers in Implementing Culturally Responsive PBL

Imelda L. Nava, University of California, Los Angeles

Jaime Park, University of California, Los Angeles, Center X

Issues in Preparing American Indian STEM Teachers

Regina C. Sievert, Salish Kootenai College/ National Science Foundation

Joan LaFrance, Mekinak Consulting

Elementary Science Pre-service Teachers' Perceptions of the Interactions of Science and Culture

Jordan L. Henley, University of Georgia

Dorothy Y. White, University of Georgia

Phaidra Buchanan, University of Georgia

Julie M. Kittleson, University of Georgia

STRAND 8: In-service Science Teacher Education

Teacher Identity

1:45 PM – 3:15 PM

Pearl

Presider:

Sage Andersen, University of California, Irvine

Dialogic Investigation of Science Teacher Identity Development: The Case of 3 Career Changers

Lara Smetana, Loyola University Chicago

Ali Kushki, Loyola University Chicago

Middle Grade STEM Teachers' Conceptions and Prioritization of Core Instructional Practices Over Time

Matthew Kloser, University of Notre Dame

Matthew Wilsey, Stanford University

Science and Mathematics Teacher Communities of Practice: Social Influences on Discipline-Based Identity and Self-Efficacy Beliefs

Samuel J Polizzi, Georgia Highlands College

Yicong Zhu, Stony Brook University

Brandon Ofem, University of Missouri, St. Louis

Sara L. Salisbury, Middle Tennessee State University

Greg Rushton, Middle Tennessee State University

The Professional Journey of STEM Teachers in Egyptian STEM Schools: Transformation and Identity Evolution in a Time of Transition

Mohamed A. El Nagdi, University of Minnesota

Gillian H. Roehrig, University of Minnesota

**STRAND 10:
Curriculum, Evaluation, and
Assessment**

*Productively Engaging 'Community' in
Project-Based Learning: Approaches
to Supporting Meaningful Science
Learning in Formal Classrooms*

**1:45 PM – 3:15 PM
Columbia**

Presider:
Joseph S. Krajcik, Michigan State
University

*Developing Usable Scientific Knowledge
through Community Inspired Project-Based
Learning: A Step Towards Science-Based
Citizenship*

Idit Adler, Tel Aviv University
Consuelo J. Morales, Michigan State
University
Irene S. Bayer, Michigan State University
Tali Tal, Technion
Joseph S. Krajcik, Michigan State University

*Developing a Partnership Through
a Community-Based Participatory
Research Approach to Develop, Enact,
and Sustain an Equitable and Inclusive
Educational Innovation*

Irene S. Bayer, Michigan State University
Idit Adler, Tel Aviv University
Consuelo J. Morales, Michigan State
University
Ella Greene-Moton, University of Michigan
Stephen Modell, University of Michigan
Tali Tal, Technion
Toby Citrin, University of Michigan
Joseph S. Krajcik, Michigan State University

*Why Don't the Irises Make Seeds? Protecting
Rare Endangered Species in Our Community*

Tali Tal, Technion
Hila Shefet, Technion
Nirit Lavie Alon, Technion

*Comparing Three Elementary Teachers'
Processes for Engaging with PBL Curriculum
that Leverages Place*

Emily C. Miller, University of Wisconsin
Madison
Cory Susanne Miller, Michigan State
University

*Anchoring Project-Based Learning Around
Our Community: Towards Relevant and
Inclusive Science Learning for Elementary
Students*

Samuel Severance, University of California,
Santa Cruz
Emily C. Miller, University of Wisconsin,
Madison

**STRAND 11:
Cultural, Social, and Gender Issues**

*Learning from Minoritized Youths'
Experiences and Promoting Equitable
Science Teaching through Research—
Practice Partnership*

**1:45 PM – 3:15 PM
Salon H**

Discussant:
Maria Varelas, University of Illinois
at Chicago
Presider:
Hosun Kang, University of California,
Irvine

Supporting Justice-Oriented STEM Teaching and Learning through Community-Engaged RPPs

Angela Calabrese-Barton, University of Michigan

Kathleen A. Schenkel, Michigan State University

Edna Tan, University of North Carolina at Greensboro

Understanding Minoritized Students' Experience in High School Biology: The Use of Electronic Exit Tickets

Kerri Wingert, University of Colorado at Boulder

William R. Penuel, University of Colorado

Douglas A. Watkins, Denver Public School District

"We Need to Step It Up—We are Basically the Future": Latinx Young Women doing Chemistry

Jasmine McBeath Nation, University of California, Irvine

Hosun Kang, University of California, Irvine

"Your Job is Always Take Care of Us": Engaging in a STEM-focused RPP with Refugee Youth

Edna Tan, University of North Carolina at Greensboro

Aerin W. Benavides, The University of North Carolina at Greensboro

Ti'Era D. Worsley, University of North Carolina at Greensboro

Angela Calabrese-Barton, University of Michigan

STRAND 11: Cultural, Social, and Gender Issues

Reconceptualizing the Pathways and Experiences of Women of Color in STEM

1:45 PM – 3:15 PM

Salon G

Presider:

Catherine Quinlan, Howard University

A Tale of Two Tables: Wrestling with Belonging for Women of Color in STEM

Apriel K. Hodari, Eureka Scientific, Inc

Vanessa S Webb, George Mason University

Angela Johnson, St. Mary's College of Maryland

Self-Efficacy of African American Female Undergraduates in STEM Disciplines

Carmen Bucknor, Oakwood University

Karen Benn Marshall, Oakwood University

Voices of Black Women in College Science Learning Spaces

Renee S. Schwartz, Georgia State University

Melissa Schoene, Georgia State University

Who's Who: "Women of Color" in STEM Education Research

Monica L Ridgeway Miles

ReAnna S. Roby

Charlotte A Agger

Terrell R. Morton, University of Missouri, Columbia

**STRAND 11:
Cultural, Social, and Gender Issues**

Storied-Identities as a Lens to Studying Science Identity

**1:45 PM – 3:15 PM
Salon I**

Storied-Identities as a Lens to Studying Science Identity

Amal Ibourk, Florida State University
Lucy Avraamidou, University of Groningen
Theila Smith, University of Groningen
Alison Mercier, University of North Carolina at Greensboro
Akira Harper, University of Massachusetts, Dartmouth
Paul Le, University of Colorado, Denver
Allison J. Gonsalves, McGill University
Anna T. Danielsson, Uppsala University
Henriette T. Holmegaard, University of Copenhagen
Jennifer D. Adams, University of Calgary

**STRAND 13:
History, Philosophy, Sociology, and Nature of Science**

NOS and Teachers' Perceptions

**1:45 PM – 3:15 PM
Portland**

Presider:
Christine V. McDonald, Griffith University

Entwining Scientific Facts and Moral Values in the Case of the Power of Words Experiment

Sein Shin, Chungbuk National University
Arif Rachmatullah, North Carolina State University

Rahmi Q. Aini, Kangwon National University
Jisun Park, Ewha Womans University
Minsu Ha, Kangwon National University
Jun-Ki Lee, Division of Science Education, Chonbuk National University

Investigating Science and Religious Education Teachers' Perceptions of Argumentation

Sibel Erduran, University of Oxford
Liam Guilfoyle, University of Oxford
Wonyong Park, University of Oxford

Using History of Science (HOS) to Communicate Nature of Science: Multiple Cases of Instructors' Perspectives

William F. McComas, University of Arkansas
Noushin Nouri, University of Texas, Rio Grande Valley

**STRAND 15:
Policy**

Examining Models of Change in STEM Education

**1:45 PM – 3:15 PM
Eugene**

Presider:
Sharon J. Lynch, The George Washington University

Critical Components of Inclusive STEM High Schools and STEM-Focused Elementary School: Opportunities for Vertical Articulation

Erin E. Peters-Burton, George Mason University
Ann House, SRI International
Vanessa L. Peters, Digital Promise
Julie Remold, SRI International

Losing Science: An Examination of NGSS and STEM in Elementary Schools

Joanne K. Olson, Texas A&M University
Jacob Pleasants, Keene State University

Supporting Diverse STEM Students' University Transfer: Research-Informed Policy Recommendations for Postsecondary Institutions and Policymakers

Stephanie Kay Ramos, Oregon State University
Jana L. Bouwma-Gearhart, Oregon State University
Cindy A. Lenhart, Oregon State University
Rican Vue, University of California, Riverside

Translating Research into Classroom Practice: Examining the Use of Research in Science Education Practitioner Journals (SEPJs)

Joseph A. Taylor, University of Colorado, Colorado Springs
G. Michael Bowen, Mount Saint Vincent University
Patricia Patrick, Columbus State University
Ryan Summers, University of North Dakota
Marcus Kubsch, IPN–Leibniz Institute for Science and Mathematics Education
Abdirizak M. Warfa, University of Minnesota
Asli Sezen-Barrie, University of Maine
Selcen Guzey, Purdue University
Cathy P. Lachapelle, Museum of Science

NETWORKING BREAK

3:15 PM – 3:45 PM

Concurrent Session 6a Roundtable Session 3:45 PM – 4:45 PM

STRAND 1: Science Learning: Development of Student Understanding

Strand 1 Roundtable Session

**3:45 PM – 4:45 PM
Exhibit Hall**

TABLE #5

Cutting-edge Evolution Research in the Hands of High-school Students: Students' Views of Scientific Inquiry

Bat-Shahar Dorfman, Weizmann Institute of Science
Orna Dahan, Weizmann Institute of Science
Amir Mitchell, University of Massachusetts
Anat Yarden, Weizmann Institute of Science

TABLE #1

Emergence of Student Argumentation

Qingna Jin, University of Alberta
Mijung Kim, University of Alberta
Hye-Gyoung Yoon, Chuncheon National University of Education

STRAND 2: Science Learning: Contexts, Characteristics and Interactions

Strand 2 Roundtable Session

**3:45 PM – 4:45 PM
Exhibit Hall**

TABLE #2

Student Experiences in a Problem-Solving Studio

Carmen A. Carrion, Georgia State University
Joseph Ledoux, Georgia Institute of Technology

TABLE #3

Interacting with Luna: Scientific Characters and 3rd Graders' Construction of Relationships with Science

Deborah Cotta, Universidade Federal de Minas Gerais

Danusa Munford, Universidade Federal do ABC

Elaine S. França, Centro Pedagógico (1-9 grades school) - Universidade Federal de Minas Gerais

TABLE #1

Variations in the Construction of Non-Planned Argumentation in Two Science Classrooms

Danusa Munford, Faculdade de Educacao– Universidade Federal de Minas Gerais

Ana Paula Souto Silva Teles, Faculdade de Educacao–Universidade Federal de Minas Gerais

TABLE #2

The Effects of Flipped Classrooms on Students' Math and Science Achievement: A Systematic Review

Gary W. Wright, North Carolina State University

Soonhye Park, North Carolina State University

TABLE #2

Overcoming the Teacher-Student Script—Student Persistence in Light of Constraints on Epistemic Data Agency

Julio Jamarillo, University of California, Berkeley

Michelle H. Wilkerson, University of California, Berkeley

Lisette Lopez, University of California, Berkeley, Lawrence Hall of Science

STRAND 3:

Science Teaching—Primary School (Grades PreK-6): Characteristics and Strategies

Strand 3 Roundtable Session

3:45 PM – 4:45 PM

Exhibit Hall

TABLE #3

Psychological Underpinning of Integrative-STEM Education Proposals

R. Bogdan Toma, Universidad de Burgos

Jesús Ángel Meneses Villagrà, Universidad of Burgos

TABLE #3

Just Playing or Future Engineers? Early Engineering and Self-Regulation Capabilities among Young Boys and Girls

Taly Shechter, Bar-Ilan University

Ornit Spektor-Levy, Bar-Ilan University

TABLE #4

Disjunctive Logic in the Language of Science

Shih-Wen Chen, Textbook Research Center, NAER

Chih-Hsiung Ku, National DongHwa University, NDHU

Chih-Chiang Yang, National Ping-Tung University

Pei-Lun HAN, Textbook Research Center, NAER

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

Strand 4 Roundtable Session

3:45 PM – 4:45 PM
Exhibit Hall

TABLE #5

***The House That STEM Built: Science,
Technology, Engineering and Math in
the Building/ Construction Trades***

Grant Williams, St. Thomas University

Eric Hanenberg, George Street Middle
School

Kayoe Stewart, Fredericton High School

TABLE #5

***Implementation of Active-Learning
During STEM Academy for Middle School
Science Teachers***

Tiffini Pruitt-Britton, Southern Methodist
University

Elizabeth L. Adams, Southern Methodist
University

Leanne R. Ketterlin-Geller, Southern
Methodist University

TABLE #6

***Fostering Productive NGSS Crosscutting
Concept Implementation through
Professional Collaboration***

Jasmine Marckwordt, University
of California, Santa Barbara

Jonathan Boxerman, WestEd

Ashley Iveland, WestEd

Kimberly Nguyen, WestEd

Edward D. Britton, WestEd

TABLE #6

***Implementing Effective Group Work in a
Middle School Science Class***

Massa Mafi, The University of New Mexico

Kathryn Watkins, University of New Mexico

Leila Flores-Duenas, University of
New Mexico

TABLE #4

***Unpacking the Meaning of Teaching
Students to Do Science***

Salih Yousef Faraj, Technion–srael Institute
of Technology

Amos Cohn, Oranim, Academic College
of Education & Haifa University, and
'Archimedes Fulcrum'-Academy of Teachers
Researchers in Physics, ACHERET Center

Shulamit Kapon, Technion–Israel Institute
of Technology

TABLE #6

***Teacher Planning with Authentic Data: How
Do Secondary Science Teachers Integrate
Analyzing and Interpreting Data?***

Karen Woodruff, Montclair State University

Amanda M. Gunning, Mercy College

Meghan E. Marrero, Mercy College

STRAND 5:

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

Strand 5 Roundtable Session

3:45 PM – 4:45 PM
Exhibit Hall

TABLE #20

***The Success of Failure: Investigating
Undergraduate Students' Experiences
of Scientific Failure through a
Phenomenological Lens***

Sandhya Krishnan, University of Georgia

TABLE #7

Students' Views on Science Learning Environments: Knowledge Generative vs. Knowledge Replicative

Ercin Sahin, University of Iowa

Ali Cikmaz, University of Iowa

Fatma Yaman, Bozok University

TABLE #7

Understanding Biology Teaching Assistants' Pedagogical Concerns: A Study of Undergraduate TAs Over One Academic Year

Hillary A. Barron, University of Minnesota, Twin Cities

Lorelei E. Patrick, Fort Hays State University

Julie C. Brown, University of Florida

Sehoya Cotner, University of Minnesota

TABLE #7

Sexual Selection Instruction: an Evaluation of Relationships Between Theory Pedagogy, Gender Self-stereotyping, and Student Misconceptions

Sarah H. Spaulding, University of Louisville

Linda C. Fuselier, University of Louisville

Laura R. Novick, Vanderbilt University

TABLE #8

The Role of Making in Supporting Undergraduate STEM Education

Edward G. Lyon, Sonoma State University

TABLE #8

Building Student Confidence through Micro-Internships at a Central California Community College

Brae Salazar, BSCS Science Learning

Zoe E. Buck Bracey, BSCS

Mohammed Yahdi, Hartnell College

TABLE #8

Epistemic Analysis of Textbooks in Quantum Mechanics

Ashwin Krishnan Mohan, Pennsylvania State University

STRAND 6:

Science Learning in Informal Contexts

Strand 6 Roundtable Session

3:45 PM – 4:45 PM

Exhibit Hall

TABLE #9

Embedded Assessment Pursuits: Identifying Important, Relevant, Accessible but Hidden Skills of Citizen Scientists

Cathlyn Stylinski, University of Maryland Center for Environmental Science

Veronica Del Bianco, University of Maryland Center for Environmental Science

Karen Peterman, Karen Peterman Consulting, Co.

Andrea Wiggins, University of Nebraska at Omaha

Rachel Becker-Klein, Two Roads Consulting

Tina Phillips, Cornell University

TABLE #9

Brazilian Visitors' Motivation to a Museum: Psychometric Properties of an Instrument Through Combination of Methods

Ana Cláudia C. Kasseboehmer, University of São Paulo

Rosana F. Martinhão, University of São Paulo

Kenia N. Parra, Federal Institute of Education, Science and Technology of São Paulo

Daniela M. L. Barbato, SEB Institute of Education

TABLE #9

Debating Socio-Scientific Issues on Social Media

Keren E. Dalyot, Technion–Israel Institute of Technology

Ayelet Baram-Tsabari, Technion–Israel Institute of Technology

TABLE #20

Staying in Science: An Examination of Persistence with STEM in Historically Under-Represented Youth

Rachel L. Chaffee, American Museum of Natural History

Preeti Gupta, American Museum of Natural History

Karen Hammerness, American Museum of Natural History

Timothy Podkul, SRI International

Kea Anderson, SRI International

Daniel Princiotta, SRI International

Alexandra Ball, SRI International

Daniela Saucedo, SRI International

STRAND 7:**Pre-service Science Teacher Education****Strand 7 Roundtable Session****3:45 PM – 4:45 PM****Exhibit Hall**

TABLE #10

FAVSTE: A Framework for Analyzing Video in Science Teacher Education

Michelle Forsythe, Texas State University

Brett Criswell, West Chester University

TABLE #10

How to Give Effective Feedback to Pre-service Teachers about their Representational Competences?

Büsra Tonyali, University of Duisburg-Essen

Mathias Ropohl, University of Duisburg-Essen

Julia Schwanewedel, Humboldt University of Berlin

TABLE #11

Pre-service Teachers' Ideas about What to assess in Modeling and Filters affecting Modeling-Based Assessment Planning

Young Ae Kim, University of Arizona

J. Steve Oliver, The University of Georgia

TABLE #11

Teaching Experiences for Undergraduates: Exploring Measures of Efficacy and Teaching Effectiveness

Maria S. Rivera Maulucci, Barnard College

Adam Stefanile, Teachers College, Columbia University

Alanna Gibbons, Teachers College, Columbia University

TABLE #11

Pre-service Teachers' Successes and Challenges around Enacting a Social Justice Framework of Science Teaching

Jarod Kawasaki, University of California, Los Angeles

Deborah La Torre, National Center for Research on Evaluation, Standards, and Student Teaching (CRESST)

Imelda L. Nava, University of California, Los Angeles

Jaime Park, University of California, Los Angeles, Center X

Annamarie Francois, University of California, Los Angeles, Center X

TABLE #11

Compare Synchronous and Asynchronous Interaction for Online Science Teacher Preparation

Jianlan Wang, Texas Tech University
Yuanhua Wang, Texas Tech University

TABLE #12

Exploring Prospective Teachers' Development of Knowledge for Teaching During their Practicum

Lu Wang, University of Georgia

TABLE #12

Using Multiple Levels of Representations to Teach Physical and Chemical Change in Science Classrooms

Funda Savasci-Acikalin, Istanbul University–Cerrahpasa

Meryem Demir-Guldal, Istanbul University–Cerrahpasa

TABLE #12

Pre-service Teachers' Implementation of NGSS-Aligned and Social Justice-Oriented Science Teaching

Hildah K. Makori, Iowa State University
Gale A. Seiler, Iowa State University

TABLE #12

Recruiting and Preparing Diverse STEM Professionals to Become Highly Effective Teachers

Natalie S. King, Georgia State University
Christine D. Thomas, Georgia State University

TABLE #13

Community Engaged Scholarship: Mixed Methods Assessment of Self-Efficacy of PSTs in Informal STEM Microteaching PD

Jacqueline N. Ekeoba, University of Houston
Paige K. Evans, University of Houston
Leah Y. McAlister-Shields, University of Houston
Mariam Manuel, University of Houston
Ramona C. Mateer, University of Houston

TABLE #13

Leveraging Community Asset Mapping in Pre-service Secondary Science Education

Kirsten K. Mawyer, University of Hawaii
Heather J. Johnson, Vanderbilt University

TABLE #13

Experiences in Science and Mathematics Methods Courses and Science Teaching Efficacy

Sheryl L. McGlamery, University of Nebraska at Omaha
Bridget A. Franks, University of Nebraska at Omaha
Saundra L. Shillingstad, University of Nebraska at Omaha

STRAND 8:

In-service Science Teacher Education

Strand 8 Roundtable Session

3:45 PM – 4:45 PM

Exhibit Hall

TABLE #14

Knowing Your Coach's Role: Navigating a Coaching Relationship at the Boundaries of STEM Integration

Justin R. McFadden, University of Louisville

TABLE #14

K-8 Teachers Planning for Supporting Sensemaking through Engineering Learning Cycles

Anna Maria Arias, Kennesaw State University
Allison Antink-Meyer, Illinois State University

TABLE #14

The Role of Self-Talk in Supporting Teachers' Implementation of Inquiry-Based Instruction in High-Need Urban Schools

Stacy Olitsky, Saint Joseph's University

TABLE #15

Teachers' Interpretations and Enactments of Storyline Curriculum

Casandra Gonzalez, Boston College
Katherine L. McNeill, Boston College

TABLE #15

U.S. and Japanese Middle and High School Science Teachers' Conceptions of Inquiry-Based Learning Practices

Noemi Waight, University at Buffalo
Koichi Furuya, Joetsu University of Education
Melinda Whitford, University at Buffalo

TABLE #15

Linking Science & Literacy for All Learners

Rachel Lee Juergensen, University of Missouri, Columbia
William L. Romine, Wright State University
Jiyung Hwang, University of Missouri, Columbia
Bill Folk, University of Missouri
Amy Lannin, University of Missouri, Columbia
Torrey Palmer
Delinda van Garderen, University of Missouri, Columbia

TABLE #16

Revisiting the Impacts of Science Research Experiences: A Critical Review of RETs, CUREs, and UREs

Sanlyn Buxner, University of Arizona
Jessica S. Krim, Southern Illinois University Edwardsville
Laleh Cote, University of California, Berkeley
Renee S. Schwartz, Georgia State University
Elisa Stone, University of California, Berkeley
Jessica Cleeves, The University of Utah
Lawrence Horvath, San Francisco State University
John Keller, University of Colorado
SoonChun Lee, Wichita State University
Bryan M. Rebar, University of Oregon

TABLE #16

Professional Learning for Leadership Development: Potential Impacts on Science Leadership Practices

Katy Nilsen, WestEd
Joshua Valcarcel, WestEd
Ashley Iveland, WestEd

TABLE #16

Multi-Year Study of Science Teachers PD through Classroom Observation

Hiya M. Almazroa, Princess Nourah Bint Abdulrahman University (PNU)
Fahad S. Al-Shaya, University of Pittsburgh
Eman M. Alrwythy, Alemam Mohammed Bin Saud University

TABLE #17

Teacher Beliefs and Practice within the Context of an Intensive Teacher STEM Professional Development

Elizabeth L. Adams, Southern Methodist University

Tryna Knox, Southern Methodist University

Cassandra Hatfield, Southern Methodist University

Leanne R. Ketterlin-Geller, Southern Methodist University

TABLE #17

Examining Teacher Leadership as a Model for Improvement in Science Education

Sheree Wilson, University of Mississippi

Brooke A. Whitworth, University of Mississippi

Shelby A. Watson, University of Mississippi

**STRAND 9:
Reflective Practice**

Strand 9 Roundtable Session

3:45 PM – 4:45 PM

Exhibit Hall

TABLE #1

Development of a Questionnaire on Teachers' Knowledge of Argument as an Epistemic Tool

William E. Hansen, University of Iowa

Jihyun Hwang

Chenchen Ding, The University of Iowa

Jee Kyung Suh, University of Alabama

Brian M. Hand, University of Iowa

Gavin W. Fulmer, University of Iowa

TABLE #18

Evaluating Intercultural STEAM Program in Australia-Korea Contexts: Teachers' Attitudes and Beliefs towards STEAM

Hye-Eun Chu, Macquarie University

Sonya N. Martin, Seoul National University

TABLE #18

Fiction, Faction and Action: A Pedagogic Fusion to Teaching Science

Deb J. McGregor, Oxford Brookes University

TABLE #18

Lived Experiences of Secondary Science Teachers: Grounding Science Education in the Host Culture and Place

Sheri Fitzgerald, University of Hawaii at Manoa

**STRAND 10:
Curriculum, Evaluation, and Assessment**

Strand 10 Roundtable Session

3:45 PM – 4:45 PM

Exhibit Hall

TABLE #19

Integrated STEM+ Computational Thinking Curriculum: Developments in an Underrepresented Community After-School Program for Girls

Henriette D. Burns, Washington State University

Samantha Murphy, Southern Illinois, University Edwardsville

Matt Johnson, SIUE STEM Center

Georgia Bracey, Southern Illinois University, Edwardsville

Mark McKenney, Southern Illinois University, Edwardsville

Ann Vogel, iBio Institute

Sharon Locke, Southern Illinois University, Edwardsville

TABLE #19

Developing Thai Students' Understanding of Light and Color Using Formative Assessment and 6E Learning Cycle: Rasch Analysis

Pongprapan Pongsophon, Kasetsart University

Chatree Faikhamta, Kasetsart University

Jeerawan Ketsing, Kasetsart University

Chun-Yen Chang, National Taiwan Normal University

Peiling Lin, National Taiwan Normal University

TABLE #19

Rethinking the Impact of Inquiry-Based Instruction on Student Achievement: Evidence from PISA 2015

Sara J. Dozier, Stanford University

STRAND 11:**Science Learning: Development of Student Understanding****Strand 11 Roundtable Session****3:45 PM – 4:45 PM****Exhibit Hall**

TABLE #20

"Big Ole Geeks": A Discourse of Black Female Representation in STEM Media

Raven Baxter, University at Buffalo

TABLE #21

Case Studies of High School Biology Science Teachers' Experiences Teaching about Race and Racism

Bhaskar Upadhyay, University of Minnesota

TABLE #21

Exploring the Lived Experiences and Narratives of the African American Gullah Geechee Peoples to Create Culturally Relevant STEM Curriculum

Catherine Quinlan, Howard University, School of Education

TABLE #24

Factors Influencing Biology Majors' Persistence in their Degree

Jennifer L Idema, Texas State University

Kristy L. Daniel, Texas State University

Shetay Ashford, Texas State University

Dana Garcia, Texas State University

TABLE #22

Noticing Whiteness in Science Education: Using Critical Whiteness Scholarship to Achieve Equity in Science

Jonathan D. McCausland, The Pennsylvania State University

TABLE #22

On Being a Person of Color in a STEM Graduate Program: Experiences of Assimilating into the Culture of Science

Renee S. Schwartz, Georgia State University

Megan Grunert Kowalske, Western Michigan University

TABLE #22

Race-Oriented Lectures Study: Racial Socialization and Bias Preparation for Black Students

Henry Hane, Indiana University–Purdue University, Indianapolis

Jomo W. Mutegi, Indiana University–Purdue University, Indianapolis

Lance Howard, Indiana University

TABLE #23

STEM Faculty Efforts in Pedagogical Innovations: An Example in Biology

Melo-Jean Yap, San Diego State University
Felisha Herrera, San Diego State University

TABLE #21

The Role of Indigenous Knowledge in Enhancing Science Concept Formation through Inquiry-Based Learning

Umesh Ramnarain, University of Johannesburg

TABLE #23

Translanguaging with Three Languages and Multimodal Interactions: English Learners' Science Experiences at a STEM-Focused School

Jennifer Tripp, University at Buffalo
Noemi Waight, University at Buffalo

TABLE #24

Urban STEM Education Successes in the Bronx: Moving Away from the Deficit Model

Judith Gouraige, NYCDOE and Stony Brook University

TABLE #24

Words Matter: A Queer Theory Analysis of Anatomy/Physiology Textbooks

Harshini Sirvisetty, University of Louisville
Katherine E. Ray King, University of Louisville
Linda C. Fuselier, University of Louisville

STRAND 12:

Educational Technology

Strand 12 Roundtable Session

3:45 PM – 4:45 PM
Exhibit Hall

TABLE #25

Textbook and Virtual Reality as a Means to Promote Scientific Writing

Richard Lamb, East Carolina University
Jing Lin, Beijing Normal University
Brian M. Hand, University of Iowa
Amanda Kavner, University at Buffalo
Douglas Hoston, University at Buffalo

TABLE #25

Engineering Students Perceived Innovative Thinking and Actual Innovation in Face-to-Face and Online Settings

Maya Usher, Technion
Miri I. Barak, Technion-Israel Institute of Technology

TABLE #25

Supporting Chemistry Learning through Augmented-Reality—A Glimpse on Usability and Cognitive Load

Sebastian Keller, University of Duisburg-Essen
Stefan Rumann, University of Duisburg-Essen

**STRAND 13:
History, Philosophy, Sociology,
and Nature of Science**

Strand 13 Roundtable Session

3:45 PM – 4:45 PM
Exhibit Hall

TABLE #26

*Analyzing Science Education as a
"Construction Site for Science" Using
Latour's Collective of Humans and
Non-Humans*

Donald J. Wink, University of Illinois, Chicago

TABLE #26

*Visualizing Connections between Nature
of Science and Engineering*

Jeffrey Radloff, SUNY Cortland

Brenda Capobianco, Purdue University

TABLE #26

*Evidence and Rationale for Expanding The
Views of Nature of Science Questionnaire*

Ryan Summers, University of North Dakota

Fouad Abd-El-Khalick, University of North
Carolina at Chapel Hill

Jeanne Brunner, University of
Massachusetts, Amherst

TABLE #17

*Using Children's literature in the Middle
School Science Class to Teach Nature of
Science: Pre-service Teachers' Development
of Sources*

Banu Avsar Erumit, Recep Tayyip Erdogan
University

Valarie L. Akerson, Indiana University

**STRAND 14:
Environmental Education**

Strand 14 Roundtable Session

3:45 PM – 4:45 PM
Exhibit Hall

TABLE #13

*Arts Integrated Environmental Education
Professional Development*

Lauren Madden, The College of New Jersey

Louise Ammentorp, The College of New
Jersey

Carolina Blatt, The College of New Jersey

Dana Kneis, Ridgewood High School

**STRAND 15:
Policy**

Strand 15 Roundtable Session

3:45 PM – 4:45 PM
Exhibit Hall

TABLE #23

*STEM Education as a District-Wide
Innovation: A Cross-Case Analysis
of Three School Districts*

Tamara Holmlund, Washington
State University Vancouver

Kristin S. Huggins, Washington
State University

Concurrent Session 6b Poster Session 4:45 PM – 5:45 PM

STRAND 1: Science Learning: Development of Student Understanding

Strand 1 Poster Session

4:45 PM – 5:45 PM
Exhibit Hall

P1:

A Review of Empirical Literature: Cognitive Processes Framing Modeling Practices in Science Education

Ayca K. Fackler, The University of Georgia

P2:

Developing and Validating a Learning Progression for Computational Thinking in Earth and Environmental Systems

Beth A. Covitt, University of Montana, SpectrUM Discovery Area

Kristin L. Gunckel, University of Arizona

John C. Moore, Colorado State University

Alan R. Berkowitz, Cary Institute of Ecosystem Studies

Bess Caplan, Cary Institute of Ecosystem Studies

Judith A. Cooper-Wagoner, University of Arizona

Michael Jahnke, University of Montana

Daniel L. Moreno, University of Arizona

P3:

Investigating Groundwater: 7th-Grade Students' Mapping Models to Phenomena

Holly White, University of Nebraska, Lincoln

Diane Lally, University of Nebraska, Lincoln

Cory T. Forbes, University of Nebraska, Lincoln

P4:

Socio-Scientific Issues to Engage Students in Claims, Evidence and Reasoning

Sissy S. Wong, University of Houston

Jie Zhang, University of Houston

Jennifer Donze, University of Houston

Jackie Relyea, North Carolina State University

Ma Glenda Wui, University of Houston

STRAND 2: Science Learning: Contexts, Characteristics and Interactions

Strand 2 Poster Session

4:45 PM – 5:45 PM
Exhibit Hall

P5:

Applying Conjecture Mapping to Analyze Children's Use of Science Practices in Story-Driven Investigations

Kyungjin Cho, Pennsylvania State University

Julia Plummer, Pennsylvania State University

P6:

Youth Social Interactions in Informal Makerspaces: What are the Pedagogical Implications for Supporting Productive Collaborations?

Ti'Era D. Worsley, University of North Carolina at Greensboro

Edna Tan, University of North Carolina at Greensboro

Sara Heredia, The University of North Carolina Greensboro

P7:

Children Arguing in Science Lessons Over Time: The Discursive Construction of Evidence Use

Luiz Gustavo Franco Silveira, Universidade Federal de Minas Gerais (Brazil)

Danusa Munford, Universidade Federal de Minas Gerais

P8:

Design-Based Lessons Foster Equity When Integrating Engineering Into Biology Classrooms

Tory H. Williams, University of Maryland, Baltimore County

Christopher R. Rakes, University of Maryland, Baltimore County

Jonathan Singer, University of Maryland, Baltimore County

Jacqueline Krikorian, University of Maryland, Baltimore County

Julie Ross, Virginia Tech

P9:

What Does Engagement Look Like? Secondary Science Teachers' Reported Evidence of Student Engagement

Vance J. Kite, North Carolina State University

Michelle Nugent, North Carolina State University

Soonhye Park, North Carolina State University

Roger Azevedo, University of Central Florida

Min Chi, North Carolina State University

Michelle Taub, University of Central Florida

P10:

Examining the Integration of Science and Engineering: The Stickiness of Tinkering in an Elementary Classroom

Jennifer Schellinger, Florida State University

Lama Jaber, Florida State University

Sherry A. Southerland, Florida State University

P11:

Multifaceted Effects of Self-efficacy on Taiwanese High School Students' Learning Engagement

Tzung-Jin Lin, National Taiwan Normal University

P12:

Traces of Ambitious Science Teaching and Science and Engineering Practices in Teachers' Noticed Moments of Students' Thinking in a Science Classroom

Sahar Vali, West Virginia University

Melissa J. Luna, West Virginia University

P13:

Threshold Concepts in Novices' and Experts' Evolutionary Explanations

Daniela Fiedler, IPN–Leibniz Institute for Science and Mathematics Education

Gena C. Sbeglia, Stony Brook University (SUNY)

Ute Harms, IPN – Leibniz Institute for Science and Mathematics Education

Ross H. Nehm, Stony Brook University (SUNY)

P14:

Teaching and Learning in Makerspaces: Equipping Teachers to Become Equity Oriented Maker Educators

Sara C Heredia, The University of North Carolina Greensboro

Edna Tan, University of North Carolina at Greensboro

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Portland Marriott
Downtown Waterfront

STRAND 3: Science Teaching—Primary School (Grades PreK-6): Characteristics and Strategies

Strand 3 Poster Session

4:45 PM – 5:45 PM
Exhibit Hall

P15:

***Changing Stigma on Wild Animals: A
Qualitative Assessment of Urban Pupils'
Pre- and Post-lesson Drawing***

Chi-Chang Liu, National Taiwan University

Meng Wu, National Taiwan University

P16:

***Exploring the Applicability of Scientific
Creativity Assessment Formula: Comparison
of Assessments by Subjects***

Minju Kim, Seoul National University
of Education

Chae-Seong Lim, Seoul National University
of Education

P17:

***Metacognitive Scaffolds for Student
Argumentation***

Qingna Jin, University of Alberta

P19:

***Telling the Energy Story: Storytelling as a
Resource in Science Learning***

Panchompoo Wisittanawat, Vanderbilt
University

Sara J. Lacy, TERC

Roger G. Tobin, Tufts University

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

Strand 4 Poster Session

4:45 PM – 5:45 PM
Exhibit Hall

P20:

***Assessing the Effectiveness of a Novel
Microscopy Technique in Middle School
Science Classrooms***

Sara P. Raven, Texas A&M University

Emel Cevik, Texas A&M University

P21:

***Empowerment of a Diaspora Through
Science Education: Perspectives from
Tibetan Teachers***

Ngawang Y. Gonsar, Gustavus Adolphus
College

P22:

***Exploring Chilean In-service Science
Teachers' Understanding about Models
and Modeling***

Alexis Gonzalez, University of British
Columbia

Carla Hernández, Universidad de Santiago
de Chile

Damian Ruz

P23:

***Have the NGSS Changed Science
Instruction to Include Engineering?
A Review of the Literature***

Stephanie D. Teeter, NC State University

P24:

Introducing Application Based Nanotechnology Modules to High School Students: Results from an Exploratory Pilot

Tejaswini S. Dalvi, University of Massachusetts

Martyna Laszcz, Graduate Student

P25:

Teachers' Intersection of Computational Thinking and Data Practices to Support Student Data Analysis during Science Investigations

Erin E. Peters-Burton, George Mason University

Laura Laclede, George Mason University

Stephanie Stehle, George Mason University

Peter J. Rich, Brigham Young University

Anastasia Kitsantas, George Mason University

Timothy Cleary, Rutgers University

Kimberly Mcleod, George Mason University

STRAND 5:

College Science Teaching and Learning (Grades 13-20)

Strand 5 Poster Session

4:45 PM – 5:45 PM

Exhibit Hall

P26:

A Model to Assist in Combatting STEM Graduate Student Imposter Syndrome

Julianne A. Wenner, Boise State University

Paul Simmonds, Boise State University

Megan Frary, Boise State University

Donna Llewellyn, Boise State University

P27:

Characteristics of Effective Professional Development for Undergraduate Science Instructors: A Critical Review of the Literature

Katherine McCance, North Carolina State University

Soonhye Park, North Carolina State University

P28:

Chemistry Students' Understanding of Dissolving and Associated Phenomena: The Case of Sodium Chloride

James M. Nyachwaya, North Dakota State University

Krystal Grieger, North Dakota State University

P29:

College Students' Perceptions of STEM and Choices of Switching out of Initial STEM Majors

Youngjin Song, California State University, Long Beach

Lisa M. Martin-Hansen, California State University, Long Beach

P30:

Cultivating Water Literacy in Undergraduate STEM Education: Students' Socio-Scientific Reasoning about Socio-hydrologic Issues

David C. Owens, Georgia Southern University

Destini N. Petitt, University of North Carolina-Charlotte

Diane Lally, University of Nebraska, Lincoln

Cory T. Forbes, University of Nebraska, Lincoln

P31:
Do International Teaching Assistants Negatively Impact Student Outcomes in Biology?: A Comparative Study

Zhigang Jia, Middle Tennessee State University

Lisa L. Walsh, University of Michigan

P32:
Symbolic-Mathematical Model Comprehension in Physical Chemistry

Ines Komor, University of Duisburg-Essen

Helena Van Vorst, University of Cologne

Elke Sumfleth, University of Duisburg-Essen

Julian Roelle, Ruhr-Universität Bochum

Eckart Hasselbrink, University of Duisburg-Essen

P33:
The Implications for STEM Retention and Career Aspirations Through a First-Year Biology Seminar

Krista Lucas, University of California, Santa Barbara

Danielle Boyd Harlow, University of California, Santa Barbara

STRAND 6:
Science Learning in Informal Contexts

Strand 6 Poster Session

4:45 PM – 5:45 PM

Exhibit Hall

P34:
Family Interpretations of Conservation Messaging at an Aquarium Exhibit

Victoria J. Reyes, Texas State University

Jennifer L. Idema, Texas State University

Kristy L. Daniel, Texas State University

P35:
Investigating Influences, Affordances & Challenges of a Summer Teen Program

Lara Smetana, Loyola University Chicago

David Bild, Chicago Academy of Sciences
Peggy Notebaert, Nature Museum

P36:
Linking Family Engagement Activities to Common Learning Outcomes at Touch Tank Exhibits

James F. Kisiel, California State University, Long Beach

Shawn M. Rowe, Oregon State University

Tamara Galvan, Facilities Director, Feiro Marine Life Center

P37:
Pedagogical Structures and Student Agency: How do Teachers of After-School Science Clubs Strike a Balance?

David J. Schouweiler, University of North Carolina at Greensboro

Sara Heredia, The University of North Carolina Greensboro

Edna Tan, University of North Carolina at Greensboro

P38:
Seeing Social Learning: Using Social Network Analysis to Operationalize Communities of Practice

K.C. Busch, North Carolina State University

Kathryn Green, University of Georgia

Lynn Chesnut, North Carolina State University

Kathryn T. Stevenson, North Carolina State University

STRAND 7: Pre-service Science Teacher Education

Strand 7 Poster Session

4:45 PM – 5:45 PM
Exhibit Hall

P39:

**A Bridge between Theory and Practice:
Field-Based Experiences in Science Teacher
Education Programs**

Hatice Ozen-Tasdemir, University of Georgia
Julie A. Luft, University of Georgia

P40:

**Analysis of Secondary Pre-service Science
Teachers' Questioning during Microteaching**

Elsun Seung, Indiana State University
Eunmi Lee, DePaul University
Aeran Choi, Ewha Womans University
Jinhong Jung, North Carolina Central
University

P41:

**Elementary Pre-service Teachers'
Perceptions of Assessment Tasks to
Measure Content Knowledge for Teaching
about Matter**

Dante Cisterna, Educational Testing Service
Jamie N. Mikeska, Educational Testing
Service (ETS)
Allison Bookbinder, Teachers College,
Columbia University
David L. Myers, University of Georgia
Heena R. Lakhani, University of Washington
Luronne Vaval, Teachers College, Columbia
University

P42:

**Examining Elementary Pre-service Teachers'
Understanding of Natural Selection Through
Technology**

Nicole Juliana Thomas, University of
Nevada, Las Vegas
Tina Vo, University of Nevada, Las Vegas

P43:

**Lesson Study Preparing Pre-service
Elementary Teachers for Science PBL and
Working with Language Minority Children**

Peter Rillero, Arizona State University
Ying-Chih Chen, Arizona State University

P44:

**Learning to Teach for Promoting
Cognitive Demand on Student Thinking
in Science Classrooms**

Miray Tekkumru Kisa, Florida State
University
Ryan Coker, Florida State University
Sebnem Atabas, Florida State University

P45:

**Impacting Pre-service Elementary
Teachers through Physical Science
Educative Curriculum Materials**

Brooke A. Whitworth, University
of Mississippi
Lauren Simpson, University of Mississippi
Whitney Jackson, University of Mississippi
Julie James, University of Mississippi
Alice Steimle, University of Mississippi

STRAND 8: In-service Science Teacher Education

Strand 8 Poster Session

4:45 PM – 5:45 PM
Exhibit Hall

P46:

**Challenges in Professional Development
Programs Aiming at Teaching Inquiry
Thinking Strategies**

Elina Lustov
Anat Zohar, The Hebrew University
of Jerusalem

P47:

Engineering Teacher Pedagogy: Using INSPIRES to Support Integration of Engineering Design in HS Biology Classroom

Jonathan Singer, University of Maryland, Baltimore County

Jacqueline Krikorian, University of Maryland, Baltimore County

Tory H. Williams, University of Maryland, Baltimore County

Christopher Rakes, University of Maryland, Baltimore County

Julia Ross, Virginia Tech

P48:

Teachers' Beliefs about the Importance and Value of the NGSS Science Practices

Soonhye Park, North Carolina State University

Gary W. Wright, North Carolina State University

Vance J. Kite, North Carolina State University

P49:

Collaborative Pedagogical Reasoning of Beginning Science Teachers in a Professional Learning Community

Aeran Choi, Ewha Womans University

Soonhye Park, North Carolina State University

Elsun Seung, Indiana State University

P50:

Exploring Relationships amongst Node-Level Variables and Teachers' Social Networks

Sara L. Salisbury, Middle Tennessee State University

Brock Couch, Middle Tennessee State University

Samuel J. Polizzi, Middle Tennessee State University

Yicong Zhu, Stony Brook

Gregory Rushton, Middle Tennessee State University

P51:

GST-Integrated PD to Promote Interdisciplinary Approaches to STEM Education

Wm. Matthew Reynolds, North Carolina State University

Soonhye Park, North Carolina State University

Eric Money, North Carolina State University

Kyle Bunds, North Carolina State University

**STRAND 10:
Curriculum, Evaluation, and Assessment**

Strand 10 Poster Session

4:45 PM – 5:45 PM

Exhibit Hall

P52:

Assesment of K-12 Students' Science and Literacy Knowledge

Claire Cesljarev, Indiana University

Valarie L. Akerson, Indiana University

P53:

Designing Educative Curriculum Materials for Teacher Educators: Supporting Elementary Teachers' Content Knowledge for Teaching about Matter

Deborah L. Hanuscin, Western Washington University

Emily J. Borda, Western Washington University

Josie Melton, Western Washington University

Jamie N. Mikeska, Educational Testing Service (ETS)

P54:

Development and Validation of a Rating Scale to Assess Modeling Competence

Anna Beniermann, Humboldt University of Berlin; Institute for Biology

Dirk Krueger, Freie Universitaet Berlin

Annette Upmeier Zu Belzen, Humboldt-Universität Zu Berlin

STRAND 11:

Cultural, Social, and Gender Issues

Strand 11 Poster Session

4:45 PM – 5:45 PM

Exhibit Hall

P55:

Indonesian Biology Teachers' Perceptions of the Theory Of Evolution:

A Multiple-Case Study

Arif Rachmatullah, North Carolina State University

Minsu Ha, Kangwon National University

Jun-Ki Lee, Division of Science Education, Chonbuk National University

Sein Shin, Chungbuk National University

P56:

Exploring Culturally Responsive Management and Disciplinary Practices in Pre-service Teachers' Culturally Responsive Tasks

Sherry A. Southerland, Florida State University

STRAND 12:

Educational Technology

Strand 12 Poster Session

4:45 PM – 5:45 PM

Exhibit Hall

P57:

Computational Experimentation, a Novel Approach in Educational Technology: Analysis of the Science Writing Heuristic

Richard Lamb, East Carolina University

Jing Lin, Beijing Normal University

Brian M. Hand, University of Iowa

Douglas Hoston, University at Buffalo

Amanda Kavner, University at Buffalo

Jonah B. Firestone, Washington State University, Tri-Cities

P58:

Pre-service Science Teachers' Perceptions of Teaching and Learning After Using Augmented Reality Applications

Denise M. Bressler, University of Pennsylvania

Len Annetta, East Carolina University

Marina Shapiro, California State University, Bakersfield

P59:

Tracing the Development of a Haptically-enabled Science Simulation (HESSs) for Buoyancy

James Minogue, North Carolina State University

David Borland, UNC-Chapel Hill (RENCI)

Tabitha Peck, Davidson College

Emily Jackson, North Carolina State University

Kern Qi, Davidson College

Niall Williams, University of Maryland, College Park

P60:

Using a Faculty-developed Documentary to Communicate Chemistry Research to a High School Audience via YouTube

Stephen R. Burgin, University of Arkansas
Michelle J. Childress, University of Arkansas
Hassan Beyzavi, University of Arkansas
Yoshie Sakamaki, University of Arkansas

**STRAND 13:
 History, Philosophy, Sociology,
 and Nature of Science**

Strand 13 Poster Session

**4:45 PM – 5:45 PM
 Exhibit Hall**

P61:

Exploring Physicists' Views of Scientific Models

Meng-Fei Cheng, National Changhua University of Education
Yi-Wen Huang, National Changhua University of Education
Chien-Yu Lin, National Changhua University of Education

A62:

Practices, Knowledge, and Nature—Engineering Educators' Views of the Domains of Engineering Literacy

Brian D. Hartman, Walla Walla University
Randy L. Bell, Oregon State University

P63:

STEM-based NOS Teaching on 7th Grade Students' NOS Views

Gunkut Mesci, Giresun University
Eda Erdas, Kastamonu University

P64:

Training the Trainer: An exploration of a Future Teacher Educator's NOS and Related Pedagogical Understandings

Bridget K. Mulvey, Kent State University
Jennifer C. Parrish, University of Northern Colorado
Jeffrey L. Papa, Kent State University
Joshua Reid, Middle Tennessee State University

Graduate Student Forum

**5:45 PM – 7:15 PM
 Salon F – Lower Level**

JRST Editorial Team Meeting/Dinner

**6:00 PM – 8:30 PM
 Portland – Lower Level**

*Sponsored by: Wiley-Blackwell
 (By invitation only)*

Research Interest Group (RIG) Meetings

6:00 PM – 7:30 PM

**Latino/a RIG
 Salon B – Lower Level**

**Engineering Education RIG
 Salon C – Lower Level**

**Indigenous Science Knowledge (ISK) RIG
 Salon H – Lower Level**

PROGRAM

2020

93RD ANNUAL
INTERNATIONAL
CONFERENCE

MARCH 15–18

PORTLAND, OR, USA

Portland Marriott
Downtown Waterfront

TUESDAY, MARCH 17, 2020

Conference Registration
7:30 AM – 4:30 PM
Ballroom Foyer – Lower Level

Concurrent Session 7
8:00 AM – 9:30 AM

Publications Advisory Committee

Admin Symposium-How to Get Your Research Published in Science Education Journals PAC Symposium

8:00 AM – 9:30 AM
Salon I

How to Get Your Research Published in Science Education Journals PAC Symposium

Catherine E. Milne, New York University
Christina Siry, University of Luxembourg
Ross H. Nehm, Stony Brook University, SUNY
Gail Jones, North Carolina State University
Troy Sadler, University of North Carolina at Chapel Hill
Kent J. Crippen, University of Florida
Todd Campbell, University of Connecticut
Erin L. Dolan, University of Georgia
Geeta Verma, University of Colorado, Denver
Gail Richmond, Michigan State University
Ange Fitzgerald, University of Southern Queensland
Carla Johnson, Purdue University
Sibel Erduran, University of Oxford
Sherry Southerland, Florida State University
John Settlage, University of Connecticut
Lucy Avraamidou, University of Groningen
Sonya N. Martin, Seoul National University

Administrative Session

Sandra K. Abell Institute for Doctoral Students

8:00 AM – 9:30 AM
Hawthorne/Belmont/Laurelhurst

Discussants:

Julie A. Luft, University of Georgia

Anna S. Grinath, Idaho State University

Presiders:

Gregory Rushton, Middle Tennessee State University

Grant E. Gardner, Middle Tennessee State University

Developing the Framework on Categorizing Instructional Approaches of Mathematics Equations in Biology Classrooms

FangFang Zhao, University of Minnesota

Mentor: **Stephen B. Witzig**, University of Massachusetts, Dartmouth

Developing Knowledge: Sex/Gender Beliefs in Undergraduates and Implications for the Classroom

Katherine Ray King, University of Louisville

Mentor: **Stephen B. Witzig**, University of Massachusetts, Dartmouth

Navigating Climate Change: Science, Politics, and Learning for Youth

Lynne Zummo, Stanford University

Mentor: **Stephen B. Witzig**, University of Massachusetts, Dartmouth

How Instructors Model Abstraction in Physical Chemistry

Jessica Karch, University of Massachusetts, Boston

Mentor: **Gillian H. Roehrig**, University of Minnesota

The Patterns of Students' Diagrams and Answers while Solving Force Problems

Judyanto Sirait, University of Leicester

Mentor: **Gillian H. Roehrig**, University of Minnesota

Examining the Cultural Specificity of Approaches to Learning Biology

Angela N. Google, Middle Tennessee State University

Mentor: **Ross H. Nehm**, Stony Brook University (SUNY)

An Investigation into the Factors Influencing Acceptance of Evolution across University Instruction

Ryan Dunk, Syracuse University

Mentor: **Ross H. Nehm**, Stony Brook University (SUNY)

Genetics Knowledge and Belief in Genetic Determinism of Biology and Nursing Students

Katie Humrick, University of Louisville

Mentor: **Ross H. Nehm**, Stony Brook University (SUNY)

The Effect of Participation in the Sandra K. Abell Institute on my Dissertation's Theoretical Framing

Jessica Dewey, University of Minnesota

Mentor: **Isha DeCoito**, Western University

The Elephant in the CURE Classroom: What do we Know about CUREs Taught by Graduate Teaching Assistants?

Emma Goodwin

Mentor: **Isha DeCoito**, Western University

Mentoring Structures and the Types of Support Provided to Early-Year Undergraduate Researchers

Gaye Defne Ceyhan

Mentor: **Isha DeCoito**, Western University

Sketching to Make Sense of Chemical Events at the Sub-Microscopic Levels

Heena Lakhani

Mentor: **Femi Otulaja**, University of the Witwatersrand

Investigating Science Teachers' Practices on Assessing Students' Understandings of Nature of Science

Wonyong Park, University of Oxford

Mentor: **Femi Otulaja**, University of the Witwatersrand

Teachers' Indigenous Knowledge and the Possibilities of Integration into Life Sciences Teaching and Learning

Uchechi Agnes Ahanonye

Mentor: **Femi Otulaja**, University of the Witwatersrand

Trends In K-12 Teacher Agency Research: A Meta-analysis of 10 Years of Science Education Research

Anica Miller-Rushing

Mentor: **Gail Richmond**, Michigan State University

What Makes Science Thinkable in High-Needs Elementary Classrooms? Conceptualizations of Elementary Science Teacher Professional Agency

Alison Mercier, University of North Carolina at Greensboro

Mentor: **Gail Richmond**, Michigan State University

Middle Grade Science Teachers' Learning Reform Based Practices in the Context of Their Physics Content Course

Harleen Singh, University of Georgia

Mentor: **Gail Richmond**, Michigan State University

History of Engineering and Engineering Education

Ezgi Yesilyurt, University of Nevada, Las Vegas

Mentor: **Gregory Rushton**, Middle Tennessee State University

Preparing STEM Graduate Students for Change: A Discursive Approach to the Study of Instructional Reform

Francesca Williamson, Indiana University

Mentor: **Greg Rushton**, Middle Tennessee State University

Increasing Retention in Graduate Education: Investigating Students' Experiences of Departmental Supports

Ntiana (Diana) Sachmpazidi, Western Michigan University

Mentor: **Greg Rushton**, Middle Tennessee State University

Factors Influencing Group Interactions While Constructing Explanations Using the CEJ Framework in a Diverse Setting

LaShawn McNeil, University of Georgia

Mentor: **Noemi Waight**, University at Buffalo

The Conceptual Profile of Substance as a Powerful Tool to Characterize Shifts in Learning Chemistry in Student's Ways of Speaking and Thinking about Substance

Raul Orduna Picon

Mentor: **Noemi Waight**, University at Buffalo

Relationships Between Students' Scaffolded Small-Group Discussions and their Written Scientific Explanations

Timothy G. Klavon, Temple University

Mentor: **Noemi Waight**, University at Buffalo

**STRAND 1:
Science Learning: Development of Student Understanding**

New Approaches to Learning

**8:00 AM – 9:30 AM
Salmon**

President:

Calvin S. Kalman, Concordia University

Comparison of Laboratories with Traditional Physics Laboratories

Calvin S. Kalman, Concordia University

Franco La Braca, Concordia University

Mandana Sobhanzadeh, Mount Royal University

Dialogical Argumentation and Assessment for Learning: Closing the Gap in the Science Classroom

Frikkie George, Cape Peninsula University of Technology

Keith R. Langenhoven, University of the Western Cape

Using Mind Maps to Determine Students Knowledge Dimensions on Disciplinary and Interdisciplinary Core Ideas

Helen Semilarski, University of Tartu

Regina Soobard, University of Tartu

Miia Rannikmae, University of Tartu

**STRAND 2:
Science Learning: Contexts,
Characteristics and Interactions**

*Epistemic Aspects of Engagement
in Novel Contexts of Learning Physics*

**8:00 AM – 9:30 AM
Mt Hood**

Discussant:
Edit Yerushalmi, Weizmann Institute
of Science, Israel

Presider:
Elon Langbeheim, Ben-Gurion
University, Israel

*Epistemic Aspects of Engagement
in Novel Contexts of Learning Physics*

Elon Langbeheim, Ben-Gurion University,
Israel

Anna M. Phillips, Cornell University

Natasha G Holmes, Cornell University

David Brookes, Florida International

Shulamit Kapon, Technion-Israel Institute
of Technology

Edit M. Yerushalmi, Weizmann Institute
of Science, Israel

Samuel Safran, Weizmann Institute
of Science, Israel

Maayan Schwartz, Technion-Israel
Institute of Technology

**STRAND 2:
Science Learning: Contexts,
Characteristics and Interactions**

*Early Childhood Engineering:
Supporting Engineering Design
Practices with Young Children
and their Families*

**8:00 AM – 9:30 AM
Eugene**

Discussant:
Monica Cardella, Purdue University

Presider:
Scott A. Pattison, TERC

*Early Childhood Engineering: Supporting
Engineering Design Practices with Young
Children and Their Families*

Scott A. Pattison, TERC

Monica E. Cardella, Purdue University

Hoda Ehsan, Purdue

Smirla Ramos-Montañez, Oregon Museum
of Science and Industry

Gina Svarovsky, University of Notre Dame

Merredith D. Portsmore, Tufts University

Elissa Milto, Tufts University

Mary McCormick,

Chris San Antonio-Tunis, Museum
of Science, Boston

**STRAND 3:
Science Teaching—Primary School
(Grades PreK-6): Characteristics
and Strategies**

*Engaging Young Children in Science
and Engineering Practices: Approaches
to Research and Design*

**8:00 AM – 9:30 AM
Meadow Lark/Douglas Fir – 3rd Floor**

Presider:
Eve Manz, Boston University Wheelock
College of Education & Human
Development

*Dance-STEP: Collective Embodied Science
Models and the Particulate Nature of Matter*

Chris Georgen, Boston University
Wheelock College of Education
& Human Development

Using Iterative Co-Design to Develop Classroom Empirical Activity

Eve Manz, Boston University
Wheelock College of Education
& Human Development

Betsy Beckert, Boston University
Wheelock College of Education
& Human Development

**Kindergarten Playground Collisions:
Reconceptualizing Gravity as a Necessary
Intellectual Resource**

Michelle Salgado, University of Washington
David Phelps, University of Washington

**Considerations when Engaging Young
Learners in Scientific Modeling for
Sense-Making**

Christina V. Schwarz, Michigan State
University

Eve Manz, Boston University Wheelock
College of Education & Human
Development

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

**Dialogic Instruction and Sense-Making
of Science Concepts**

8:00 AM – 9:30 AM

Salon E

Presider:
Tara M. Nkrumah, Arizona State
University

**Science Teaching at the Instructional Core:
Opportunities for Students' High-Level
Thinking and Sensemaking**

Miray Tekkumru Kisa, Florida State
University

Ozlem Akcil Okan, Florida State University
Zahid Kisa, Florida State University

**Teacher Learning and Planning for
Epistemic Agency in Storyline Discussions**

Kevin Cherbow, Boston College
Katherine L. McNeill, Boston College

**Using Cogenerative Dialogues to Help
Teachers Support Meaningful and Coherent
Sensemaking through Consensus**

Abraham Lo, BSCS Science Learning

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

**The Impact of Chemistry Education
Research on Theory Development,
Classroom Improvements, and
Pre-service Teacher Training**

8:00 AM – 9:30 AM

Salon D

Discussant:
Anita Schuchardt, University
of Minnesota

**Modeling the Influence of a Constructivist
Learning Environment in Diverse Chemistry
Courses**

Regis Komperda, San Diego State University
Anita Schuchardt, University of Minnesota

**Understanding How Active Learning
Catalyzes Students' Attitudes and
Understanding of Chemistry**

Paulette Vincent-Ruz, Learning Research
and Development Center
Christian D. Schunn, University of Pittsburgh
Anita Schuchardt, University of Minnesota

Measuring Theoretically Grounded Aspects of Chemistry Identity

Kathryn Hosbein, East Carolina University
Jack Barbera, Portland State University
Anita Schuchardt, University of Minnesota

What Can University Science Faculty Learn about Teaching through Engaging in Curriculum Design with K12 Teachers?

Jeffrey Spencer, University of Michigan at Ann Arbor
R. Charles Dershimer, Greenhills School
Ginger V. Shultz, University of Michigan at Ann Arbor
Anita Schuchardt, University of Minnesota

Assessment of Undergraduate Students Participation in the Science Practice in Transformed Laboratory Courses

Joi P. Walker, East Carolina University
Anita Schuchardt, University of Minnesota

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

Student Understandings and Perceptions of Evolution

**8:00 AM – 9:30 AM
Salon C**

Presider:
Grace Elizabeth Baker, Western Washington University

College Student Understanding of Extinction & Natural Selection in the Anthropocene

Yael Wyner, City College of New York, City University of New York, New York, NY
Rob DeSalle, American Museum of Natural History, New York, NY

How to Read the Tree of Life: Investigating Factors Influencing the Ability to Read Evolutionary Trees

Thilo Schramm, University Duisburg-Essen
Philipp Schmiemann, University of Duisburg-Essen–Biology Education

Moving Between Contexts: a Pedagogical Intervention's Effects on Community College Biology Students

Kathryn Green, University of Georgia
Cesar Delgado, North Carolina State University
Brandon Foster, Wake Technical Community College

Students' Perspectives on their Acceptance of Evolution

Ryan D. P. Dunk, Syracuse University
Jason R. Wiles, Syracuse University

**STRAND 6:
Science Learning in Informal Contexts
Science Interest and Identity Formation in Informal Spaces**

**8:00 AM – 9:30 AM
Salon F**

Presider:
Scott Byrd, Maine Mathematics and Science Alliance

DHH Students Making Connections across Gaps between Formal and Informal Science Learning Spaces

Scott Cohen, Georgia State University
Patrick J. Enderle, Georgia State University
Jessica Scott, Georgia State University
Maggie Renken, Georgia State University

***I'm Fine With Just Collecting Data:
Engagement Profiles Differ in
Citizen Science***

Till Bruckermann, IPN–Leibniz Institute
for Science and Mathematics Education

Hannah Greving, Leibniz–Institut für
Wissensmedien (IWM)

Ute Harms, IPN–Leibniz Institute for
Science and Mathematics Education

***Participating in the Scientific Publication
Process: Expanding Students' Perceptions
of Scientific Inquiry and Identity***

Sarah Fankhauser, Oxford College
of Emory University

Gwendolynne Reid, Oxford College
of Emory University

Gwendolyn Mirzoyan, Emory University

Clara Meaders, Cornell University

Olivia Ho-Shing, Harvard University

***Reasons for Teenagers to Continuously
Volunteer in an Informal Science Program***

Sapir Salamander, Ben-Gurion University
of the Negev, Israel

Orit Ben Zvi Assaraf, Ben-Gurion University
of the Negev, Israel

Netzach Farbiash

***Why Some Persist: A Case Study of Six Girls'
Development of Interest in Science***

Stephanie Rafanelli, Stanford University
Graduate School of Education

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

***Informal Science Education and
Socioscientific Issues***

**8:00 AM – 9:30 AM
Salon A**

Presider:

Joanne K. Olson, Texas A&M University

***Developing Practice across Contexts:
Examining Long-Term Impacts of Pre-
service Teacher Internships within an
Informal Setting***

James F. Kiesel, California State University,
Long Beach

***A Place-Based Education Analysis of
Pre-service Teachers Images of Science
Instruction in Informal Settings***

Karthigeyan Subramaniam, University
of North Texas

Christopher S. Long, University of North
Texas

Pamela Harrell, University of North Texas

***Elementary Pre-service Teachers'
Perceptions of Facilitating Socioscientific
Issues***

Melanie Kinskey, University of South Florida

Dana L. Zeidler, University of South Florida

***Socio-Scientific Issues as Tools for
Improving Environmental Knowledge, Skills,
and Behavior in Pre-service Education***

Anat Abramovich, Malam Headquarters
Israeli Center for Scientific Technological
Education Techn

Shirley Miedijensky, Technion–Israel
Institute of Technology

Yael Schwartz, The Weizmann Institute
of Science

STRAND 7: Pre-service Science Teacher Education

Shifting the Teaching Paradigm

8:00 AM – 9:30 AM

Salon B

Presider:

Claire Ceslajarev, Indiana University

Pre-service Elementary Teachers' Intensive Field Experience at a Science Summer Program: Effects on Self-Efficacy

Jacquelyn Duran, Teachers College, Columbia University

Alison Matthews, Teachers College, Columbia University

Allison Bookbinder, Teachers College, Columbia University

Min Jung Lee, Teachers College, Columbia University

Changes in Pre-service Teachers' Orientations Towards Teaching—A Four-Year Case Study

Stefan Sorge, IPN–Leibniz Institute for Science and Mathematics Education, Kiel

Development of Beginning Teacher's Understanding of Students, Learning and Assessment: A Longitudinal Study

Enrique Pareja, Truman State University

Development of Resident Teachers' Noticing Skills Prior to Student Teaching

Amity F. Gann, Temple University, College of Education

Janelle M. Bailey, Temple University

STRAND 8: In-service Science Teacher Education

Professional Development using Computational Thinking and Robotics

8:00 AM – 9:30 AM

Pearl

Presider:

Todd L. Hutner, The University of Alabama

Engage Teachers as Active Co-Designers to Integrate Computational Thinking in STEM Classes

Sally PW Wu, Northwestern University

Gabriella Anton, Northwestern University

Connor Bain, Northwestern University

Amanda N. Peel, Northwestern University

Michael Horn, Northwestern University

Uri Wilensky, Northwestern University

Secondary Science Teachers Conceptualizations of Computational Thinking and Perceived Barriers to CT/Content Integration

Vance J. Kite, North Carolina State University

Soonhye Park, North Carolina State University

Teaching Science, Math, and Coding using Collective Argumentation: A Case Study of One Teacher's Implementation

Anna Gillespie-Schneider, University of Georgia

Barbara A. Crawford, University of Georgia

AnnaMarie Conner, University of Georgia

ChanMin Kim, Pennsylvania State University

Roger Hill, University of Georgia

Timothy Foutz, University of Georgia

Sidney Thompson, University of Georgia

David F. Jackson, University of Georgia

Using Teacher Narratives of Integrating LEGO Robotics as Assessment Tools and Evidence of Professional Learning

Adam Devitt, California State University, Stanislaus

**STRAND 10:
Curriculum, Evaluation, and Assessment**

Analysis and Evaluation of Science Curricula

**8:00 AM – 9:30 AM
Columbia**

Presider:
Gyeong-Geon Lee, Seoul National University

Evaluating Computational Modeling Curriculum through Students' and Teachers' Perspectives: Insight into Enacted and Experienced Curriculum

Arif Rachmatullah, North Carolina State University
Danielle C. Boulden, North Carolina State University
Jennifer Houchins, North Carolina State University
Bitu Akram, North Carolina State University
Nicholas Lytle, North Carolina State University
Veronica Cateté, North Carolina State University
Tiffany Barnes, North Carolina State University
Eric N. Wiebe, North Carolina State University

Examining the Role of Curriculum in Supporting Literacy Demands in NGSS Instruction

Carrie D. Allen, University of North Texas
Rasha Elsayed, WestEd
Ryan Burke, WestEd

International Baccalaureate Biology Curriculum Analysis

Mohammed Estaiteyeh, Western University

Structural Causal Modeling of Science and General Core Competencies in Korean 2015 Revised National Curriculum

Gyeong-Geon Lee, Seoul National University
Hun-Gi Hong, Seoul National University
Yu-Jung Kim, Seoul National University
Wonhyeong Jang, Seoul National University

**STRAND 11:
Cultural, Social, and Gender Issues**
Partnerships and STEM Learning Experiences Across (In)formal Contexts

**8:00 AM – 9:30 AM
Salon H**

Presider:
Eli Tucker-Raymond, TERC

Factors that Impact the Development of STEM Programming at a Newly Emerging STEM School

Felicia D. T. Leammukda, St. Cloud State University
Gillian H. Roehrig, University of Minnesota

Rightful Presence and Power: Examining Our Research-Practice and Youth-Adult Partnerships

Day W. Greenberg, University of Michigan

Angela Calabrese Barton, University of Michigan

Carmen Turner, The Boys and Girls Club of Lansing

Kaila Williams, The Boys and Girls Club of Lansing

Jaila Williams, The Boys and Girls Club of Lansing

Za'Mani Roper, The Boys and Girls Club of Lansing

Teacher Learning, Identity and Agency, and the Enactment of Informal Science Learning in Formal Classrooms

Jennifer Adams, University of Calgary

Teacher Perceptions as Key Role in Science Education Outcomes across all Places and Contexts

Takeshia Pierre, University of Florida

Julie C. Brown, University of Florida

STRAND 12:

Educational Technology

Beyond the Novelty Effect—Examining Learning Affordances of XR Educational Technologies

8:00 AM – 9:30 AM

Salon G

Not all Novelty Effects are Created Equal: Differential Gains in Self-Efficacy and Online Behavior

Shane Tutwiler, University of Rhode Island

Jason Chen, William and Mary

Amy M. Kamarainen, Harvard Graduate School of Education

Shari J. Metcalf, Harvard University

Tina Grotzer, Harvard University

Christopher Dede, Harvard University

Leveraging the Novelty of Virtual Reality to Challenge Students' Initial Ideas of Cells

Meredith P. Thompson, MIT

Lucy Cho, MIT

Melat Anteneh, MIT

Cigdem Uz Bilgin, MIT

Developing Spatial Awareness in Novel Learning Environments

Cigdem Uz Bilgin, MIT

Melat Anteneh, MIT

Lucy Cho, MIT

Meredith P. Thompson, MIT

Good Learning Shouldn't Be Novel: Individual Level Impact of Collaborative Learning in Mobile Augmented Reality on Student Learning

Denise M. Bressler, University of Pennsylvania

Shane Tutwiler, University of Rhode Island

STRAND 13:

History, Philosophy, Sociology, and Nature of Science

Teaching of NOS

8:00 AM – 9:30 AM

Portland

Presider:

Jennifer C. Parrish, University of Northern Colorado

Understanding Teachers' Use of a Tool for Selecting Nature of Science Trade Books

Jeanne Brunner, University of Massachusetts, Amherst

Christine McGrail, University of Massachusetts, Amherst

Improving Students' Perceptions of NOS: An Experimental Study

Aysegul Cilekrenkli, Bogazici University
Ebru Kaya, Bogazici University

Promoting 4th Graders' NOS and Environmental Views through Bridging Formal and Informal Place-Based SSI Learning

Ben C. Herman, University of Missouri
Sarah V. Poor, University of Missouri
Robert T. Oertli, University of Missouri
Kristen Schulte, Missouri River Relief
Blake Romaker, University of Missouri

What Changes to Students' Ideas About Science When History of Science Stories Become Everyday Homework?

Shiang-Yao Liu, National Taiwan Normal University, Taiwan
Cyong-Huei Chen, Jingxing Junior High School, Taipei, Taiwan
Shih-Yeh Chen, Dali Senior High School, Taichung, Taiwan

NETWORKING BREAK

9:30 AM – 10:00 AM

Concurrent Session 8 10:00 AM – 11:30 AM

Awards Committee

Admin Symposium-Diverse Scholarly Trajectories in Science Education: Charting Pathways for Science Education Research

10:00 AM – 11:30 AM
Eugene

Diverse Scholarly Trajectories in Science Education: Charting Pathways for Science Education Research

Noemi Waight, University at Buffalo

Indigenous Science Knowledge-RIG (ISK-RIG)

Admin Symposium-School, Community, Citizenship: Indigenizing Science Education across Places and Contexts

10:00 AM – 11:30 AM
Salon I

Developing Indigenous Students' STEM identities through a Phenomenon-Based Approach: Integrating a Stream Curriculum in the Elementary Classroom

Julie Robinson, University of North Dakota
Joshua Hunter, University of North Dakota
Bonni Gourneau, University of North Dakota
Anna Bahnson, United Tribes Technical College

Indigenizing High School Science Curriculum: A Case of Indigenous Local School Board in Nepal

Mahesh Tharu Chaudhary, Shree Jagadamba Higher Secondary School
Dinesh Gautam, Shree Jagadamba Higher Secondary School
Bhaskar Upadhyay, University of Minnesota

Equity and Ethics Committee

**Jhumki Basu Poster Symposium—
Equity In Science Education Across
Places and Contexts**

10:00 AM – 11:30 AM

Hawthorne/Belmont/Laurelhurst

Organizers:

Gillian U. Bayne, Lehman College
of CUNY

Stephanie Eldridge, University
of Georgia

Althea Hoard, Relay Graduate School
of Education

Tara M. Nkrumah, Arizona State
University

James M. Nyachwaya, North Dakota
State University

Presider:

Catherine Quinlan, Howard University

**White Teachers and Diverse STEM Students’
Learning Progressions Towards or Away
From Culturally Relevant STEM Education**

Amelia A. Brown, University of Tennessee,
Knoxville

**“Judgment Free” Space in Supporting
African American Girls’ Identity in STEM**

Faith Freeman, Guilford County Schools/
University of North Carolina at Greensboro

**Identities in Crisis?: Understanding the
Identity Work of Elementary Students
of Color**

Terrance Burgess, Syracuse University

**Supporting Student Interest Development
and Transformative Learning in Geoscience:
The Testing of a Socio-Cognitive
Pedagogical Model**

Shondricka Burrell, Duquesne University

**Do Students Gain Scientific Inquiry
Knowledge and Practices by Participating
in a School Garden Inquiry Unit**

Carmen Angelica Carrion

**Does Systematic Professional
Development(PD) for Science Teachers
of English Language Learners(ELLs)Meet
Their Professional Needs and What is the
Relationship Between Perceptions of PD
and Self-Efficacy to Teach Science to ELLs?**

Lillian Hau-Degand, Illinois Institute
of Technology

**Students Know the Language Boundaries
in Science: Challenges and Opportunities
of Translanguaging in Engineering Learning**

Greses Anabell Perez, Stanford University

**Active Learning in Large STEM Classes:
Perceptions from Undergraduate and
Graduate Students**

Ngawang Y. Gonsar, Gustavus Adolphus
College

Lorelai Patrick, University of Minnesota

Sehoya Cotner, Gustavus Adolphus College

**Exploring Pre-service Teachers’ Developing
Understandings of Equitable Pedagogies
for Engaging Elementary Students in
Science Practices**

María González-Howard, The University
of Texas at Austin

Tia Madkins, The University of Texas at
Austin

Tatiane Russo-Tait, The University of Texas
at Austin

Maximilan Sherard, The University of Texas
at Austin

Approaches to Learning Biology of Women of Color: The Intersectionality of Gender, Race, and Science Identity

Angela N. Google, Middle Tennessee State University

Anna S. Grinath, Idaho State University

Grant E. Gardner, Middle Tennessee State University

Urban Science Teacher Education Across Contexts: An Examination of Teacher Learning through the Lenses of Identity and Agency

Lisa M. Marco-Bujosa, Villanova University

Revealing the Queer-spectrum in STEM: Undergraduate Student Responses to Diverse Gender Identity and Sexual Orientation Demographics Questions

A.M. Aramati Casper

Katherine Ray King

Rebecca A. Atadero

Linda C. Fuselier

Othermothering in Science Education: When Leading Transcends Walls

Stefanie LuVenia Marshall, University of Minnesota

Urban Students' perspectives on Advanced Placement Enrollment

Justina Ogodo, Baylor University School of Education

Indonesian Pre-service Biology Teachers' and Biology Education Professors' Views on Evolution: Religious, Socio-Cultural, and Dilemma of Teaching and Learning Evolution

Arif Rachmatullah, North Carolina State University

Joys and Traumas of Black Female Science Teachers, a Phenomenological Study

Alexis Riley, Teachers College, Columbia University

Minority STEM Undergraduates: A Comprehensive Model for STEM Identity and Self-Efficacy

Kelly Marie Shepard, Illinois Institute of Technology

Ivan Mutis

Power at Play: The Social, Political, and Cultural Mechanisms of Digital Game-Based Learning in Science

Ora D. Tanner, University of South Florida

Girls Prefer Biology, Boys Physics: Gender Differences in School Science Content Interest

Radu Bogdan Toma, Universidad de Burgos

Jesus Ángel Meneses Villagrà

Becoming a Teacher: Reflective Practice as a Way of Exploring Secondary Science Teacher Beliefs And Practices

Preethi Titu, University of Minnesota

Examining Elementary Students' Images of Engineers and Interests in Engineering Careers

Ezgi Yesilyurt, University of Nevada, Las Vegas

Re-Novicing to Teach Science: The Case of an Experienced Elementary Teacher

Lu Wang, University of Georgia

Hui Tang

STRAND 1:
**Science Learning: Development
of Student Understanding**

Student Learning

10:00 AM – 11:30 AM
Salmon

Presider:
Jonathan Shemwell, University of
Alabama

*Arts-Integrated Impact on Earth Science
Misconceptions: Exploring instructional
Order Effects in Elementary School Science*

Joseph T. Wong, University of California,
Irvine
Sage Andersen, University of California -
Irvine
Michael Corrigan, MDED Inc
Doug Grove, MDED Inc.
Brad Hughes, University of California, Irvine

*Examining Middle School Students'
Knowledge and Beliefs of Earthquake and
Tsunami*

Douglas S. Lownsbey, Oregon State
University
Lawrence B. Flick, Oregon State University

*Learning Progression of Students'
Reasoning about Life Cycles*

Hayat Hokayem, Texas Christian University
Ihsan Ghazal, Modern Community School
Fady Maalouf, Modern Community School
Savannah Graham, Texas Christian
University
Hui Jin, Educational Testing Service

*Student Learning of Emergent Science
Processes Using the PAIR-C Framework*

Brandon VanBibber, University High School
Polly K Lai, Queensland University
Lu Ding
Josh Adams
Michelene Chi, Arizona State University

STRAND 2:
**Science Learning: Contexts,
Characteristics and Interactions**

*Disrupting Science Education Across
Contexts: K-12 Learning, Teaching &
Local Communities*

10:00 AM – 11:30 AM
Mt Hood

*Immersive Science Learning Using the Eco
Challenge App*

Michelle Williams, Michigan State University
Manju Lind, Williams Learning Solutions

*Making Assessments Essential to Elicit
Student Thinking: Emphasis on Crosscutting
Concepts*

Dante Cisterna, Educational Testing Service
Lei Lui, Educational Testing Service

*Elementary Principals as Boundary
Spanners: How One's Social Network
Impacts Decision-Making for Science*

Stefanie Marshall, University of Minnesota

*Centering Critical Race Epistemology in the
Learning to Teach of Science*

Christina Restrepo Nazar, California State
University, Los Angeles

STRAND 2: Science Learning: Contexts, Characteristics and Interactions

*Teacher Perspectives, Contexts,
Networks, & Roles*

10:00 AM – 11:30 AM

Meadow Lark/Douglas Fir – 3rd Floor

Presider:

Xiaoxin Lyu, Teachers College Columbia University

*Leveraging Networks to Achieve Change
at Scale: Identifying Capacity for Science
Professional Learning in Schools*

Thomas "TJ" McKenna, Boston University

Todd Campbell, University of Connecticut

*Rattlesnakes with Vision: Teacher
Perspectives of Administrative Affordances
and Constraints to District-Wide STEM*

Michael Giamellaro, Oregon State University
- Cascades

Debbie Siegel, Institute for Learning
Innovation

Benjamin Ewing, Oregon State University

*Caregiver-Child Interactions during a Family
Making Program: Our Role as Facilitators
and Researchers*

Jing Yang, Indiana University

Amber M. Simpson, Binghamton University

Adam V. Maltese, Indiana University

Euisuk Sung, Indiana University

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

*Formative Assessment tools and
practices*

10:00 AM – 11:30 AM

Salon E

Presider:

Jonathon Grooms, George Washington University

*Analytical Framework of Influences on
Science Teachers' Formative Assessment
(FA) Practices*

Ira Caspari, University of Massachusetts,
Boston

Hannah Sevan, University of Massachusetts,
Boston

*Qualitative Analysis to Elicit Features
of Epistemic Knowledge When Middle
School Students Engaged in Dialogical
Argumentation*

Getachew T Zegeye, Addis Ababa University

Jonathan Francis Osborne, Stanford
Graduate School of Education

Mesfin Tadesse Beshah, University
of Addis Ababa

*Using Design Drawings to Formatively
Assess Design-Based Science Learning*

Hanna Stammes, Delft University
of Technology

Ineke Henze-Rietveld, Delft University
of Technology

Erik Barendsen, Radboud University
& Open University

Marc de Vries, Delft University of Technology

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

Developing Students' Contemporary Practices

**10:00 AM – 11:30 AM
Salon D**

Presider:
Lisa Kenyon, Wright State University

Moral Reasoning About Human Genetic Enhancement Using CRISPR

Katie Humrick, University of Louisville
Linda C. Fuselier, University of Louisville

Patterns of Disengagement: How Students Avoid Discussing Ethics

Eun Ah Lee, University of Texas at Dallas
Nicholas Gans, University of Texas at Arlington
Magdalena Grohman, University of Texas at Dallas
Marco Tacca, University of Texas at Dallas
Matthew J. Brown, University of Texas at Dallas

STEM Graduate Students' Development at the Intersection of Research, Innovation, and Leadership

Cindy A. Lenhart, Oregon State University
Jana L. Bouwma-Gearhart, Oregon State University
Judith Giordan, Oregon State University
Rich Carter, Oregon State University

STRAND 6: Science Learning in Informal Contexts

Examining Under-Represented Young Women's STEM Identities

**10:00 AM – 11:30 AM
Salon C**

Using a Storied-Identity Lens to Understand How Under-represented Women Become a STEM Person

Amal Ibourk, Florida State University
Roxanne M. Hughes, Center for Integrating Research and Learning, NHMFL /FL State University
Clausell Mathis, Florida State University

Exploring Intersectionality and Rightful Presence in Girls' Engineering Experiences in Middle School Science

Edna Tan, University of North Carolina at Greensboro
Aerin W. Benavides, The University of North Carolina at Greensboro
Angela Calabrese Barton, University of Michigan, Ann Arbor

Positioning Girls of Color as Future Scientists: The Implications for Identity Research

Semiha Gun-Yildiz, University of Massachusetts Dartmouth
Shakhnoza Kayumova, University of Massachusetts-Dartmouth
Akira Harper, University of Massachusetts, Dartmouth

Weaving In- and Out-of-School Experiences to Craft STEM Identities

Carrie D. Allen, University of North Texas

STRAND 6: Science Learning in Informal Contexts

Learning Science in Informal Science Clubs and Camps

10:00 AM – 11:30 AM
Salon F

Presider:
Heidi Cian, Florida International University

An Exploration of Youth Approaches to Community Engineering Problem Definition

Jacqueline Handley, University of Michigan
Elizabeth B. Moje, University of Michigan

Understanding Quality Learning and Teaching in STEM clubs: What Does the Evidence Base Tell Us?

Angela Fitzgerald, University of Southern Queensland
Kate Davis, University of Southern Queensland
Tania Leach, University of Southern Queensland
Neil Martin, University of Southern Queensland
Shelley Dunlop, Queensland Museum

Using Place as a Primary Resource for Youth Independent Projects at a Wilderness Summer Camp

Eleanor Kenimer, Michigan State University

Working Towards Community-Responsive Science Club Programs in Low-Income Communities

Lydia Burke, OISE, University of Toronto

STRAND 7: Pre-service Science Teacher Education

Making Instructional Decisions: Assessment and edTPA

10:00 AM – 11:30 AM
Salon A

Presider:
Amity F. Gann, Temple University, College of Education

Increasing Candidate Success on the edTPA Through an NGSS-Aligned Science Methods Course

Wm. Matthew Reynolds, North Carolina State University
Soonhye Park, North Carolina State University
K. C. Busch, North Carolina State University
Gary W. Wright III, North Carolina State University

What Happens after edTPA? New Teachers' Views of the Value of edTPA Experiences

Meghan E. Marrero, Mercy College
Jessica Riccio, Teachers College, Columbia University
Amanda M. Gunning, Mercy College
Latanya Brandon, University of Connecticut

Fostering Informed Design Decision-Making Using Argumentation

Ying Ying Seah, Purdue University
Alejandra J. Magana, Purdue University
Carina M. Rebello, Purdue University

STRAND 8: In-service Science Teacher Education

Argumentation in STEM Education

10:00 AM – 11:30 AM

Pearl

Presider:
Wonyong Park, University of Oxford

Comparing Teacher and Professional Developer Artifacts to Assess Perceptions of Key Aspects of Argument-Based Inquiry

Andrea Ash, University of Iowa
Mark A. McDermott, University of Iowa

Cross-Subject Collaboration about Argumentation between Science and Religious Education Teachers in England: A Case Study

Wonyong Park, University of Oxford
Sibel Erduran, University of Oxford
Liam Guilfoyle, University of Oxford

Professional Development for Science Teachers on Socioscientific Argumentation: Examining the Change in Teachers' Knowledge

Bahadir Namdar, Recep Tayyip Erdogan University
Hasan Bag, Recep Tayyip Erdogan University

Understanding the Impact of Short-Term Professional Development on Secondary Science Teacher's Conceptions of Argumentation Pedagogy

Karen Woodruff, Montclair State University

STRAND 8: In-service Science Teacher Education

Looking Beyond Routines to Study How Teachers Develop Adaptive Expertise with Epistemic Tools

10:00 AM – 11:30 AM

Salon B

Discussant:
Andy Cavagnetto, Washington State University

Presider:
Gavin W. Fulmer, University of Iowa

Looking beyond Routine Pedagogy to the Development of Adaptive Expertise for Immersive Argument-Based Inquiry

Brian Hand, University of Iowa
Gavin W. Fulmer, University of Iowa
Jee Suh, University of Alabama

Developing Teacher Instruments and Protocol to Study Teachers' Knowledge of Language, Argument, and Dialogic Interaction as Epistemic Tools

Gavin W. Fulmer, University of Iowa
Jee Suh, University of Alabama
Brian Hand, University of Iowa
Jihyun Hwang, University of Iowa
Chenchen Ding, University of Iowa
William Hansen, University of Iowa

Developing Adaptive Expertise through a Three-year Professional Development Program: Evaluation of the First Year Program

Jee Suh, University of Alabama
Brian Hand, University of Iowa
Gavin W. Fulmer, University of Iowa
Jale Ercan Dursun, University of Alabama
Krystal Flantroy, University of Alabama

Elementary Teachers' Understandings and Concerns about Epistemic Tools and Adaptiveness: Preliminary Findings from Case Studies

Krystal Flantroy, University of Alabama
Catherine Lammert, University of Iowa
Jee Suh, University of Alabama
Brian Hand, University of Iowa
Gavin W. Fulmer, University of Iowa
Jale Ercan Dursun, University of Alabama
Yejun Bae, University of Iowa
Andrea Malek Ash, University of Iowa

Preliminary Baseline Results of Teachers' Epistemic Orientation and Knowledge of Epistemic Tools

Jihyun Hwang, University of Iowa
Gavin W. Fulmer, University of Iowa
Brian Hand, University of Iowa
Jee Suh, University of Alabama

**STRAND 10:
Curriculum, Evaluation, and Assessment**

Analyzing Real-world Data

**10:00 AM – 11:30 AM
Columbia**

Presider:
Molly Stuhlsatz, BSCS

An Exploration of Everyday Contexts of Energy through Online News Article Text Mining

Nam-Hwa Kang, Korea National University of Education
Chi Yeong Oh, Korea National University of Education

Making Expertise Visible: Transferring the Control-of-Variables Strategy Across Disciplinary Contexts

Martin Schwichow, PH Freiburg
Johanna Kranz, Biology Education, University of Vienna
Martina Brandenburger, PH Freiburg
Andreas Nehring, Leibniz Universität Hannover
Peter Edelsbrunner, ETH Zürich
Andrea Moeller, University of Vienna, Biology Education

Measuring the Efficacy of an Approach to Integrating Quantitative Reasoning in High School Biology

Molly Stuhlsatz, BSCS Science Learning
Melissa Kjellvik, Michigan State University
Elizabeth Schultheis, Michigan State University
Brian M. Donovan, BSCS Science Learning
Jeffrey Snowden, BSCS Science Learning
Louise Mead, Michigan State University

What do Data-Based Questions Really Test: Insights from Pre-service Physics Teachers' Think Aloud Interviews

Yann S Ong, National Institute of Education, Nanyang Technological University

STRAND 11: Cultural, Social, and Gender Issues

Centering Race, Whiteness, and Cultural Responsiveness in Science Education

10:00 AM – 11:30 AM
Salon H

Presider:
Mario Pickens, Georgia State University

Critical Race Theory & Critical Whiteness Studies: Unpacking Pre-service Science Teachers' Conceptualizations of Equity

Amber C. Davis, University of Michigan

Stories from the Field: Exploring Culturally Responsive Science Teaching in a Pilot Study

Jamie Wallace, American Museum of Natural History

Elaine V. Howes, American Museum of Natural History
Richard Gilder Graduate School

The Policing Presence of Whiteness in Science Education

Jonathan D. McCausland, The Pennsylvania State University

Upbringing: An Equity Issue in Science Teacher Recruitment

Mumiah Rasmusen, University College Copenhagen

Bjørn Friis Johannsen, University College Copenhagen

STRAND 11: Cultural, Social, and Gender Issues

Using Critical Frameworks to Disrupt Deficit Perspectives of Latinx Teachers, Students, and Communities

10:00 AM – 11:30 AM
Salon G

Presider:
Greses Pérez, Stanford University

Cultivating and Characterizing the Development of STEM Interest Through the Lens of Intersectionality

Deena Gould, Arizona State University

Priyanka Parekh, Transylvania University

Disparities in Biology Teachers' Expectations for a Student Science Writing Activity

Quentin C. Sedlacek, California State University, Monterey Bay

Interrupting Deficit Perspectives with Elementary Teachers in a Latinx Community: Reflections from a Collaborative Ethnography

Michelle Brown, Penn State University

Using Autobiographies of Latinx Pre-service Teachers (LPTs) to Build a Culturally Relevant Instruction

Noushin Nouri, University of Texas, Rio Grande Valley

Jair Aguilar, The University of Texas, Rio Grande Valley

Patricia Ramirez-Biondolillo, The University of Texas, Rio Grande Valley

Vero G. Frady, The University of Texas, Rio Grande Valley

**STRAND 13:
History, Philosophy, Sociology, and
Nature of Science**

SSI and NOS

**10:00 AM – 11:30 AM
Portland**

Presider:
Renee S. Schwartz, Georgia State
University

*Compassion as a Framework for
Understanding and Responding to
Socioscientific Issues*

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

*Identifying Socioscientific Orientations
in the Context of Socioscientific Issues*

Dana L. Zeidler, University of South Florida
Ben C. Herman, University of Missouri
Melanie Kinskey, University of South Florida
Michael Mitchell, University of South Florida
Selene Y. Willis, University of South Florida
Karrie A. Wikman, University of South
Florida
Tara M. Nkrumah, Arizona State University
Scott M. Applebaum, University of South
Florida
Eunhang Lee, University of South Florida

*Promoting Active Informed Citizenry
through Science Education: A Stage
beyond SSI*

Tapashi Binte Mahmud Chowdhury,
University of Tartu
Jack B. Holbrook, University of Tartu
Miia Rannikmaa, University of Tartu

*Socioscientific Topics or Issues, and Why
This Distinction Matters: A Critical Review*

Nannan Fan, East China Normal University
Si Han Xiao, East China Normal University
Li Ke, University of North Carolina,
Greensboro

NARST ANNUAL MEMBERSHIP MEETING

**11:30 AM – 12:30 PM
Salon I – Lower Level**

LUNCH

**11:30 AM – 12:30 PM
On Your Own**

PLENARY SESSION 2

12:30 PM – 1:45 PM

Salon E & F – Lower Level

Announcement of 2021 Venue & Passing of the Gavel



Philip Bell, University of Washington

Philip Bell is Professor and Chair of Learning Sciences & Human Development in the College of Education at the University of Washington where he holds the Shauna C. Larson Endowed Chair in Learning Sciences. His

current research focuses on understanding and resourcing equity improvements in PK-12 science education. He has worked with families and communities in their home settings and neighborhoods, in classrooms and informal education programs, and across districts and national networks with teachers and educational leaders. Since 2008 he has directed the UW Institute for Science & Math Education focused on promoting equity and justice in PK-12 STEM education through partnerships between the university, community organizations, and educational institutions. Bell edits a popular collection of professional learning resources called STEM Teaching Tools. He has a background in human cognition and development, science education, computer science, and electrical engineering.

Making Science Education Matter in a Damaged and Unjust World

Abstract: Whose interests are being served through contemporary efforts in science education? In what ways are researchers responsible for promoting equity and justice? Through this presentation I continue a conversation in our field about the multiple ways in which science education should engage in justice projects. I use this focus to explore how our work can promote a thriving world at a time of ecological crisis and social turmoil. By leveraging insights from a range of research and development efforts, I highlight how our field might go about infrastructuring

specific equity and justice projects. I argue for collectively deliberating on and enacting social imaginaries for science education that center diverse sense-making; coordinate science learning directly with civic, family, and community life; and work in solidarity with the interests of communities experiencing systemic oppression and marginalization. From this stance, I call upon our community to continue exploring how we might organize ourselves and our efforts to enact science-related justice projects within and across institutions and organizations to better support thriving and just futures.

Concurrent Session 9

2:00 PM – 3:30 PM

International Committee

Admin Symposium-International Perspectives on Science Education in Multicultural and Multilingual Contexts

2:00 PM – 3:30 PM

Eugene

International Perspectives on Science Education in Multicultural and Multilingual Contexts

Mariona Espinet, Autonomous University of Barcelona, Spain

Audrey Msimanga, Sol Plaatje University, South Africa

Saouma B. Boujaoude, American University of Beirut, Lebanon

Alberto J Rodríguez, Purdue University, USA

Sonya N. Martin, Seoul National University, Republic of Korea

Maurício Pietrocola, Universidade de Sao Paulo, Brasil

CADASE RIG

Admin Symposium-The African Diaspora Context: School, Community, and Citizenship in Science Education

2:00 PM – 3:30 PM

Hawthorne/Belmont/Laurelhurst

The African Diaspora Context: School, Community, and Citizenship in Science Education

Mary M. Atwater, University of Georgia

Rona M. Robinson-Hill, Ball State University

Terrell R. Morton, University of Missouri, Columbia

Contemporary Methods RIG

Admin Symposium-Supporting and Advancing Science Education Research Practice through Community Discussions

2:00 PM – 3:30 PM

Salon I

Stanley M. Lo, University of California, San Diego

Francesca Williamson, Indiana University

Glenn Dolphin, University of Calgary

Joe Taylor, University of Colorado, Colorado Springs

Ayca K. Fackler, The University of Georgia

Christa Haverly, Northwestern University

Harini Krishnan, Florida State University

STRAND 1:

Science Learning: Development of Student Understanding

Student Understandings about Energy and Light

2:00 PM – 3:30 PM

Salmon

Presider:

Cari F. Herrmann Abell, BSCS Science Learning

A Little Knowledge is a Dangerous Thing: Diffraction Vs. Understanding of Rectilinear Propagation of Light

Estelle Blanquet, LACES, ESPE d'Aquitaine, University of Bordeaux (France)

Violette Blé, Lycée de Langon, Bordeaux (France)

Claire Darraud, XLIM, University of Limoges (France)

Fabienne Goldfarb, Aime Cotton Laboratory, university Paris Sud (France)

Manuela Miron, University of Iasi (Romania)

Eric Picholle, Inphyni, CNRS-Université de Nice Sophia-Antipolis membre Université Côte d'Azur (France)

An Elementary Student's Journey to Improved Understanding of Energy

Sara J. Lacy, TERC

Roger G. Tobin, Tufts University

Sally Crissman, TERC

Nick Haddad, TERC

Developing Energy, Systems, and Fields in Middle School—In Praise of Modest Goals

Marcus Kubsch, IPN–Leibniz Institute for Science and Mathematics Education

Sebastian T. Opitz, IPN–Leibniz Institute for Science and Mathematics Education

Jeffrey Nordine, IPN–Leibniz Institute for Science and Mathematics Education

David L. Fortus, Weizmann Institute of Science

Knut Neumann, Leibniz Institute for Science Education (IPN) Kiel

Joseph S. Krajcik, Michigan State University

Following Students' Conceptualizations of Refraction

Yaron Schur, David Yellin Academic College, Jerusalem, Israel

Ainat Guberman, David Yellin Academic College, Jerusalem, Israel

Svetlana Ovsyannikov, David Yellin Academic College, Jerusalem, Israel

STRAND 2: Science Learning: Contexts, Characteristics and Interactions

Agency

2:00 PM – 3:30 PM
Mt Hood

Presider:
Heesoo Ha, Seoul National University

Student Opportunities to Enact Epistemic Agency Through Engagement with the NGSS Science and Engineering Practices

Meghan Macias, University of California, Santa Barbara

Elizabeth Arnett, WestEd

Alexis Spina, University of California, Santa Barbara

Ashley Iveland, WestEd

Ted Britton, WestEd

Shifting Towards NGSS Instruction: Epistemic Agents in Middle School Classrooms

Katy Nilsen, WestEd

Jacklyn Powers, WestEd

Ashley Iveland, WestEd

Developing Epistemic Agency: Students' Perspectives on and Experiences with Argumentation During STEM Design Challenges

María González-Howard, University of Texas at Austin

Victor D. Sampson, University of Texas at Austin

Christina L. Baze, University of Texas at Austin

Lawrence Chu, The University of Texas at Austin

Todd L. Hutner, The University of Alabama

Richard Crawford, The University of Texas at Austin

A Marginalized Student's Epistemic Agency and Associated Conflicts in Small-Group Argumentation in a Science Classroom

Heesoo Ha, Seoul National University

Heui-Baik Kim, Seoul National University

STRAND 3: Science Teaching—Primary School (Grades PreK-6): Characteristics and Strategies

Factors Influencing Early Elementary Teachers' Integration of Science and Engineering Practices in Their Classrooms

2:00 PM – 3:30 PM
Meadow Lark/Douglas Fir – 3rd Floor

Discussant:
Katherine McNeill, Boston College

The Role of Context in the Development of Elementary Science Teachers

Elizabeth Davis, University of Michigan
Adam Bennion, University of Michigan
Amber Bismack, University of Michigan

Teacher Learning in a Professional Development for Scientific Sense-Making

Amelia Wenk Gotwals, Michigan State University
Kirsten Edwards, Michigan State University
Lisa Domke, Michigan State University
Arianna Pikus, Michigan State University
Blythe Anderson, Michigan State University
Tanya S. Wright, Michigan State University

The Influence of Curriculum Conditions on Teachers' Use of Informational Books in Teaching Science

Alison K. Billman, University of California, Berkeley
Bryce Becker, University of California, Berkeley
Marjorie Rowe, University of California, Berkeley
P. David Pearson, University of California, Berkeley

Integrating Scientific Modeling in Elementary Classrooms: Why a PD May Work for Some but not Others

Christa Haverly, Northwestern University

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

Science across contexts

**2:00 PM – 3:30 PM
Salon E**

Presider:
Melody Russell, Auburn University

Physics Teachers' Interpretation of Scientific Literacy in China

Guopeng Fu, East China Normal University

Science and Religious Education Teachers' Views of the Comparison of Argumentation in Science and Religion

Liam Guilfoyle, University of Oxford
Sibel Erduran, University of Oxford
Wonyong Park, University of Oxford

Teaching Students with LD and English Learners to Write Mechanistic Explanations

Yewon Lee, University of Maryland, College Park
Susan De La Paz, University of Maryland, College Park
Daniel M. Levin, University of Maryland, College Park

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

Tools and Frameworks to Measure Students' Success and Struggles

**2:00 PM – 3:30 PM
Salon C**

Presider:
Sanlyn Buxner, University of Arizona

Defining Dimensions of Student Struggle in Undergraduate General Chemistry Lab Activities

Clarissa Keen, University of Massachusetts, Boston
Hannah Sevia, University of Massachusetts, Boston

Innovative Thinking in Science and Engineering Education: The Validity and Reliability of a Modified Tool

Abeer M. Watted, Al-Qasemi Academic College of Education

Miri I. Barak, Technion–Israel Institute of Technology

Measuring Student Success as a Latent Variable in Undergraduate Biology Courses

Hannah Huvard, University of Colorado, Denver

Courtney Donovan, University of Colorado, Denver

Robert M. Talbot, University of Colorado, Denver

Chelsey Grassie, University of Colorado, Denver

Testing the Impacts of Data Sources, Magnitudes, and Methods for Developing Biology Early Warning Systems

Roberto Bertolini, Stony Brook University, SUNY

Stephen J. Finch, Stony Brook University, SUNY

Ross H. Nehm, Stony Brook University, SUNY

Which Components of Evidence-Based Teaching Impact Student Learning?: Insights from using PORTAAL for Classroom Observations

Sungmin Moon, University of Washington Seattle

Mallory Jackson, University of Washington, Seattle

Jennifer H. Doherty, University of Washington

Mary Pat Wenderoth, University of Washington, Seattle

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

Contemporary Instructional Approaches in Postsecondary STEM

**2:00 PM – 3:30 PM
Salon D**

Presider:

Jayson M. Nissen, California State University, Chico

Regardless of Major, Undergraduates Learn When Participating in Citizen Science

Lisa Lundgren, North Carolina State University

Caren B. Cooper, North Carolina State University

Bradley Allf, North Carolina State University

Lincoln R. Larson, North Carolina State University

Brianna L. Johns, North Carolina State University

Sara E. Futch, North Carolina State University

Student Outcomes in an Concentrated Chemistry Laboratory Course for Online Students

Ara C. Austin, Arizona State University

Deena Gould, Arizona State University

Smitha Pillai, Arizona State University

Mary Zhu, Arizona State University

Ian R. Gould, Arizona State University

Students' Epistemological Views of Socialization and Teacher Support in the Undergraduate Physics Laboratory

Drew J. Rosen, Stony Brook University

Angela M. Kelly, Stony Brook University

Thomas Hemmick, Stony Brook University

The Effects of Instructor Classroom Talk on Student Engagement and Reasoning

Abdirizak M. Warfa, University of Minnesota
 Petra Kranzfelder, University of California, Merced
 Marin Melloy, University of Minnesota

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

Pre-service Teacher Recruitment

**2:00 PM – 3:30 PM
 Salon A**

President:
 Meredith P. Thompson, MIT

The Missing Link in Science Teacher Recruitment: STEM Faculty

Elana B. Worth, University of Georgia
 Julie A. Luft, University of Georgia
 Dorothy Y. White, University of Georgia
 Paula Lemons, University of Georgia
 Julia E. Przybyla-Kuchek, University of Georgia
 Hatice Ozen Tasdemir, University of Georgia

Evaluating Pre-service Science Teachers' Commitment to Science Teaching

Ashley N. Coon, University of Maryland

Understanding the Factors Influencing Pre-service Science Teachers' Decisions to Pursue Teaching as a Profession

Christine V. McDonald, Griffith University

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

Equity and Elementary Science Teaching & Learning

**2:00 PM – 3:30 PM
 Salon B**

Equity and Elementary Science Teaching & Learning

Jessica J. Thompson, University of Washington
 Carla Zembal-Saul, Pennsylvania State University
 Christina V. Schwarz, Michigan State University
 Heather J. Johnson, Vanderbilt University
 Gail Richmond, Michigan State University
 Shakhnoza Kayumova, University of Massachusetts-Dartmouth
 Melissa Braaten, University of Colorado, Boulder
 Déana A. Scipio, IslandWood
 Kristin L. Gunckel, University of Arizona
 Jessica Lee Chen, Teachers College, Columbia University

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

Professional Learning Communities

**2:00 PM – 3:30 PM
 Pearl**

President:
 Wisam Sedawi, Ben Gurion University

Exploring Secondary Science Teachers' Engagement Within a Professional Learning Community During Instruction on Evolution

Margaret M. Lucero, Santa Clara University

Keeping it Going: Roles Teachers Take on to Support Ongoing Science Professional Development

Julianne A. Wenner, Boise State University

Sara Hagenah, Boise State University

Science Teachers' Professional Vision of Students' Motivation to Learn: Assessment and Implications

Wisam Sedawi, Ben-Gurion University of the Negev, Israel

Dana Vedder-Weiss, Ben-Gurion University of the Negev, Israel

Hasida Yakobov, Ben-Gurion University of the Negev, Israel

Teachers' Learning Communities as a Framework for Promoting Changes in the Instructional Physics Lab

Smadar Levy, Weizmann Institute of Science

Zehorit Kapah, Weizmann Institute of Science

Esther Magen, Weizmann Institute of Science

Edit M. Yerushalmi, Weizmann Institute of Science

**STRAND 10:
Curriculum, Evaluation, and Assessment**

Attitudes, Beliefs, Motivation, and Identity in Science Learning

**2:00 PM – 3:30 PM
Columbia**

Presider:
Claire Ceslajarev, Indiana University

A 12-Item Survey to Measure

Linda Morell, University of California, Berkeley

Shruti Bathia, University of California, Berkeley

Ben Koo, University of California, San Francisco

Rebecca Smith, University of California, San Francisco

Mark R. Wilson, University of California, Berkeley

Are Science Education Attitude Instruments Conceptually Robust? A Systematic Review of 2004-2018 Literature

Radu Bogdan Toma, Universidad of Burgos

Norman G. Lederman, Illinois Institute of Technology

Jesús Ángel Menéses Villagrà, Universidad of Burgos

Assessment of Attitudes Towards Evolution and Understanding of Evolutionary Processes and Concepts Across Europe

Anna Beniermann, Humboldt University of Berlin; Institute for Biology

Paul Kuschmierz, Justus Liebig University of Giessen; Institute for Biology Education

Dittmar Graf, Justus Liebig University of Giessen; Institute for Biology Education

Measuring Students' STEM Identity: Adaptation of an Engineering Identity Survey to the Broader Context of STEM

Kelli Paul, Indiana University

Adam V. Maltese, Indiana University

**STRAND 11:
Cultural, Social, and Gender Issues**

Commitment to Equity & Social Justice for Girls and Women of Color in STEM

**2:00 PM – 3:30 PM
Salon H**

Presider:
Felicia Moore Mensah, Teachers College, Columbia University

***Black Girls as Activists and Civil Agents:
Promoting Stem for Social Justice***

Natalie S. King, Georgia State University

***Creating Nuance for Black Girls' Science
Alignment Using the CLIC Framework***

Ashley N. Jackson, University of Michigan

***How a "Judgement Free" Space Influences
African American Girls Sisterhood and
STEM Identity***

Faith Freeman, University of North Carolina
at Greensboro

Edna Tan, University of North Carolina
at Greensboro

***Talking about Systemic Racism in Science
Teacher Education***

Felicia M. Mensah, Teachers College,
Columbia University

**STRAND 12:
Educational Technology**

***Technology-Enhanced Framing of Data
to Facilitate Classroom Enactment of
Science Practices***

**2:00 PM – 3:30 PM
Salon G**

Discussant:

Scott McDonald, Pennsylvania State
University

Presider:

Hee-Sun Lee, The Concord Consortium

***Tracking Students' Data Collection from
a Simulation Model: Teacher Framing and
Student Variations***

Gey-Hong Gweon, Physics Front

Hee-Sun Lee, The Concord Consortium

Scott McDonald, Pennsylvania State
University

***Small Group Reasoning about Unexpected
Sensor Readings When Scaffolded (or Not):
One Physics Lesson, Four Teachers***

A. Lynn Stephens, The Concord Consortium

Tom Farmer, The Concord Consortium

Daniel N. Damelin, The Concord
Consortium

Computer-aided Collaborative Learning

Paul Horwitz, The Concord Consortium

Cynthia McIntyre, The Concord Consortium

Jessica Andrews-Todd, Educational Testing
Service

***Can a Pedagogy of Learner Agency and
the Internet of Things Improve Science
Classroom Learning and Culture?***

Sarah Haavind, The Concord Consortium

Sherry H. Hsi, The Concord Consortium

**STRAND 14:
Environmental Education**

***Fostering Young Learners'
Socioecological Systems Reasoning
and Decision-Making through
Family and Community Supported
Field-Based Science***

**2:00 PM – 3:30 PM
Portland**

Discussant:

Sarah Stapleton, University of Oregon

Presider:

Leah A. Bricker, Northwestern
University and The Spencer Foundation

**Complex Socioecological Systems, Nature—
Culture Relations, and Field-Based Science:
A Model for Early Childhood Science
Education**

Megan Bang, Northwestern University
Carrie Tzou, University of Washington,
 Bothell
Christine Benita, Seattle Public Schools
MaryMargaret Welch, Seattle Public
 Schools
Sharon Siehl, Tilth Alliance

**An Analysis of Young Children's
Socioecological Sensemaking**

Priya Pugh, University of Washington
Megan Bang, Northwestern University
Carrie Tzou, University of Washington,
 Bothell
Jordan D. Sherry-Wagner, University
 of Washington
Leah A. Bricker, Northwestern University

**Wondering in Places: Culture, Ethics,
and Complexity in Early Science Education**

Jordan D. Sherry-Wagner, University
 of Washington
Megan Bang, Northwestern University
Carrie Tzou, University of Washington,
 Bothell

**Leveraging Place-Based Science to Mediate
and Transform Teacher, Family, and Student
Relationships**

Charlene LaDawn Montañó Nolan, Western
 Washington University
Megan Bang, Northwestern University
Carrie Tzou, University of Washington,
 Bothell

NETWORKING BREAK

3:30 PM – 3:45 PM
Concurrent Session Rooms

Concurrent Session 10
3:45 PM – 5:15 PM

Research Committee

**Admin Symposium-Impacting Practice
through Science Education Research:
Communicating Within and Across
Places, Contexts, and Communities**

3:45 PM – 5:15 PM
Salon I

**Impacting Practice through Science
Education Research: Communicating
within and Across Places, Contexts,
and Communities**

Carrie D. Allen, University of North Texas
Mary M. atwater, University of Georgia
Anne E. Emerson Leak, High Point
 University
Norman G. Lederman, Illinois Institute
 of Technology
Stanley M. Lo, University of California,
 San Diego
Stefanie Marshall, University of Minnesota
David C. Owens, Georgia Southern
 University
Christina Siry, University of Luxembourg

International Committee

**Admin Symposium-Promoting an
International Focus on Research and
Science Teacher Education to Improve
Science and Special Education**

3:45 PM – 5:15 PM
Eugene

Promoting an International Focus on Research and Science Teacher Education to Improve Science and Special Education

Sonya N. Martin, Seoul National University, Republic of Korea

Ileana M Greca, Universidad de Burgos, Spain

Eva Silfver, Umeå University, Sweden

Ying-Ting Chiu, The Ohio State University

Da Yeon Kang, Seoul National University, Republic of Korea

Sungmin Im, Daegu University, Republic of Korea

Jeongho Daniel Cha, Daegu University, Republic of Korea

Scott Cohen, Georgia State University

Patrick J. Enderle, Georgia State University

Renee S. Schwartz, Georgia State University

Graduate Student Committee

Admin Symposium-Graduate Student Research Symposium

3:45 PM – 5:15 PM

Hawthorne/Belmont/Laurelhurst

Graduate Student Research Symposium

Ayca K. Fackler, University of Georgia

Christa Haverly, Northwestern University

Kathryn Green, University of Georgia

Melanie Kinskey, University of South Florida

Sina J. Fakoyede, University of Witwatersrand

Jessica Karch, University of Massachusetts, Boston

Timothy Klavon, Temple University

Jose Pavez, University of Georgia

Shelby Watson, University of Mississippi

Klaudja Caushi, University of Massachusetts, Boston

Caroline T Spurgin, University of California, Santa Cruz

Daniel Pimentel, Stanford University

Anne McAlister, University of Virginia

Jordan Bader, University of New Hampshire

Stephanie Eldridge, University of Georgia

Kirsten Edwards, Michigan State University

Mohammed Estaiteyeh, Western University

Chelsea Sexton, University of Georgia

Hannah Huvard, University of Colorado Denver

Scott Cohen, Georgia State University

Johannah Crandall, Washington State University

Sarah Lilly, University of Virginia

Caitlin Fine, University of Colorado, Boulder

Clarissa Keen, University of Massachusetts, Boston

Catherine Cullicott, Arizona State University

Anna Gillespie-Schneider, University of Georgia

Laura Zeller, University of Illinois at Chicago

STRAND 2:

Science Learning: Contexts, Characteristics and Interactions

Argumentation & Sense-Making

3:45 PM – 5:15 PM

Mt Hood

Presider:

Andy Cavagnetto, Washington State University

Examining Dynamics that Contribute to the Initiation and Sustenance of Sensemaking in Science

Harini Krishnan, Florida State University

Lama Jaber, Florida State University

Jennifer Schellinger, Florida State University

Sherry A. Southerland, Florida State University

Use of Evidence in Arguments about Scientific and Near-Scientific Issues

Minghui Zhu, East China Normal University
Sihan Xiao, East China Normal University

Elementary Students' Epistemic Processes on the Earth Revolution and Apparent Motion of Constellations: Practical Epistemology Analysis

Seungho Maeng, Seoul National University of Education

Influence and Characteristics of Small Group Argumentative Dialogue in Large Lecture Biology

Andy Cavagnetto, Washington State University
Erika offerdahl, Washington State University
Jessie Arneson, Washington State University
Larry Collins, Washington State University
Jacob Woodbury, Washington State University
William B. Davis, Washington State University

**STRAND 3:
Science Teaching—Primary School (Grades PreK-6): Characteristics and Strategies**

The Effects of Children's Media on Preschoolers Language, Understanding, and Perceptions of Science and Engineering

**3:45 PM – 5:15 PM
Meadow Lark/Douglas Fir – 3rd Floor**

Children's Media as a Model of Three Dimensional Science Learning

Sara B. Sweetman, University of Rhode Island
Kelly Jean Shea, University of Rhode Island

Educational Media's Impact on Preschool Children's Perceptions of Science and Engineering

Kelly Jean Shea, University of Rhode Island
Sara B. Sweetman, University of Rhode Island

Divergent Paths to Building Understanding of Science and Engineering: A Comparative Case Study

Beth Rubin Holland, The University of Rhode Island
Sara B. Sweetman, University of Rhode Island

The Effects of Media on Children's Language to Describe Scientists

Susan Trostle Brand, University of Rhode Island
Kelly Jean Shea, University of Rhode Island
Sara B. Sweetman, University of Rhode Island

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

NGSS—Practices and Implementation
**3:45 PM – 5:15 PM
Medford**

President:
Heesoo Ha, Seoul National University

Investigating Explicitness in Teaching the NGSS Crosscutting Concepts

Kimberly Nguyen, WestEd
Maya Salcido White, WestEd
Ashley Iveland, WestEd
Jonathan Boxerman, Northwestern University

***Middle School Science Teachers'
Conceptions of Motivation Supports
in NGSS Instruction***

David McKinney, University of Nevada,
Las Vegas

Pei Pei Liu, Michigan State University

Katy Nilsen, WestEd

Nonye M. Alozie, SRI International

Christopher J. Harris, WestEd

Lisa Linnenbrink-Garcia, Michigan State
University

Gwen Marchand, University of Nevada,
Las Vegas

Jennifer A. Schmidt, Michigan State
University

***NGSS Instructional Practice and
Impact on Student Classroom Experience:
A Comparative Case Study***

Maya Salcido White, WestEd

Ashley Iveland, WestEd

Katy Nilsen, WestEd

Alexis Spina, University of California,
Santa Barbara

Edward D. Britton, WestEd

***Teachers' Understanding and
Implementation of Equitable Instructional
Strategies with the NGSS***

Alexis Spina, University of California,
Santa Barbara

Meghan Macias, University of California,
Santa Barbara

Ashley Iveland, WestEd

Ted Britton, WestEd

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

***Diverse Student Perceptions,
Positioning, and Retention in STEM***

**3:45 PM – 5:15 PM
Salon D**

Presider:

Melo-Jean Yap, San Diego State
University

***"Makes Me Think More": Student
Perceptions of Learning in a Student-
Centered Classroom***

Ashley N. Harlow, University of California,
Irvine

Brian Sato, University of California, Irvine

***Educational Debts in Students' Physics
Beliefs Incurred by Racism and Sexism***

Jayson M. Nissen, California State University,
Chico

Ian Her Many Horses, University of Colorado,
Boulder

Ben Van Dusen, California State University,
Chico

***Impact of PBL Chemistry Laboratory
Curriculum on Persistence of Traditionally
at-Risk Students Majoring in Engineering***

Corey A. Payne, University of Florida

Kent J. Crippen, University of Florida

Lorelie Imperial, University of Florida

***Institutional Context and Identity of Black
Undergraduates Pursuing STEM Degrees***

Eileen Carlton Parsons, University of North
Carolina at Chapel Hill

STRAND 6:
Science Learning in Informal Contexts
Science Learning in Museums and Zoos

3:45 PM – 5:15 PM
Salon E & F

Presider:
Reanna S. Roby, Michigan State University

Designing Complementary Activities for Learning in Classrooms and Fieldtrips to an Interactive Science Center

Danielle Boyd Harlow, University of California at Santa Barbara
Ron Skinner, Ron.Skinner@moxi.org
Alexandria Muller, University of California, Santa Barbara

How Students Interact with a Model Scale in a Science Museum Lab Activity?

Orit Ben Zvi Assaraf, Ben-Gurion University of the Negev, Israel
Neta Shaby, Ben-Gurion University of the Negev, Israel
Nicole Pillemer, Ben-Gurion University of the Negev, Israel

Study of Influence the Museum Model on High School Students' Chemistry Learning

Ana Carolina Steola
Franciani Cássia Sentanin
Patrícia Silva
Ana Cláudia C. Kasseboehmer, University of São Paulo

Development of Environmental Science Agency in Youth Participating in Natural History Museum-Led Citizen Science Programs

Maryam Ghadiri Khanaposhtani, University of California, Davis
Heidi Ballard, University of California, Davis
Julia Lorke, Natural History Museum
Lucy Robinson, Natural History Museum
Jessie Jennewein, Natural History Museum of Los Angeles County
Annie E. Miller, California Academy of Sciences
Sasha Pratt-Taweh, The Natural History Museum
Lila Higgins, Natural History Museum of Los Angeles County
Rebecca Johnson, California Academy of Sciences
Alison Young, California Academy of Sciences

STRAND 6:
Science Learning in Informal Contexts

Storybooks and STEM: Using Books as a Tool to Support Early Childhood Family STEM Learning

3:45 PM – 5:15 PM
Salon C

Discussant:
Phyllis Katz, University of Maryland
 Presider:
Scott A. Pattison, TERC

National Survey Results on the Use of Children's Books to Support STEM Learning

Scott A. Pattison, TERC
Gina Svarovsky, University of Notre Dame
Phyllis Katz, University of Maryland

A Cross-Storybook Analysis of How Story-Driven Investigations Engage Preschool-Age Children in Science Practices

Julia Plummer, Pennsylvania State University

Kyungjin Cho, Pennsylvania State University

Impacts of Connecting Children's Storybooks and Science to Increase Educator Knowledge, Confidence, and Skills Leading STEM Programs

Tara Cox, The Franklin Institute

Julia B. Skolnik, The Franklin Institute

Karen Peterson, National Girls Collaborative Project

Erin Stafford, Education Development Center

Sara Greller, Education Development Center

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

Practice-Based Science Teaching

3:45 PM – 5:15 PM

Salon A

Presider:

Jacqueline N. Ekeoba, University of Houston

Hybridizing Equity-Focused, Field-Based Theory and Practice for Pre-service Science Teachers

Alexandra I. Race, University of California, Santa Cruz

Doris B. Ash, University of California, Santa Cruz

Practice-based Approaches to Elementary Science Teacher Preparation: Examination of an Immersed Methods Course Model

Stephen L. Thompson, University of South Carolina

How Do Secondary Science Teacher Candidates' Noticing Skills Develop in the Context of their Methods Courses?

Rebecca McNall Krall, University of Kentucky

Brett A. Criswell, West Chester University of Pennsylvania

Samantha Ringl, University of Kentucky

Activity Theory and Identity: A Framework for Investigating Teacher Research Experiences and Classroom Practices

Daniel L. Moreno, University of Arizona

Austin R. Cruz, University of Arizona

Sanlyn Buxner, University of Arizona

John M. Keller, University of Colorado, Boulder

Lawrence Horvath, San Francisco State University

Deidre B. Sessoms, California State University, Sacramento

Dermott Donnelly-Hermosillo, California State University, Fresno

Elsa K. Bailey, San Francisco State University

Bo Zhu, American Institutes for Research

STRAND 8: In-service Science Teacher Education

Scaling an Effective Analysis-of-Practice PD Program in Two High-Needs Districts: Impacts, Successes, and Challenges

3:45 PM – 5:15 PM

Salon B

Discussant:

Gillian H. Roehrig, University of Minnesota

Presider:

Kathleen J. Roth, California State Polytechnic University, Pomona

Developing Elementary Analysis-of-Practice PD Teacher Leaders in an Urban District: Teacher and Student Impact

Paul M. Beardsley, California State Polytechnic University, Pomona

Joseph A. Taylor, University of Colorado, Colorado Springs

Kathleen J. Roth, California State Polytechnic University, Pomona

Rebecca Eddy, Cobblestone Applied Research & Evaluation, Inc.

Nicole Wickler, California State Polytechnic University, Pomona

Christopher Wilson, BSCS Science Learning

Stacey L. Carpenter, University of California, Santa Barbara

Factors that Support and Challenge Scaling of Videobased Analysis-of-Practice PD through K-6 Teacher Leader Development

Nicole Wickler, California State Polytechnic University, Pomona

Rebecca Eddy, Cobblestone Applied Research & Evaluation, Inc.

Kathleen J. Roth, California State Polytechnic University, Pomona
Stephanie Baker, Pomona Unified School District

A Video-Based, Analysis-of-Practice PD Program in High School Biology: Results for Students, Teachers, and TLs

Jody Bintz, BSCS Science Learning
Connie Hvidsten, BSCS Science Learning
Christopher Wilson, BSCS Science Learning
Molly Stuhlsatz, BSCS Science Learning
April L. Gardner, BSCS Science Learning
Cynthia Gay, BSCS Science Learning

Factors in Scaling a Videobased, Analysis-of-Practice PD Program through Development of High School Biology TLs

Christopher Wilson, BSCS Science Learning
Jody Bintz, BSCS Science Learning
Connie Hvidsten, BSCS Science Learning
Molly Stuhlsatz, BSCS Science Learning
April L. Gardner, BSCS Science Learning
Cynthia Gay, BSCS Science Learning
Gillian H. Roehrig, University of Minnesota

STRAND 8: In-service Science Teacher Education

Student Achievement

3:45 PM – 5:15 PM

Pearl

Presider:
Darrin Collins

Effects of Professional Development and Classroom Learning Environment on Student Science Achievement

Siqi Li, State University of New York
at Buffalo (SUNY)

Xiufeng Liu, State University of New York
at Buffalo (SUNY)

Out-of-Field Physics Teaching in Urban, Suburban, and Rural Contexts

Robert Krakehl, Stony Brook University

Angela M. Kelly, Stony Brook University

Keith Sheppard, Stony Brook University

Linda Padwa, Stony Brook University

School Counseling and the Preparation of Pre-College Students for STEM Careers

Richard Gearn, Stony Brook University

Angela M. Kelly, Stony Brook University

Monica Bugallo, Stony Brook University

STRAND 10: Curriculum, Evaluation, and Assessment

Assessing Scientific Concepts across Disciplines

3:45 PM – 5:15 PM

Columbia

Presider:
Peng He, Michigan State University

Systems Thinking Theory and Practice in Chemistry Education—Three International Case Studies

Mei-Hung Chiu, National Taiwan Normal
University

Rachel Mamlok-Naaman, The Weizmann
Institute of Science

Jan Apotheker, Faculty of Science and
Engineering University of Groningen,
The Netherlands

Measuring Interdisciplinary Application of the Energy Conservation Principle: A Physics/Chemistry Instrument Pair

Emily J. Borda, Western Washington
University

Todd Haskell, Western Washington
University

Andrew Boudreaux, Western Washington
University

Learning Progressions in Science Assessments

Karyn Housh, Indiana University

Abeera P. Rehmat, Purdue University

Cindy E. Hmelo-Silver, Center for Research
on Learning & Technology

Dante Cisterna, Educational Testing Service

Lei Liu, Educational Testing Service

Developing an Integrated Learning Progression and Assessments to Measure Middle School Student Proficiency of Energy

Peng He, Michigan State University

Namsoo Shin, Michigan State University

Tingting Li, Michigan State University

Joseph S. Krajcik, Michigan State University

**STRAND 10:
Curriculum, Evaluation,
and Assessment**
Automated Scoring of Complex Performances
**3:45 PM – 5:15 PM
Salmon**

Discussant:

James Pellegrino, University of Illinois at Chicago

Presider:

Charles W. Anderson, Michigan State University

Automated Scoring of Complex Performances
Charles W. Anderson, Michigan State University

Xiaoming Zhai, Michigan State University

Karen Draney, University of California, Berkeley

Jay Thomas, Act Inc.

Karen D Wang
Jill A. Wertheim, Stanford University

Brian W. Riordan, ETS

James Pellegrino, University of Illinois at Chicago

**STRAND 11:
Cultural, Social, and Gender Issues**
Considerations for Girls & Women in Science and Engineering
**3:45 PM – 5:15 PM
Salon H**

Presider:

Melody Russell, Auburn University

Examining the Effect of Counterspaces on Undergraduate Women in Physics
Zahra Hazari, Florida International University

Idaykis Rodriguez, Florida International University

Eric Brewe, Drexel University

Renee-Michelle Goertzen, American Physical Society

Theodore Hodapp, American Physical Society

Monica Plisch, American Physical Society

Girls Constructing Engineering Identities through STEM Design Challenges
Christina L. Baze, University of Texas at Austin

Todd L. Hutner, The University of Alabama

Victor D. Sampson, University of Texas at Austin

María González-Howard, University of Texas at Austin

Catherine Riegle-Crumb, University of Texas at Austin

Richard H. Crawford, The University of Texas at Austin

Identity Work of Successful Women in Science During Their School Years
Jonathan L. Hall, University of West Florida

Malcolm B. Butler, University of Central Florida

Seeing Women's Science and Engineering Experiences: The Affordance of a Visual Methodology in Understanding Context
Helen Douglass, University of Tulsa

Geeta Verma, University of Colorado, Denver

Bryan Shao-Chang Wee, University of Colorado, Denver

**STRAND 12:
Educational Technology**
Breakthroughs in Online Learning
3:45 PM – 5:15 PM
Salon G
Building Community in an Online Asynchronous PD Course: Designing for Social Capital Development
Katherine Miller, University of Pennsylvania

Susan Yoon, University of Pennsylvania

Denise M. Bressler, University of Pennsylvania

Daniel Wendel, Massachusetts Institute of Technology

Ilana Schoenfeld, Massachusetts Institute of Technology

Emma Anderson, Massachusetts Institute of Technology

Modeling with Real-Time Informative Feedback: Implementation and Assessment of a New MOOC Component
Niva Wengrowicz, Technion–Israeli Institute of Technology Levinsky College–Research & Development Authority MOFET Institute–School of Professional Development

Rea Lavi, Technion–Israeli Institute of Technology

Daniel Gluskin, Technion–Israel Institute of Technology

Uri Shani, Technion–Israel Institute of Technology

Hanan Kohen, Technion–Israel Institute of Technology

Dov Dori, Technion–Israel Institute of Technology

Online Ethics Education: Expectations, Views, and the Design Components that May Foster Ethical Practices
Miri I. Barak, Technion–Israel Institute of Technology

**STRAND 14:
Environmental Education**
Modelling, Assessment, and Promotion of Climate Literacy
3:45 PM – 5:15 PM
Portland

Discussant:

Hui Jin, Educational Testing Service

Presider:

Ute Harms, IPN–Leibniz Institute for Science and Mathematics Education

Modelling, Assessment, and Promotion of Climate Literacy
Ute Harms, IPN–Leibniz Institute for Science and Mathematics Education

Hui Jin, Educational Testing Service

Towards a Heuristic Model for the Development of Climate Literacy
Ute Harms, IPN–Leibniz Institute for Science and Mathematics Education

Dirk S. Mittenzwei, IPN–Leibniz Institute for Science and Mathematics Education

Hanno Michel, IPN–Leibniz Institute for Science and Mathematics Education

Exploring the Epistemic Orientations of Eighth Graders in a Unit on Weather & Climate
Nathan Quarderer, University of Iowa

Gavin W. Fulmer, University of Iowa

Assessing Climate Literacy—Development and Implementation of a Multidimensional Assessment Instrument Subject

Dirk S. Mittenzwei, IPN–Leibniz Institute for Science and Mathematics Education

Hanno Michel, IPN–Leibniz Institute for Science and Mathematics Education

Ute Harms, IPN–Leibniz Institute for Science and Mathematics Education

Fostering Secondary Students' Evidence-Based Reasoning about Earth's Climate with Models

Devarati Bhattacharya, University of Nebraska, Lincoln

Kimberly Carroll Steward, University of Nebraska, Lincoln

Cory T. Forbes, University of Nebraska, Lincoln

Mark A. Chandler, Columbia University

STRAND MEETINGS

5:15 PM – 6:15 PM
Concurrent Session Rooms

EQUITY & ETHICS DINNER

6:30 PM – 9:30 PM
Off-site

PROGRAM

2020

93RD ANNUAL
INTERNATIONAL
CONFERENCE

MARCH 15–18

PORTLAND, OR, USA

Portland Marriott
Downtown Waterfront

WEDNESDAY, MARCH 18, 2020

Conference Registration
7:30 AM – 4:30 PM
Ballroom Foyer – Lower Level

Concurrent Session 11
8:30 AM – 10:00 AM

NSTA

Admin Symposium-Translating your Research into Forms that are Useful to K-12 Science Educators

8:30 AM – 10:00 AM
Eugene

Discussant:

Norman G. Lederman, Illinois Institute of Technology

Valarie L. Akerson, Indiana University
David Crowther, University of Nevada, Reno
Judith Lederman, Illinois Institute of Technology
Victor D. Sampson, University of Texas at Austin
Kathy Trundle, Utah State University

STRAND 1:
Science Learning: Development of Student Understanding

Understanding of Climate and Natural Systems

8:30 AM – 10:00 AM
Salmon

Presider:

Asli Sezen-Barrie, University of Maine

Assessment of Students' Explanatory Models for Conceptual and Epistemic Quality: The Case of Ocean Acidification (OA) and Its Impacts on Oysters

Asli Sezen-Barrie, University of Maine
Mary K. Stapleton, Towson University
Anica Miller-Rushing, University of Maine

Climate Education in Secondary Science: Comparison of Model-Based and Non-Model-Based Investigations of Global Climate Data

Devarati Bhattacharya, University of Nebraska
Kimberly Carroll Steward, University of Nebraska, Lincoln
Cory T. Forbes, University of Nebraska, Lincoln
Mark Chandler, Columbia University

Making Community Experiences and Knowledge Visible in Modeling Local Climate Systems

Heather F. Clark, University of California, Los Angeles
William A. Sandoval, University of California, Los Angeles

Preschool Children's Understandings of Food Webs Throughout a Summer Camp Experience

Lisa A. Borgerding, Kent State University
Fatma Kaya, Kent State University

Students' Plausibility Shifts and Knowledge Gains When Evaluating Competing Explanatory Models about Freshwater Resource Availability

Timothy Klavon, Temple University
Janelle M. Bailey, Temple University
Doug Lombardi, University of Maryland, College Park
Archana Dobaria, Temple University

STRAND 2:
**Science Learning: Contexts,
Characteristics and Interactions**

Motivating Youth Engagement

8:30 AM – 10:00 AM

Hawthorne/Belmont/Laurelhurst

Presider:
Jonathan Shemwell, University
of Alabama

*Influences of Worldview and Knowledge
on Climate Change Discourse: Evidence
for Ideologically-Motivated Reasoning
among Youth*

Lynne Zummo, Stanford University
Brian M. Donovan, BSCS
K. C. Busch, North Carolina State University

*Social Interdependence of Young
Adolescents during a Smart-Greenhouse
Project in a Required Science Class*

David W. Jackson, Boston College
Pablo Bendiksen Gutierrez, Boston College
Amy R. Semerjian, Boston College

STRAND 2:
**Science Learning: Contexts,
Characteristics and Interactions**

*Characteristics of the Learning
Environment*

8:30 AM – 10:00 AM

Mt Hood

Presider:
Jeanna R. Wieselmann, Southern
Methodist University

*"Integrating" Investigations into Science
Teaching: What Are Essential?*

Lin Zhang, Providence College
Jennifer Van Reet, Providence College

*Characterizing Epistemic Messages that
Support the Development of Student
Intellectual Authority in the Classroom*

Susan B. Kelly, University of Illinois
Stina Krist, University of Illinois at
Urbana, Champaign

*Developing and Teaching Science
Textbooks' Content According to STEM
Education Approach: The Centralized
Educational System Context*

Mohammed A. Aljallal, Riyadh Educational
Administration, Ministry of Education,
Saudi Arabia. Excellence Research Center
of Science and Mathematics Education
ECSME, King Saud University.
Saeed M. Alshamrani, Department
of Curriculum & Instruction, College of
Education, King Saud University. Excellence
Research Center of Science
and Mathematics Education ECSME,
King Saud University

*Experience Characteristics and Knowledge
Sharing Interactions in a Field-Based
Paleontology Social Network*

Richard T. Bex, University of Florida
Corey A. Payne, University of Florida
Jennifer E Bauer, University of Florida
& University of Michigan
Kent J. Crippen, University of Florida
Jeanette Pirlo, Florida Museum
of Natural History

STRAND 3:
Science Teaching—Primary School
(Grades PreK-6): Characteristics
and Strategies

Early Childhood Scientific Thinking

8:30 AM – 10:00 AM
Meadow Lark/Douglas Fir – 3rd Floor

President:
Emily C. Miller, University of Wisconsin,
 Madison

*A Study of the Impact of an Early Childhood
 Intervention on STEM Learning*

Charlene M. Czerniak, University of Toledo
Peter Paprzycki, University of Toledo
Grant Wilson, The University of Toledo
Jeanna Heuring, The University of Toledo
Susanna Hapgood, The University of Toledo
Joan Kaderavek, University of Toledo
Scott Molitor, The University of Toledo

*Kindergarten Students' Emerging Particle
 Models of Matter*

Alaina Pearl Glidden, Purdue University,
 Department of Curriculum and Instruction
Bima Sapkota, Purdue University,
 Department of Curriculum and Instruction
Krista Hook, Purdue University, Department
 of Curriculum and Instruction
Lynn A. Bryan, Purdue University, Center
 for Advancing the Teaching and Learning
 of STEM
Ala Samarapungavan, Purdue University,
 Department of Educational Studies

*To What Extent Does The Lab Center
 Influence Preschoolers' Inquiry, Self-
 Regulation, and Metacognitive Capabilities?*

Ornit Spektor-Levy, The School of
 Education Bar-Ilan University Israel

Ronit Fridman, The School of Education
 Bar-Ilan University Israel

Netta Perry, The School of Education
 Bar-Ilan University Israel

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

*Intersecting Earth Science and
 Engineering Concept in the Classroom*

8:30 AM – 10:00 AM
Salon E

President:
Matthew Johnson, Pennsylvania State
 University

*Impact of Engineering Design Integrated
 Science on Student Learning Outcomes*

Laura O. Pottmeyer, Carnegie Mellon
 University
Frackson Mumba, University of Virginia

*Instructional Differences in the Support
 of System-Level Mechanistic Models of
 Plate Tectonics*

Scott McDonald, Pennsylvania State
 University
Kathryn M. Bateman, Temple University
Arzu Tanis Ozcelik, Aydin Adnan Menderes
 University

*Middle School Students' Understanding of
 Lunar Phases: A Quasi-Experimental Study*

Merryn Cole, University of Nevada Las Vegas
Jennifer A. Wilhelm, University of Kentucky

Science Teachers' Goal Conflicts when Integrating Engineering into Science Classes

Todd L. Hutner, The University of Alabama

Victor D. Sampson, University of Texas at Austin

Christina L. Baze, University of Texas at Austin

Lawrence Chu, The University of Texas at Austin

Richard H Crawford, The University of Texas at Austin

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

Using Representations to Learn Science

8:30 AM – 10:00 AM

Salon F

Presider:

Nicole Graulich, Justus-Liebig Universität Giessen

Development of a Framework for Studying Abstraction in Undergraduate Physical Chemistry

Jessica Karch, University of Massachusetts, Boston

Hannah Sevan, University of Massachusetts, Boston

Effects of Dynamic and Static Cueing in Instructional Videos on Students' Conceptual Understanding in Chemistry

Nicole Graulich, Institute of Chemistry Education, Justus-Liebig Universität Giessen

Sascha Bernholt, IPN–Leibniz Institute for Science and Mathematics Education, Kiel, Germany

Marc Rodemer, IPN–Leibniz Institute for Science and Mathematics Education, Kiel, Germany

Julia Eckhard, Institute of Chemistry Education, Justus-Liebig Universität Giessen

Exploring Student Strategic Flexibility: System Choices for Energy Analysis in Physics

Grace Elizabeth Baker, Seattle University

Thanh K. Le, Western Washington University

Investigating Simulation Use on Student Learning Outcomes in Introductory Physics

Emily C. Allen, Boston University

Andrew Duffy, Boston University

Manher Jariwala, Boston University

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

Empowering Emerging Postsecondary Educators

8:30 AM – 10:00 AM

Salon D

Presider:

Robert Idsardi, Eastern Washington University

An Exploration of Biology Graduate Students Ambivalent Perceptions of the Research—Teaching Ecology

Joshua W. Reid, Middle Tennessee State University

Grant E. Gardner, Middle Tennessee State University

Engaging Undergraduate Learning Assistants in Formative Assessment in Large STEM Classes

Young Ae Kim, University of Arizona
Katelyn Southard, University of Arizona
Jonathan Cox, University of Arizona
Lisa Elfring, University of Arizona
Paul Blowers, University of Arizona
Vicente A. Talanquer, University of Arizona

Exploring Sources of And Changes In Graduate Teaching Assistant Teacher Efficacy Throughout A Semester

Cody Smith, University of Nebraska-Lincoln
Cesar Delgado, North Carolina State University

Opportunities for Graduate Teaching Assistants to Make Epistemic Shifts in the Laboratory

Justin McFadden, University of Louisville
Linda C. Fuselier, University of Louisville

STRAND 6:
Science Learning in Informal Contexts
Science Learning through Non-Traditional ISL Experiences

8:30 AM – 10:00 AM
Salon C

Presider:
Angela Fitzgerald, University of Southern Queensland

Can Laypeople Identify and Judge Scientific Expertise in the Context of Vaccines?

Aviv J. Sharon, Technion–Israel Institute of Technology
Ayelet Baram-Tsabari, Technion–Israel Institute of Technology

Engaging Students in Learning about Climate Change through Filmmaking: A Transformative Educational Experience

Megan K. Littrell, CIRES Education & Outreach University of Colorado, Boulder
Erin Leckey, CIRES Education & Outreach University of Colorado, Boulder
Anne U. Gold, CIRES Education & Outreach University of Colorado, Boulder
Kelsey Tayne, CIRES Education & Outreach University of Colorado, Boulder
Christine Okochi, CIRES Education & Outreach University of Colorado, Boulder
Kristin L. K. Koskey, The University of Akron
Toni A. Sondergeld, Drexel University

Exploring Science in a Science Fiction Convention Community: Convention attendees' Perceptions of Science

Gina Childers, Texas Tech University
Donna Governor, University of North Georgia
Kania Greer, Georgia Southern University
Vaughan S. James, University of Florida

Situated Escape Games: Facilitating Knowledge and Awareness about Healthy Nutrition

Tal Yachin, Technion–Israel Institute of Technology
Miri I. Barak, Technion–Israel Institute of Technology

Thinking Beyond the Conference: Fan Conventions as Places to Communicate Science

Donna Governor, University of North Georgia
Gina Childers, Texas Tech University
Kania Greer, Georgia Southern University
Vaughan S. James, University of Florida

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

*Pre-service Teacher Journaling
and Reflection*

**8:30 AM – 10:00 AM
Salon A**

Presider:
Felicia Moore Mensah, Teachers
College, Columbia University

*The Effect of Interactive Science Journals
on Pre-service Teachers' Planning and
Teaching*

Christine Schnittka, Auburn University
Mark Brenneman, Auburn University

*Nascent Impacts of Engaging Pre-service
Elementary Teachers with Wonder*

Christie C. Byers, George Mason University
Andrew B. Gilbert, George Mason University

*Developing Shared Conception of STEM
Education among Pre-service Elementary
Teachers: How Effective is Short
Intervention?*

Mounir R. Saleh
Hanan Abdo
Faris Alsuliman
Adam AlZayer
Reem Saleh

**STRAND 8:
In-service Science Teacher Education**
Supporting Authentic Science Practices

**8:30 AM – 10:00 AM
Pearl**

Presider:
Laura Zeller, University of Illinois
at Chicago

*Developing and Sustaining Lines of Inquiry
to Improve Modeling-based Teaching in a
Professional Learning Community*

Soo-Yean Shim, University of Washington
Jessica J. Thompson, University of
Washington

*Examining how Professional Development
with Educative Curriculum Materials
Supports Teachers' Modeling Knowledge
and Pedagogical Design Capacity*

Karen Lionberger, University of Georgia
Julie M. Kittleson, University of Georgia

*Changes In Middle School STEM Teachers'
Drawn Mental Models of STEM Education
Over Time*

Matthew Wilsey, Stanford University
Matthew Kloser, University of Notre Dame

**STRAND 8:
In-service Science Teacher Education**
*Teachers' Beliefs, Perceptions and
Knowledge of Socioscientific Issues
for Global Citizenship*

**8:30 AM – 10:00 AM
Salon B**

Discussant:
Troy Sadler, University of North Carolina
at Chapel Hill

Science Teachers' Pedagogical Content Knowledge Development during Enactment of Socioscientific Curriculum Materials

Durdane Bayram-Jacobs, Department of Science Education, Radboud University, Nijmegen, The Netherlands

Ineke Henze, Radboud University, Nymegen

Maria Evagorou, University of Nicosia

Yael Schwartz, The Weizmann Institute of Science

Elin Leirvoll Aschim, Department of Mathematics and Science Education, University of South-Eastern Norway, Horten, Norway

Silvia Alcaraz-Dominguez, Universitat de Barcelona

Mario Barajas, Universitat de Barcelona

Etty Dagan, Darcaa School Gedera, Israel

Teacher Perceptions about Using SSI to Teach Scientific Knowledge

Silvia Alcaraz-Dominguez, Universitat de Barcelona

Tension and Conflict in Implementing SSI as Reflected in Teachers' Beliefs and Implementation

Emil Eidin, Michigan State University

Yael Schwartz, The Weizmann Institute of Science

The Design and impact of SSI Professional Development program

Yael Schwartz, The Weizmann Institute of Science

Emil Eidin, Michigan State University

Discussion

Troy Sadler, University of North Carolina at Chapel Hill

**STRAND 9:
Reflective Practice**

Teacher Efficacy, Ownership, and Practice

**8:30 AM – 10:00 AM
Salon I**

Presider:

Lisa M. McDonald, Teachers College, Columbia University

Cross-Curricular Planning to Enhance Faculty Practice: An Analysis of Graduate-Level STEM and Diversity Course Instruction

Ebony Terrell Shockley, University of Maryland, College Park

Deborah Roberts-Harris, University of New Mexico

Natalie Harr Ylizarde, University of Maryland, College Park

Cachanda K. Orellana, University of Maryland, College Park

Kristina Kramarczuk, University of Maryland, College Park

Improving Teacher Efficacy in a Chinese School: A Case Study of Professional Learning Community

Daniel Carpenter, Researcher and Educational Consultant

Qing Gao, Science Teacher and Administrator, Shenzhen China

Brenda L. Carpenter, National Science Foundation

Teacher Ownership for the Proposed Teaching Approaches

Ana Valdmann, University of Tartu

Jack B. Holbrook, University of Tartu

Miia Rannikmae, University of Tartu

**STRAND 10:
Curriculum, Evaluation, and
Assessment**

*Design, Development, and Testing of a
Media-Rich Three-dimensional Middle
School Science Unit*

**8:30 AM – 10:00 AM
Columbia**

Discussant:
Katherine McNeill, Boston College

*Developing a Unit Designed for NGSS:
Successes and Lessons Learned in the
Development Process*

Lindsey Mohan, BSCS Science Learning
Susan M. Kowalski, BSCS
Betty Stennett, BSCS
Mark Bloom, BSCS
Catherine Stimac, Oregon Public
Broadcasting
Heather Young, Oregon Public
Broadcasting
Lisa Carey, BSCS Science Learning
Jeffrey Snowden, BSCS Science Learning

*Paper 2: Developing a Media-Rich Digital
Unit to Support 3D Teaching and Learning*

Catherine Stimac, Oregon Public
Broadcasting
Heather Young, Oregon Public
Broadcasting
Susan M. Kowalski, BSCS
Betty Stennett, BSCS
Lindsey Mohan, BSCS Science Learning
Mark Bloom, BSCS
Jeffrey Snowden, BSCS Science Learning
Lisa Carey, BSCS Science Learning

*Professional Development for A Medical
Mystery: Moving Beyond the Curriculum*

Betty Stennett, BSCS
Susan M. Kowalski, BSCS
Lindsey Mohan, BSCS Science Learning
Mark Bloom, BSCS
Catherine Stimac, Oregon Public
Broadcasting
Heather Young, Oregon Public
Broadcasting
Lisa Carey, BSCS Science Learning
Jeffrey Snowden, BSCS Science Learning

*A Quasi-experimental Study of the Efficacy
of a Designed-for-NGSS Unit and PD*

Susan M. Kowalski, BSCS
Jeffrey Snowden, BSCS Science Learning
Lisa Carey, BSCS Science Learning
Betty Stennett, BSCS
Lindsey Mohan, BSCS Science Learning
Mark Bloom, BSCS
Heather Young, Oregon Public
Broadcasting
Catherine Stimac, Oregon Public
Broadcasting

*Designing, Developing, and Testing
Curriculum and PD for the NGSS: Discussant
Remarks*

Katherine L. McNeill, Boston College

**STRAND 10:
Curriculum, Evaluation, and
Assessment**

Investigation of Teacher Knowledge

**8:30 AM – 10:00 AM
Portland**

Presider:
Jamie N. Mikeska, Educational Testing
Service (ETS)

Knowledge in Use: Examining Elementary Teachers' Content Knowledge for Teaching about Matter using Scenario-Based Assessments

Jamie N. Mikeska, Educational Testing Service (ETS)

Dante Cisterna, Educational Testing Service

Heena R. Lakhani, University of Washington

Luronne Vaval, Teachers College, Columbia University

Allison Bookbinder, Teachers College, Columbia University

David L. Myers, University of Georgia

Investigating Teacher Knowledge of NGSS Through Developing 3D Science Assessments

Elizabeth X. De Los Santos, University of Nevada, Reno

Candice R. Guy-Gaytán, University of Nevada

Assessing Professional Vision of Oral Scientific Argumentation Using Video Annotations

April B. Holton, Arizona State University

J. Bryan Henderson, Arizona State University

Eric Greenwald, University of California, Berkeley, Lawrence Hall of Science

Nicole Zillmer, Authentic Connections

Megan Goss, University of California, Berkeley, Lawrence Hall of Science

Christina Morales, University of California, Berkeley, Lawrence Hall of Science

Lisette Lopez, University of California, Berkeley, Lawrence Hall of Science

P. David Pearson, University of California, Berkeley

Development of a Questionnaire on Teachers' Knowledge of Language as an Epistemic Tool

Chenchen Ding, University of Iowa

Gavin W. Fulmer, University of Iowa

Jihyun Hwang, University of Iowa

Brian M. Hand, University of Iowa

Jee Kyung Suh, University of Alabama

William Hansen, University of Iowa

**STRAND 11:
Cultural, Social, and Gender Issues**

Exploring Feminism and Materialism in Science Education

**8:30 AM – 10:00 AM
Salon H**

Presider:

David M. Sparks, University of Texas at Arlington

Implications of Materialism Feminism for Chemistry Teaching and Students' Learning

Kathryn Scantlebury, University of Delaware

Catherine E. Milne, New York University

Anita Hussenius, Uppsala University, Centre for Gender Research

Learning to Use "The Mill": Material-Embodied STEM Learning in High School Robotics

Colin H. Hennessy Elliott, NYU

South Korean Students' and Teachers' Views of Gender in Science

Hannoori Jeong, University of Maryland, College Park

Using Scientific Practice to Address the Girls' Crisis: Designing Science Education From a Feminist Perspective

Heather B. Page, New York University

STRAND 12: Educational Technology

New Methods of Measurement and Analysis to Move the Field Forward

8:30 AM – 10:00 AM
Salon G

Presider:
Richard Lamb, East Carolina University

An Emotional-Cognitive Approach to Holistically Assessing Computational Thinking and Emotional Constructs for Classrooms and Researchers

Amy R Semerjian, Boston College
Mike Barnett, Boston College

Analyzing Girls' Flow Experience in an AR Game: Regularized Bayesian Regression in Design-Based Research

Shane Tutwiler, University of Rhode Island
Denise M. Bressler, University of Pennsylvania

Development, Validity and Reliability of an Educational Robotics Based Technological Pedagogical Science Knowledge Self-Efficacy Scale

Hilal Yanis, Gazi University
Nejla Yürük, Gazi University

STRAND 14: Environmental Education

Environmental and Social Responsibility

8:30 AM – 10:00 AM
Medford

Presider:
Elliott Karetny, Timber Creek High School

Action Research in a Rural Afro-Ecuadorian School and Community: El Problema de la Basura

Daniel M. Levin, University of Maryland, College Park

Carolina Napp-Avelli, University of Maryland, College Park

Carlos Vieira, The Onzole River Project

Callie Herring, Teachers2Teachers-Global

Sebastian Fernandez-Napp, University of Maryland, College Park

Jenny McGlone, Teachers2Teachers-Global

Chadd McGlone, Teachers2Teachers-Global

Infusing Social Responsibility in Higher Education through Education for Sustainable Development

Heba El-deghaidy, American University in Cairo

Motivating High School Environmental Science Students through the Lens of Environmental Justice

Elliott J Karetny, Rowan University

Issam H. Abi-El-Mona, Rowan University

Youth as Conservationists, Altruists, Inventors, and Investigators: Designing for Multi-Faceted Disciplinary Identities

Heidi B. Carlone, The University of North Carolina at Greensboro

Michelle Lovett, The University of North Carolina at Greensboro

Alison Mercier, The University of North Carolina at Greensboro

Dearing Blankmann, The University of North Carolina at Greensboro

Ti'Era D. Worsley, University of North Carolina at Greensboro

NETWORKING BREAK

10:00 AM – 10:30 AM

Concurrent Session 12

10:30 AM – 12:00 PM

Publications Advisory Committee

Admin Symposium-NSTA's Annual Research Worth Reading Recognition

10:30 AM – 12:00 PM
Eugene

NSTA's Annual Research Worth Reading Recognition

Hayat Hokayem, Texas Christian University

G. Michael Bowen, Mount Saint Vincent University

Emily G. Schoerning, Anshe Emet

Christina Siry, University of Luxembourg

Selected Papers:

Ryoo, K., & Bedell, K. (2019). Supporting linguistically diverse students' science learning with dynamic visualizations through discourse-rich practices, JRST 56, p. 270-301

Peel, A., Sadler, T. & Friedrichsen (2019). Learning natural selection through computational thinking: Unplugged design of algorithmic explanations. JRST, 56, p. 983-1007

Rouse, A. & Rouse, R. (2019) – 3rd graders' use of writing to facilitate learning of engineering concepts. JRST, 56, 1406-1430.

STRAND 1:

Science Learning: Development of Student Understanding

Understandings about Genetics, Evolution, and Natural Selection

10:30 AM – 12:00 PM
Salmon

Presider:
Nonye M. Alozie, SRI International

Fostering the Use of Key Concepts in Natural Selection

Helena Aptyka, Institute for Biology Education, University of Cologne

Victoria Hollmann, Institute for Biology Education, University of Cologne

Daniela Fiedler, IPN–Leibniz Institute for Science and Mathematics Education, Kiel, Germany

Jörg Großschedl, Institute for Biology Education, University of Cologne

Generating a Comprehensive, Context-Sensitive Framework for Evolution Cognition

Cesar Delgado, North Carolina State University

Kathryn Green, University of Georgia

Improving Student Knowledge of Multifactorial Genetics Could Reduce Racial Prejudice

Brian M. Donovan, BSCS

Monica Weindling, BSCS Science Learning

Brae Salazar, BSCS Science Learning

Scaffolding Secondary Students' Natural Selection Transfer Through Computational Thinking

Amanda N. Peel, Northwestern University

Golnaz Arastoopour Irgens, Clemson University

STRAND 2: Science Learning: Contexts, Characteristics and Interactions

Complexity, Cognition, & the Human Experience

**10:30 AM – 12:00 PM
Mt Hood**

Presider:
Sihan Xiao, East China Normal University

Does Class Size Really Matter in a Metacognitive Biology Classroom?

Ngozika M. Mbajorgu, Enugu State University of Science and Technology

Chinenye P Nwobodo, Enugu State University of Science and Technology

Chidinma A Ezeano, Enugu State University of Science and Technology

Conatance E Idoko, Enugu State University of Science and Technology

Toward a Conception of Humanizing Science Learning

Takumi Sato, Virginia Tech

Daniel Birmingham, Colorado State University

Can Elementary School Students Understand The Complexity of The Lesser Kestrel's Ecological System?

Dafna Gan, Kibbutzim College of Education and the Arts, Israel

Adiv Gal, Kibbutzim College of Education and the Arts, Israel

Orit Ben Zvi Assaraf, Ben-Gurion University of the Negev, Israel

STRAND 2: Science Learning: Contexts, Characteristics and Interactions

Perceptual & Conceptual Change

**10:30 AM – 12:00 PM
Hawthorne/Belmont/Laurelhurst**

Presider:
David McKinney, University of Nevada, Las Vegas

Comparing Pre-service Teachers' Perception of Learning Between Conceptual Change Inquiry Curriculum and Traditional Lecture Approaches

Lloyd M. Mataka, Lewis-Clark State College

Rex N. Taibu, Queensborough CC: City University of New York

The Role of Confusion in Conceptual Change Scenarios for Pre-service Science Teachers

Mariya Pachman, Florida State University

Hye-Eun Chu, Macquarie University, Sydney

Lori Lockyer, University of Technology Sydney

The Impact of a Rich Classroom Epistemic Climate: Students' Perceptual Changes and Cognitive Growth

Yejun Bae, University of Iowa

Seohee Park, University of Iowa

Brian M. Hand, University of Iowa

STRAND 3:**Science Teaching—Primary School (Grades PreK-6): Characteristics and Strategies***Integration in the Elementary Curriculum***10:30 AM – 12:00 PM****Meadow Lark/Douglas Fir – 3rd Floor*****Arts-Integrated Science Instruction: Exploring the Impacts of Instructional Order Effects on Earth Science Learning Gains*****Sage Andersen**, University of California, Irvine**Joseph T. Wong**, University of California, Irvine**Michael Corrigan**, MDED Inc**Doug Grove**, MDED Inc.**Brad Hughes**, University of California, Irvine***Elementary Teachers' Conceptions of Successful Science and Literacy Integration*****Leigh K. Smith**, Brigham Young University**Ryan Nixon**, Brigham Young University**Kendra Hall-Kenyon**, Brigham Young University***Linking literacy and Science in Elementary through Project-based Learning*****Joi Merritt**, James Madison University**Sarah Lupo**, James Madison University***Talking and Writing Three-Dimensional Science: Examining Productive Language Demands of the NGSS Elementary Standards*****Karl G. Jung**, University of South Florida**STRAND 4:****Science Teaching—Middle and High School (Grades 5-12): Characteristics and Strategies***Inquiry-Based Instruction and Explorative Science Practices***10:30 AM – 12:00 PM****Salon E**

Presider:

Mohammed Estaiteyeh, University of Western Ontario***Inquiry-Based Science Instruction and Student Science Achievement in PISA 2015*****Cory T. Forbes**, University of Nebraska, Lincoln**Knut Neumann**, Leibniz Institute for Science Education (IPN) Kiel**Anja Schiepe-Tiska**, Technische Universität München TUM School of Education Zentrum für Internationale Vergleichsstudien (ZIB) e.V.***Matter Matters: Exploring the Role of Materiality in the Science Classroom*****Rishi (Shruti) Krishnamoorthy**, New York University***The Progression of Pre-service and In-service Science Teachers' Abilities to Teach Inquiry-based Science*****Jeanette Bartley**, Illinois Institute of Technology**Judith S. Lederman**, Illinois Institute of Technology

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

*Engaging Students' Interdisciplinary
Connections*

**10:30 AM – 12:00 PM
Salon D**

Presider:
Renata P. Orofino, Universidade Federal
do ABC

*Connecting Ideas Across Courses: Relating
Energy, Bonds, and How ATP Hydrolysis can
Power a Molecular Motor*

Abigail I. Green, Michigan State University
Kristin N. Parent, Michigan State University
Sonia M. Underwood, Florida International
University
Rebecca L. Matz, Michigan State University

*Creating and Testing an Assessment
of Interdisciplinary Connections: Entropy
to Osmosis*

Brianna L. Martinez, Michigan State
University
Kristin N. Parent, Michigan State University
Sonia M. Underwood, Florida International
University
Rebecca L. Matz, Michigan State University

*When Differences Don't Divide: Graduate
Students' Perceptions of Participating in
an Interdisciplinary Collaboration*

Katherine McCance, North Carolina State
University
Margaret R. Blanchard, North Carolina
State University

**STRAND 6:
Science Learning in Informal Contexts**

*Measuring the Long-Term Effects of
Informal Education Experiences: An
Interactive Research Symposium*

**10:30 AM – 12:00 PM
Salon C**

Discussant:
Aaron Price, Museum of Science and
Industry, Chicago, Neta Shaby, Oregon
State University

Presider:
John H. Falk, Institute for Learning
Innovation

*Measuring the Long-Term Effects of Informal
Education Experiences: An Interactive
Research Symposium*

John H. Falk, Institute for Learning
Innovation
Adam V. Maltese, Indiana University
Lynn D. Dierking, Oregon State University
Nancy L. Staus, Oregon State University
Angela Skeeles-Worley, University of
Virginia
Neta Shaby, Oregon State University
Aaron Price, Museum of Science and
Industry, Chicago
David Meier, Institute for Learning
Innovation

**STRAND 7:
Pre-service Science Teacher Education**
*Pre-service Teachers Perceptions of
Engineering*

**10:30 AM – 12:00 PM
Salon F**

Presider:
Heesoo Ha, Seoul National University

Looking across Multiple Practice-Based Science Methods Courses to Empirically Ground the Draw-an-Engineering-Teacher Test (DAETT)

Rebekah Hammack, Montana State University

Tina Vo, University of Nevada, Las Vegas

Using Epistemic Network Analysis to Explore Pre-service Teachers' Connections among Nature of Engineering Ideas

Jennifer C. Parrish, University of Northern Colorado

Jacob Pleasants, Keene State College

Joshua W. Reid, Middle Tennessee State University

Bridget K. Mulvey, Kent State University

Erin E. Peters-Burton, George Mason University

Pre-service Elementary Teachers' Conceptions of Engineering and their Future Teaching Practice

Amy V. Farris, Penn State University

**STRAND 7:
Pre-service Science Teacher Education**
Using Principles of Engineering Design to Advance Elementary Science Teacher Preparation

**10:30 AM – 12:00 PM
Salon A**

Discussant: **Kristen Wendell**, Tufts University

Presenter:
Brenda M. Capobianco, Purdue University

Integrating Learning of Science with Engineering Design in a Physics Course for Elementary Pre-service Teachers

Sanjay Rebello, Purdue University

The Impact of Engineering Design on Student Achievement in Science

Selcen Guzey, Purdue University

Richard Lie, Purdue University

Conceptualizing Modeling as a Situated Engineering Practice within Pre-service Teachers' Learning of Science and Design

Richard J. Aleong, Purdue University

Robin Adams, Purdue University

Elementary Pre-service Teachers' Trajectories in Learning to Teach Science Ambitiously through Engineering Design

Brenda M. Capobianco, Purdue University

Jeffrey Radloff, SUNY Cortland

Kristen B. Wendell, Tufts University

Brenda M. Capobianco, Purdue University

**STRAND 8:
In-service Science Teacher Education**
Approaches to PD to Support Science Teaching

**10:30 AM – 12:00 PM
Salon B**

Presenter:
Lisa M. McDonald, Teachers College, Columbia University,

A Model for Teacher-Initiated STEM Project-Based Learning

Bryan M. Rebar, University of Oregon

Talbot Bielefeldt, Clearwater Program Evaluation

Dean Livelybrooks, University of Oregon

From Doing Science to Teaching Science: Enhancing Instruction by Engaging Teachers in Extended Scientific Inquiry

Lama Jaber, Florida State University

Vesal Dini, Tufts University

Motivating Change: Meeting Teachers' Needs in Science Professional Development

Brit Toven-Lindsey, California State University, East Bay

Kathryn N. Hayes, California State University, East Bay

Christine L Bae, Virginia Commonwealth University

Dawn O'Connor, Alameda County Office of Education

Jeffery Seitz, California State University, East Bay

Impact of Beginning Career Science Teachers' Social Networks and Self-Efficacy on Retention

Meltem Alemdar, Georgia Institute of Technology

Christopher Cappelli, Georgia Institute of Technology

Jessica Gale, Georgia Institute of Technology

The Impact of Induction on Aspects of Culturally Responsive Instruction

Zachary Stepp, University of Florida

Julie C. Brown, University of Florida

The Professional Learning of Secondary Science Teachers: The First-Five Years

Julie A. Luft, University of Georgia

Sissy S. Wong, University of Houston

Kathleen Hill, Pennsylvania State University

STRAND 8:

In-service Science Teacher Education

Professional Development to Support Induction of New Science Teachers

10:30 AM – 12:00 PM

Medford

Presider:

Ryan Coker, Florida State University

Beginning Secondary Science Teachers' Contextualized and Decontextualized Inquiry Implementation: A Randomized Controlled Trial

Shannon L. Navy, Kent State University

Jennifer L. Maeng, University of Virginia

Randy L. Bell, Oregon State University

Fatma Kaya, Kent State University

STRAND 8:

In-service Science Teacher Education

Teacher Learning in the Physical Sciences

10:30 AM – 12:00 PM

Pearl

Presider:

Kelly Riedinger, Oregon State University

Analysis of AP Chemistry Teachers' Online Interaction on Facebook

Shaghayegh Fateh, Middle Tennessee State University

Gregory Rushton, Middle Tennessee State University

David Yaron, Carnegie Mellon University

Chinmay Kulkarni, Carnegie Mellon University

AP Chemistry Teachers' Online Professional Learning Platform: A Design Perspective

Samuel G. Karanja, Middle Tennessee State University

Gregory Rushton, Middle Tennessee State University–Tennessee Science, Technology, Engineering and Mathematics Education Center (TSEC)

David Yaron, Carnegie Mellon University

Chinmay Kulkarni, Carnegie Mellon University

Amanda Perez, Research Associate, Carnegie Mellon University

Factors Related to Reform in Science Teaching through Teacher Professional Development

Dennis Sunal, University of Alabama

Cynthia Szymanski Sunal, University of Alabama

Marilyn Maxwell Stephens, University of Alabama

Marsha Simon, University of West Georgia

Rachael L. Tawbush, The University of Alabama

Haley Harville-York, University of Alabama

Sabrina Stanley, University of Alabama

**STRAND 10:
Curriculum, Evaluation, and Assessment****Dynamic Relationships between Practices and Knowledge in Science Assessment****10:30 AM – 12:00 PM
Columbia**

Presider:
Xiaoxin Lyu, Teachers College
Columbia University

Assessing Novelty and Model-Based Systems Thinking in Solutions to Design Problems

Dov Dori, Technion

Rea Lavi, Technion–Israeli Institute of Technology

Judy Yehudit Dori, Technion

Validating a Learning Progression for 'Mathematization' of Science

Dante Cisterna, Educational Testing Service

Hui Jin, Educational Testing Service

Shin Hyo Jeong, Educational Testing Service

Grade 12 Students' Conceptual Understanding of Core Ideas in Biology

Helin Semilarski, University of Tartu

Anne Laius, University of Tartu

Developing an Appropriate Measurement Model for the State-Level NGSS Science Assessment in Michigan

Tamara J. Smolek, Michigan State University

Ji Zeng, Michigan Department of Education

Incorporate Science Concepts in the Process of Generating Scientific Explanations

Xiaoxin Lyu, Teachers College Columbia University

Anna C. MacPherson, American Museum of Natural History

STRAND 11: Cultural, Social, and Gender Issues

Counterspaces and Critical Considerations in University Settings

10:30 AM – 12:00 PM
Salon H

Presider:
Tara M. Nkrumah, Arizona State University

"Maybe on the Spectrum": Physical Science Pedagogy and Gender Performativity at a Major Research University

Katherine Doerr

Creating a Virtual Counterspace for Marginalized Communities in STEM

Ann Varnedoe, Vanderbilt
William Robinson
Monica L. Ridgeway, Vanderbilt University
Dara Naphan-Kingery
Ebony McGee

How Biology and Physics Faculty Guide Female and URM Faculty toward Leadership, Research, and Teaching

Eugene Judson, Arizona State University
Lydia Ross, Arizona State University

Sexism, Hostile Work Environment, and the Impostor Phenomenon

Devasmita Chakraverty, Indian Institute of Management Ahmedabad

STRAND 12: Educational Technology

Digital Tools: Research and Demonstration Showcase

10:30 AM – 12:00 PM
Salon G

Presider:
Denise M. Bressler, University of Pennsylvania

Digital Curation for Promoting Personalized Science Learning

Dina Tsybulsky, Technion-Israel Institute of Technology

Examining High School Students' Scientific Practices during an Augmented Thermal Perception Lab

Shannon H. Sung, The Concord Consortium
Guanhua Chen, The Concord Consortium
Ji Shen, University of Miami
Xudong Huang, The Concord Consortium
Joyce Massicotte, The Concord Consortium
Changzhao Wang, University of Miami
Charles Xie, The Concord Consortium
Elena Sereviene, The Concord Consortium

Exploring Middle School Students' Epistemological Framings of a Gesture-Augmented Computer Simulation Depicting Thermal Conduction

Nitasha Mathayas, University of Illinois at Urbana-Champaign
Robb Lindgren, University of Illinois at Urbana, Champaign

**STRAND 14:
Environmental Education**

*Traditional Ecological Knowledge (TEK):
Water Stories, Sustainability, Models,
and Evidence*

**10:30 AM – 12:00 PM
Portland**

Presider:
Bhaskar Upadhyay, University
of Minnesota

*Indigenous Science Agency: Water,
Local Knowledge, and Politics*

Mahesh Tharu, Jagadamba Higher
Secondary School

Bhaskar Upadhyay, University of Minnesota

*Indigenous Mapping: Culturally Relevant,
Technology-Enhanced Teaching Strategies
for Indigenous Learners Across Places
and Contexts*

Sharon Nelson-Barber, WestEd

Jonathan Boxerman, WestEd

Matt Siberglitt, WestEd

Zanette Johnson, Intrinsic Impact
Consulting

Sean O'Connor, BSCS

*Indigenous Education for Sustainable
Development Rooted in Traditional
Ecological Knowledge*

Paichi Shein, National Sun Yat-sen University

Kai-Lung Wang, National Sun Yat-sen
University

Wei-Ting Li, Taichung Municipal Sha-Lu
Junior High School

Peresang Sukinarhimicc, Indigenous
People Cultural Development Center

*Traditional Environmental Knowledge:
What can we Learn from Folk Tales?*

Rouhollah Aghasaleh, Georgia State
University

*Community Mapping: A Strategy to Build
Knowledge of Place, STEM, and Culture*

Pauline W. U. Chinn, University of Hawaii
at Manoa

LUNCH

**12:00 PM – 1:00 PM
On Your Own**

**Concurrent Session 13
1:00 PM – 2:30 PM**

**STRAND 2:
Science Learning: Contexts,
Characteristics and Interactions**

*Constructing and Receiving Peer
Feedback on Engineering Designs:
Student Engagement and
Pedagogical Supports*

**1:00 PM – 2:30 PM
Eugene**

Presider:
Chelsea Joy Andrews, Tufts University

*Exploring Peer-Observers' Feedback on
Engineering Communication Challenges*

Michelle Jordan, Arizona State University

Mia DeLaRosa, Arizona State University

"I'm like a Scientist:" Critique Sessions as Spaces of Learning and Identity in Urban Classrooms

Rasheda Likely, Drexel University
Christopher G. Wright, Drexel University
Mikhail Miller, Drexel University

Towards a more Expansive Framing of Feedback in Elementary Engineering: The Social and Affective Benefits of Asking for and Giving Advice

Chelsea Joy Andrews, Tufts University
Kristen B. Wendell, Tufts University

Structures of Interaction in Elementary Engineering Peer-to-Peer Feedback

Nicole A. Batrouny, Tufts University Center for Engineering Education and Outreach

Elementary Teachers' Responsiveness to Supporting Students' Engineering Design Feedback

Jeffrey Radloff, Purdue University
Brenda M. Capobianco, Purdue University

**STRAND 2:
Science Learning: Contexts, Characteristics and Interactions
Inquiry Science Learning**

**1:00 PM – 2:30 PM
Mt Hood**

President:
Zuway-R Hong, National Sun Yat-Sen University

Designing a Learning Sequence for Inquiry: Students' Perspectives

David Perl Nussbaum, Weizmann Institute of Science
Edit M. Yerushalmi, Weizmann Institute of Science

"When I do Hands-on Things I will Remember": Authentic Inquiry Supporting Ninth Graders' Science Identities

Jennifer Tripp, University at Buffalo
Noemi Waight, University at Buffalo

Supporting Students' Autonomy throughout an Open Inquiry Process

Liron Schwartz
Idit Adler, CREATE for STEM Institute
Michal Zion, Bar-Ilan University
Nir Madjar, Bar-Ilan University

**STRAND 2:
Science Learning: Contexts, Characteristics and Interactions
Students & STEM Careers**

**1:00 PM – 2:30 PM
Hawthorne/Belmont/Laurelhurst**

President:
Isha DeCoito, Western University

Stepping Into the Shoes of STEM Professionals- the Results from Longitudinal Intervention Promoting Career Awareness

Tormi Kotkas, University of Tartu
Jack B. Holbrook, University of Tartu
Miia Rannikmaa, University of Tartu

Developing an Intervention Course to Raise Middle School Students Science-Related Career Awareness

Regina Soobard, University of Tartu
Moonika Teppo, University of Tartu
Aet Möllits, Tallinn University
Miia Rannikmaa, University of Tartu

How an Independent Engineering Fair Project Can Affect Student Perceptions of Science

Kelly Feille, University of Oklahoma
Annie Wildes, University of Oklahoma

The Effect of STEM Workshops on STEM Career Aspirations Amongst Middle School Students: A Longitudinal Study

Isha DeCoito, Western University
Ahmad Khanlari, OISE/UT
Stephanie L. Florence, York University

**STRAND 3:
Science Teaching—Primary School
(Grades PreK-6): Characteristics and Strategies**

Teacher Instructional Practices for Equity in the NGSS

1:00 PM – 2:30 PM
Meadow Lark/Douglas Fir – 3rd Floor

Presider:
Anna Maria Arias, Kennesaw State University

An Examination of Teacher Questioning within Science and Engineering NGSS-Aligned Classrooms

Christopher Dittrick, University of Virginia
Sarah J. Fick, University of Virginia
Anne McAlister, The University of Virginia
Jennifer Chiu, University of Virginia
Kevin W. McElhaney, SRI International

Changes in One Teacher's Instructional Practices to Support Elementary Students in Making Sense of Phenomena

Cory Susanne Miller, Michigan State University
I-Chien Chen, Michigan State University
Joseph S. Krajcik, Michigan State University

Rural Elementary Teachers' Perceptions about Incorporating Representations into their Science Teaching

Celeste Nicholas, Indiana University
Meredith Park Rogers, Indiana University
Joshua Danish, Indiana University
Cindy E. Hmelo-Silver, Indiana University
Qiu Zhong, Indiana University
Christina Stiso, Indiana University
Andrea Phillips, Indiana University
Jessica McClain, Indiana University
Alex Gerber, Indiana University

Teaching Evolution in a 5th Grade Spanish Classroom

Lucia Vazquez-Ben, Universidade da Coruña, Spain
Anxela Bugallo-Rodriguez, Universidade da Coruña, Spain

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

Faculty Positioning and Partnerships to Support Teaching

1:00 PM – 2:30 PM
Salon D

Presider:
Anna S. Grinath, Idaho State University

A Social Network Analysis of Lecturers with Security of Employment

Daniel Z. Grunspan, Arizona State University
Stanley M. Lo, University of California, San Diego
Brian Sato, University of California, Irvine
Naneh Apkarian, Western Michigan University

Partners in Community College Science Education Reform: A Phenomenographic Study of Faculty and Graduate Students

Song Wang, University of California, San Diego

Nicole Suarez, University of California, San Diego

Stacey Brydges, University of California, San Diego

Stanley M. Lo, University of California, San Diego

Professional Development for Biology Instructors Focusing on Student Thinking

Paula Lemons, University of Georgia

Sophia (Sun Kyung) Jeong, University of Georgia

Jakayla Clyburn, University of North Carolina, Greensboro

**STRAND 6:
Science Learning in Informal Contexts**

Professional Development Opportunities for Informal STEM Learning Professionals

**1:00 PM – 2:30 PM
Salon C**

Presider:

Rebecca D. Swanson, Tufts University

Professional Development Opportunities for Informal STEM Learning Professionals

Martin Storksdieck, Oregon State University

Jill K Stein, JKS Consulting

Rebecca D. Swanson, Tufts University

Lynn Uyen Tran, University of California, Berkeley

Preeti Gupta, American Museum of Natural History

Ardice Hartry, University of California, Berkeley

Danielle B. Harlow, University of California, Santa Barbara

Ron Skinner, MOXI, The Wolf Museum of Exploration + Innovation

Sinead Brien, Michigan State University

Micaela Balzer, Impression 5 Science Center

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

Pre-service Teacher as Scholars and Professionals

**1:00 PM – 2:30 PM
Salon F**

Creating Academic STEM Teacher Scholars: Research Experiences for Undergraduates

Jennifer A. Wilhelm, University of Kentucky

Molly Fisher, University of Kentucky

Tensions in Student Teaching: Can they be Productive?

Jennifer E Mesiner, University of Maryland, College Park

Daniel M. Levin, University of Maryland, College Park

Pre-service Science Teachers' Epistemological Beliefs

Gunkut Mesci, Giresun University

Busra Tuncay-Yuksel, Giresun University

STRAND 8: In-service Science Teacher Education

Research Experiences for Teachers

1:00 PM – 2:30 PM

Salon B

Presider:

Matthew Johnson, Pennsylvania State University

Experience with Authentic Practice in an Engineering RET: Perceptions of Teachers, Mentors and Independent Observation

Kent J. Crippen, University of Florida

Gayle Nelson Evans, University of Florida

Christine Garand Scherer, University of Florida

Courtney M. Spillman, University of Florida

K-12 Teachers using Authentic STEM Practices in the Classroom Based on Research Immersion Experiences

Matthew Johnson, Pennsylvania State University

Kathleen Hill, Pennsylvania State University

Personally-Relevant Critical Events as Catalysts for Shifts in Teachers' Disciplinary Understandings about Science

Shannon G. Davidson, Florida State University

Lama Jaber, Florida State University

Sherry A. Southerland, Florida State University

STRAND 8: In-service Science Teacher Education

Teacher Learning in the Biological/ Environmental Sciences

1:00 PM – 2:30 PM

Pearl

Presider:

Mohammed Estaiteyeh, University of Western Ontario

Assessment of Professional Development Supports for Teaching Bioinformatics in High School Biology: Benefits and Challenges

Susan Yoon, University of Pennsylvania

Denise M. Bressler, University of Pennsylvania

Joeeun Shim, University of Pennsylvania

Katherine Miller, University of Pennsylvania

Blanca Himes, University of Pennsylvania

Ryan Urbanowicz, University of Pennsylvania

Michael Gonzalez, University of Pennsylvania

Beth Twiss Houting, The Historical Society of Pennsylvania

From Pockets of Implementation to Embedded Practice: A Case of Teacher Learning across Contexts

Casandra Gonzalez, Boston College

Megan McKinley-Hicks, Boston College

Mike Barnett, Boston College

Investigating Teacher Concerns about Climate Change: Identifying Concerns Before and after a Professional Development Experience

Susan Gomez Zwiep, California State University, Long Beach

Jill Grace, K12 Alliance@WestEd

Teachers' Challenges Learning to Teach Coherent NGSS Storylines

Jarod Kawasaki, University of California, Los Angeles

Heather F. Clark, University of California, Los Angeles

William A. Sandoval, University of California, Los Angeles

STRAND 9: Reflective Practice

Teachers' Beliefs and Identity in their Reflective Practices

1:00 PM – 2:30 PM
Salmon

Presider:

Lisa M. McDonald, Teachers College, Columbia University

Exploring Pre-service Teachers' Beliefs about Effective Science Teaching through their Collaborative Oral Reflections

Valarie L. Akerson, Indiana University

Mina Min, Appalachian State University

Fetiye Aydeniz, Indiana University

Exploring Secondary Science Teachers' Identity Development Through Reflective Practice

Preethi Titu, University of Minnesota

Gillian H. Roehrig, University of Minnesota

Joshua A. Ellis, Florida International University

Toward more Agentic Reflection: Analyzing Beginning Science Teacher Narratives of Professional Growth

Anton Puvirajah, University of Western Ontario

Michael Dias, Kennesaw State University

Laurie Brantley-Dias

STRAND 10: Curriculum, Evaluation, and Assessment

Integration of STEM Disciplines

1:00 PM – 2:30 PM
Columbia

Presider:

Emilie A. Siverling, Minnesota State University, Mankato

Seventh-Grade Students' Use of Heat Transfer Conceptions During an Engineering Design-Based STEM Integration Curriculum

Emilie A. Siverling, Minnesota State University, Mankato

Tamara J. Moore, Purdue University

Does STEM Education Work?: A Data-Driven Rethinking of STEM Education in China's Basic Education

Jing Lin, Collaborative innovation center of assessment toward basic education quality, Beijing Normal University

Richard Lamb, East Carolina University

Ping-Han Cheng, Science Education Center, National Taiwan Normal University

Yu-hsuan Chen, Science Education Center, National Taiwan Normal University

Chun-Yen Chang, Science Education Center, National Taiwan Normal University

Xiaoyu Shi

Toward Integrated STEM Practices: Exploring the Intersections of Science, Engineering, and Mathematical Practice

Daniel Pimentel, Stanford University

Megan Selbach-Allen, Stanford University

Brandon Reynanate, Stanford university

A Model for Argumentation in Integrated STEM Curriculum

Carina M. Rebello, Purdue University

Yuri B. Piedrahita Uruena, Purdue University

Paul Asunda, Purdue University

Hui-Hui Wang, Purdue University

STRAND 10: Curriculum, Evaluation, and Assessment

What is the Science Curriculum of Today and the Future?

1:00 PM – 2:30 PM
Medford

Presider:

Jan H. Van Driel, University of Melbourne

What is the Science Curriculum of Today and the Future?

Jan H. Van Driel, University of Melbourne

Victoria Millar, University of Melbourne

Michael J. Reiss, University of London

Dana L. Zeidler, University of South Florida

Sami Kahn, Princeton University

Richard A. Duschl, Southern Methodist University

Jonathan Francis Osborne, Stanford Graduate School of Education

Knut Neumann, Leibniz Institute for Science Education (IPN) Kiel

Troy Sadler, University of North Carolina at Chapel Hill

Justin Dillon, University of Exeter

STRAND 11: Cultural, Social, and Gender Issues

Embracing Indigenous Knowledge of the African Diaspora and Tribal Communities

1:00 PM – 2:30 PM
Salon H

Presider:

Michael A. Arove, Lagos State University

Culture, Context and Scientific Explanations by Biology Students: An African Case Study

Peter A. Okebukola, Africa Centre of Excellence in Innovative and Transformative STEM Education Lagos State University, Lagos, Nigeria

Tunde Owolabi, Africa Centre of Excellence in Innovative and Transformative STEM Education Lagos State University, Lagos, Nigeria

Michael A. Arove, Africa Centre of Excellence in Innovative and Transformative STEM Education Lagos State University, Lagos, Nigeria

Akeem Akintoye, Africa Centre of Excellence in Innovative and Transformative STEM Education Lagos State University, Lagos, Nigeria

For the Next Seven Generations: the Hopes and Needs of Pottawatomie Parents for their Children

Jared Tenbrink, University of Michigan

The Pull from Both Sides: Analyzing the Bicultural Experiences of 1.5-Generation Nigerian-American Female STEM Students

David M. Sparks, University of Texas at Arlington

U.S. and Ghana: Exploring Cross-Cultural Perspectives on Engagement in Science for Underrepresented Students

Tara M. Nkrumah, Arizona State University

**STRAND 12:
Educational Technology**

Teaching with Technology

1:00 PM – 2:30 PM

Salon G

Presider:
Jonah B. Firestone, Washington State University Tri-Cities

Co-Teaching with Digital Games: Cultivating Effective Teacher-Game Partnerships in Science Classrooms

Karen Mutch-Jones, TERC
Santiago Gasca, TERC
Danielle C. Boulden, North Carolina State University
Eric N. Wiebe, North Carolina State University

Examining Professional Development Designed to Support Geospatial Inquiry

Brooke A. Whitworth, University of Mississippi
Eric Nolan, Northern Arizona University
Lori Rubino-Hare, Northern Arizona University
Mark Manone, Northern Arizona University
Nena Bloom, Northern Arizona University

Understanding the Perceived Usefulness of Mobile Technology in Physics Learning: A Pedagogical Perspective

Lehong Shi, East Lansing
Xiaoming Zhai, Michigan State University

**STRAND 14:
Environmental Education**

Citizen Engagement: Between Attitudes and Behavior

1:00 PM – 2:30 PM
Portland

Presider:
Dani Lin Hunter, Colorado State University

Adult Food Waste and the Effectiveness of a Video Intervention on Increasing Intended Pro-Environmental Behaviors

Kathleen A. Fadigan, Pennsylvania State University
Zelnnetta Clark, Pennsylvania State University
Jaclyn Bolton, Pennsylvania State University
Amira Spikes, Pennsylvania State University
Visalakshi Vaithianathan, Pennsylvania State University

Citizen Scientist or Citizen Technician: How we Talk about Volunteer Tasks and Who's Benefiting

Danielle Lin Hunter, Colorado State University
Gregory Newman, Colorado State University
Meena M. Balgopal, Colorado State University

Environmental Attitudes/Values and Concern —Two Constructs with One Aim

Gregor Torkar, Professor, University of Lubljana
Franz X. Bogner, University of Bayreuth

NARST BOARD MEETING #2

4:00 PM – 9:00 PM
Pearl – 2nd Floor

2020

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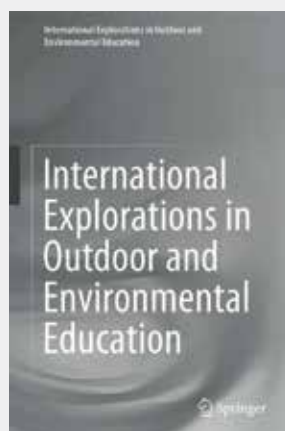
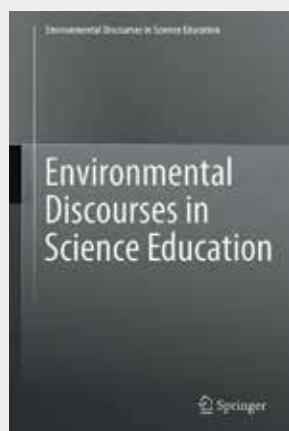
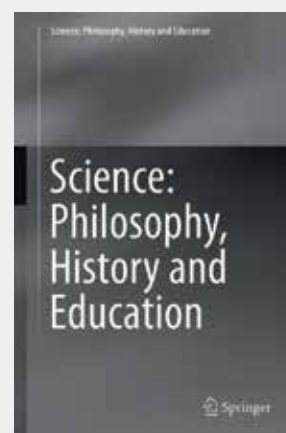
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