96th NARST International Conference | Program

April 18 - 21, 2023

REFLECTING on REFORM

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96th NARST International Conference

Please note that this program is subject to change.

Check the addendum posted at the meeting and on the NARST website for updates.

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96th NARST International Conference

General Information

Information about NARST

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

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

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

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

NARST Mission Statement

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

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

Member Benefits

- Ten issues of the Journal of Research in Science Teaching (JRST) are published each volume year. JRST has been ranked as one of the highest quality educational journals according to studies published by War, Holland and Schramm (American Educational Research Journal) and Guba and Clark (Educational Researcher) for the American Educational Research Association (AERA). These authors identified JRST as clearly the top research journal in science education.
- Website, Member Portal and Listserv, allowing access to further information about the Association. You may access this site at: http://www.narst.org. There is further information about subscribing to the listserv on this site.
- Opportunities to participate in monthly webinars.

Code of Ethical Conduct

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

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

A. Professional Competence

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

B. Integrity

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

C. Professional and Scholarly Responsibility in Science Teaching, Learning, and Research

Science education professionals have a responsibility to use research practice and policy to advance NARST members' understanding of the teaching and learning of science in all learning contexts—formal, informal, local, and global—through research, practice, and policy. They adhere to the highest scholarly and professional standards within their field of expertise and accept responsibility for adherence to those standards. Science education professionals should regard the tutelage of graduate students and early career faculty as a trust conferred by the organization for which they work, as well as NARST, for the promotion of these individuals' learning and professional development.

Science education professionals understand that they form a community and show respect for other science education professionals even when they disagree on theoretical, methodological, or personal approaches to professional activities. In activities involving marginalized populations, it is essential that responsible science education professionals seek out the voices and experiences of members of these groups and treat them as critical to their scholarship. While always endeavoring to be collegial, science education professionals must never let the desire to be collegial outweigh their shared responsibility for ethical behavior. When appropriate, they consult with colleagues, NARST's Equity and Ethics Committee, or organizational entities such as their institutional review board in order to prevent, avoid, or challenge unethical conduct.

D. Respect for People's Rights, Dignity, and Diversity

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

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

E. Social Responsibility

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

References

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/

Research Interest Groups (RIGs) Information

Continental and Diasporic Africa in Science Education RIG (CADASE)

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

Chair: **Mary M. Atwater**
atwater@uga.edu

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

Secretary: **Shari Earnest Watkins**
shariear@yahoo.com

Treasurer: **Brittany Gavin-Hudson**
bagarvin@gmail.com

LATINO/A RIG (LARIG)

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

Chair: **Angela Chapman**, University of Texas Rio Grande Valley
angela.chapman@utrgv.edu

Contemporary Methods for Science Education Research

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

Chair: **Francesca Williamson**, Indiana University
frawhite@iu.edu

Engineering Education RIG (ENE-RIG)

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

Chair: **Monica Cardella**, Florida International University
mcardell@fiu.edu

Indigenous Science Knowledge Research Interest Group (ISK-RIG)

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

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

Research in Artificial Intelligence-Involved Science Education (RAISE)

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

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

Asian and Pacific Islander Science Education Research (APISER)

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

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

Strand Key

Strand 1:	**Science Learning: Development of Student Understanding**
Strand 2:	**Science Learning: Contexts, Characteristics, and Interactions**
Strand 3:	**Science Teaching—Primary School: Characteristics and Strategies** (Grades PreK-6)
Strand 4:	**Science Teaching—Middle and High School: Characteristics and Strategies** (Grades 5-12)
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:	**Discontinued**
Strand 10:	**Curriculum, Evaluation, and Assessment**
Strand 11:	**Cultural, Social, and Gender Issues**
Strand 12:	**Technology for Teaching, Learning, and Research**
Strand 13:	**History, Philosophy, Sociology, and Nature of Science**
Strand 14:	**Environmental Education and Sustainability**
Strand 15:	**Policy, Reform and Program Evaluation**

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Teachers College, Columbia University

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The University of North Carolina at Chapel Hill

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Shannon Navy (2023)
Kent State University

Xiaoming Zhai (2024)
University of Georgia

Strand 2: Science Learning—Contexts, Characteristics and Interactions

Angela Chapman (2023)
University Of Texas Rio Grande Valley

Patricia Patrick (2024)
Columbus State University

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Valparaiso University

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University of Southampton

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Florida State University

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University of California, Santa Barbara

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Beijing Normal University

Tejaswini Dalvi (2024)
University of Massachusetts, Boston

Strand 11: Cultural, Social, and Gender Issues

Katharine Wade-Jaimes (2023)
University of Nevada

Kathryn Kirchgasler (2024)
University of Wisconsin, Madison

Strand 12: Technology for Teaching, Learning, and Research

Preethi Titu (2023)
Kennesaw State University

Richard Lamb (2024)
East Carolina University

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Gunkut Mesci (2023)
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University of Oklahoma

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Heather Page (2023)
New York City Department of Education

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Framingham State University

Strand 15: Policy, Reform, and Program Evaluation

Sanlyn Buxner (2023)
University of Arizona

Felicia Leammukda (2024)
St. Cloud State University

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Teresa Massey
Terrance Burgess
Tess Bernhard
Tessa Andrews
Theila Smith
Thomas McKenna
Ti'Era Worsley
Tim Goebel
Tim Hartelt
Tingting Li
Todd Harwell
Toma Radu Bogdan
Tulana Ariyaratne
Tyler Harper-Gampp
Valarie Akerson
Vanessa Fischer
Vanessa Louis
Verena Ruf
Veronica McGowan
Veronika Rozhenkova
William Romine
Wisal Ganaiem
Wisam Sedawi
Won Jung Kim
Wonyong Park
Xinyu He
Yael Rozenblum
Yang Zhanng
Yehudit Judy Dori
Yejun Bae
Ying Chen
Ying-Yan Lu
Yu Zhang
Yu-Chen Chiu
Yu-Jan Tseng
Zac Patterson
Zoubeida Dagher

NARST Presidents

1928 **W. L. Eikenberry**
1929 **W. L. Eikenberry**
1930 **W. L. Eikenberry**
1931 **Elliot R. Downing**
1932 **Elliot R. Downing**
1933 **Francis D. Curtis**
1934 **Ralph K. Watkins**
1935 **Archer W. Hurd**
1936 **Gerald S. Craig**
1937 **Walter G. Whitman**
1938 **Hanor A. Webb**
1939 **John M. Mason**
1940 **Otis W. Caldwell**
1941 **Harry A. Carpenter**
1942 **G. P. Cahoon**
1943 **Florence G. Billig**
1944 **Florence G. Billig**
1945 **Florence G. Billig**
1946 **C. L. Thield**
1947 **Earl R. Glenn**
1948 **Ira C. Davis**
1949 **Joe Young West**
1950 **N. Eldred Bingham**
1951 **Betty Lockwood**
1952 **Betty Lockwood**
1953 **J. Darrell Barnard**
1954 **George G. Mallinson**
1955 **Kenneth E. Anderson**
1956 **W. C. Van Deventer**
1957 **Waldo W. Blanchet**
1958 **Nathan S. Washton**
1959 **Thomas P. Fraser**
1960 **Vaden W. Miles**
1961 **Clarence H. Boeck**
1962 **Herbert A. Smith**
1963 **Ellsworth S. Obourn**
1964 **Cyrus W. Barnes**
1965 **Frederic B. Dutton**
1966 **Milton P. Pella**
1967 **H. Craig Sipe**
1968 **John M. Mason**
1969 **Joseph D. Novak**
1970 **Willard D. Jacobson**
1971 **Paul D. Hurd**
1972 **Frank X. Sutman**
1973 **J. David Lockard**
1974 **Wayne W. Welch**
1975 **Robert E. Yager**
1976 **Ronald D. Anderson**
1977 **O. Roger Anderson**
1978 **Roger G. Olstad**
1979 **James R. Okey**
1980 **John W. Renner**
1981 **Stanley L. Helgeson**
1982 **Stanley L. Helgeson**
1983 **Carl F. Berger**
1984 **Ann C. Howe**
1985 **Ertle Thompson**
1986 **David P. Butts**
1987 **James P. Barufaldi**
1988 **Linda DeTure**
1989 **Patricia Blosser**
1990 **William G. Holliday**
1991 **Jane Butler Kahle**
1992 **Russell H. Yeany**
1993 **Emmett L. Wright**
1994 **Kenneth G. Tobin**
1995 **Dorothy L. Gabel**
1996 **Barry J. Fraser**
1997 **Thomas R. Koballa, Jr.**
1998 **Audrey B. Champagne**
1999 **Joseph S. Krajcik**
2000 **David F. Treagust**
2001 **Sandra K. Abell**
2002 **Norman G. Lederman**
2003 **Cheryl L. Mason**
2004 **Charles W. (Andy) Anderson**
2005 **John R. Staver**
2006 **James A. Shymanksy**
2007 **Jonathan F. Osborne**
2008 **Penny J. Gilmer**
2009 **Charlene M. Czerniak**
2010 **Richard A. Duschl**
2011 **Dana L. Zeidler**
2012 **J. Randy McGinnis**
2013 **Sharon J. Lynch**
2014 **Lynn A. Bryan**
2015 **Valarie L. Akerson**
2016 **Mary M. Atwater**
2017 **Mei-Hung Chiu**
2018 **Barbara Crawford**
2019 **Gail Richmond**
2020 **Tali Tal**
2021 **Eileen R. C. Parsons**
2022 **Renée Schwartz**
2023 **Gillian Roehrig**
2024 **Jomo Mutegi**

NARST Executive Directors

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

1975–1980 **Paul Joslin**
1980–1985 **Bill Holliday**
1985–1990 **Glenn Markle**
1990–1995 **John Staver**
1995–2000 **Art White**
2000–2002 **David Haury**
2002–2007 **John Tillotson**
2007–2017 **Bill Kyle**
2018–2021 **Helen Schneider Lemay**
2021–Present **Lisa Martin-Hansen**

JRST Editors

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

Emeritus Members

Alan McCormack
Albert Nous
Avi Hofstein
Aviva Klieger
Barbara Crawford
Bill Jaffarian
Carl Angell
Charles Anderson
Charles McFadden
Dale Baker
David Haury
David Kennedy
Donald Riechard
Donald Schmidt
Doris Ash
Doris Simonis
Ed Van Den Berg
Edward Smith
Eileen Parsons
Elke Sumfleth
Ellen Simmons
Elsa Feher
George Bodner
Gerald Krockover
Gian Pedemonte
Glenn Berkheimer
Glenn Markle
Gottfried Merzyn
Guilford Bartlett
Hanna Arzi
Hans Andersen
Helmut Dahncke
Herbert Thier
Ivo Lindauer
J. Prather
J. Swift
Jacqueline Mallinson
James Poth
James Shymansky
Jane Kahle
Jay Lemke
Jim Minstrell
John Christopher
Joseph Novak
Judith Lederman
Julia Clark
Kathryn Scantlebury
Larry Enochs
Larry Yore
Leonie Rennie
Linda Phillips
Lowell Bethel
Mansoor Niaz
Manuel Sequeira
Marianne Barnes
Marlene Thier
Michael Agin
Michael Padilla
Michael Piburn
Nitza Barnea
Obed Norman
Onno De Jong
Patricia Friedrichsen
Paul Joslin
Peter Hewson
Peter Okebukola
Richard Haney
Richard Walding
Robert Dehaan
Robert Poel
Robert Sherwood
Robert Williams
Rodney Doran
Roger Olstad
Ronald Anderson
Ryda Rose
Stanley Helgeson
Sue Tunnicliffe
Sung Jae Pak
Uri Ganiel
Vincent Lunetta
Wayne Welch
William Holliday

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(s)
1986	Anton E. Lawson
1987	Paul DeHart Hurd
1988	John W. Renner
1989	Willard Jacobson
1990	Joseph D. Novak
1991	Robert L. Shrigley
1992	Pinchas Tamir
1993	Jack Easley, Jr.
1994	Marcia C. Linn
1995	Wayne W. Welch
1996	Carl F. Berger
1997	Rosalind Driver
1998	James J. Gallagher
1999	Peter J. Fensham
2000	Jane Butler Kahle
2001	John K. Gilbert
2002	Audrey B. Champagne
2003	Barry J. Fraser
2004	Robert E. Yager Paul Black
2005	John C. Clement
2006	David Treagust
2007	Kenneth Tobin
2008	Dorothy Gabel
2009	Peter W. Hewson Leonie Jean Rennie Wolff-Michael Roth
2010	Reinders Duit Joseph Krajcik
2011	Norman Lederman
2012	Charles W. (Andy) Anderson Larry Yore
2013	Dale R. Baker
2014	Glen Alkenhead Richard Gunstone Frances Lawrenz
2015	Richard A. Duschl Meshach Mobolaji Ogunniyi
2016	Lynn D. Dierking John N. Falk Dana L. Zeidler
2017	Avi Hofstein
2018	Marissa Rollnick Jonathan Osborne
2019	Mary M. Atwater Maria Pilar Jiménez-Aleixandre
2020	Judy Dori Saouma Bou Jaoude
2021	Valarie Akerson Greg Kelly
2022	Fouad Abd-El-Khalick Gail Jones
2023	Franz X. Bogner Okhee Lee

NARST Award Recipients

Outstanding Doctoral Research Award

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

Year	Awardee(s)	Advisor(s)
1992	Rene Stofflett	Dale R. Baker
1993	Julie Gess-Newsome	Norman G. Lederman
1994	Carolyn W. Keys	Burton E. Voss
1995	Jerome M. Shaw	Edward Haertel
1996	Christine M. Cunningham	William L. Carlsen
1997	Jane O. Larson	Ronald D. Anderson
1998	Kathleen Hogan	Bonnie K. Nastasi
1999	Fouad Abd-El-Khalick	Norman G. Lederman
2000	Danielle Joan Ford	Annemarie S. Palinscar
2001	Iris Tabak	Brian Reiser
2002	Mark Girod	David Wong
2003	Hsin-Kai Wu	Joseph Krajcik
2004	David L. Fortus	Ronald Marx Joseph Krajcik
2005	Thomas Tretter	Gail M. Jones
2006	Stacy Olitsky	Kenneth Tobin
2007	Julia Plummer	Joseph S. Krajcik
2008	Victor Sampson	Douglas Clark
2009	Lei Liu	Cindy E. Hmelo-Silver
2010	Heather Toomey	Phillip Bell Zimmerman
2011	Jeffrey J. Rozelle	Suzanne M. Wilson
2011	Catherine Eberbach	Kevin Crowley
2012	Melissa Braaten	Mark Windschitl
2013	Lori Fulton	Jian Wang
2014	Daniel Birmingham	Angela Calabrese Barton Anne-Lise Halvorsen
2015	Allison Godwin	Geoffrey Potvin
2016	Anna MacPherson	Jonathan Osborne
2017	Anita Schuchardt	Christian Schunn
2018	Katherine Wade-Jaimes	Renée Schwartz
2019	Anita S. Tseng	Jonathan F. Osborne
2020	Netta Shaby	Orit Ben Zvi-Assaraf
2021	Eben Witherspoon	Christian D. Schunn
2022	Won Jung Kim	Angela Calabrese Barton Alicia Alonzo
2023	Gary William Wright III	Cesar Delgado

NARST Award Recipients

Early Career Research Award

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

Year	Awardee(s)
1993	Wolff-Michael Roth
1994	Deborah J. Tippins
1995	Nancy B. Songer
1996	Mary B. Nakhleh
1997	Peter C. Taylor
1998	J. Randy McGinnis
1999	Craig W. Bowen Gregory J. Kelly
2000	Angela Calabrese Barton
2001	Julie A. Bianchini
2002	Alan G. Harrison
2003	Fouad Abd-El-Khalick
2004	Grady J. Venville
2005	Randy L. Bell
2006	Heidi Carlone
2007	Bryan A. Brown
2008	Hsin-Kai Wu
2009	Troy D. Sadler
2010	Thomas Tretter
2011	Katherine L. McNeill
2012	Victor Sampson
2013	Alandeom W. Oliveira
2014	Cory Forbes
2015	Benjamin C. Herman
2016	Richard L. Lamb
2017	Ying-Chih Chen David Stroupe
2018	Doug Lombardi
2019	Hosun Kang Eve Manz
2020	Brian Donovan Dana Vedder Weiss
2021	Lama Jaber
2022	Maria González-Howard Laura Zangori
2023	Natalie S. King Christina Krist

NARST Fellows Award:

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

Year	Awardee(s)
2021	Bryan A. Brown
2021	Richard A Duschl
2021	Gillian Roehrig
2022	Peter A. Okebukola
2023	Julie Bianchini
2023	Ron Blonder
2023	Patricia Friedrichsen

Future NARST Meeting Dates

2024
March 16–19 | Denver, CO

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

2026
April 18-21 | Seattle, WA

NARST Award Recipients

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

*Tie

NARST Award Recipients

The NARST Outstanding Paper Award

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

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

*Tie

NARST Award Recipients

Outstanding Masters Thesis Award

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

Year	Awardee	Major Professor	Advisor
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

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

NARST Leadership Committees

Elections Committee

Final Year	Committee Leadership
2023	**Nazan U. Bautista** (Chair) Miami University
2025	**David Crowther** (Co-Chair) University of Nevada, Reno
	Members
2024	**Hernán Cofré Mardones** Pontificia Universidad Católica de Valparaíso, Chile
2024	**Miri Barak** Technion
2024	**Holly Kennedy Amerman** University of Georgia
2025	**Carina Rebello** Purdue University
	Board Member Liaison
2024	**Scott McDonald** Penn State University
	Representative from the International Committee
2023	**Sheron Mark** University of Louisville
	Ex Officio
2023	**Renee Schwartz** (Immediate Past President) Georgia State University

Equity and Ethics Committee

Final Year	Committee Leadership
2023	**María González-Howard** (Chair) University of Texas, Austin
	Members
2023	**Sara Salloum** University of Balamand
2024	**Ebru Eren** Trinity College of Dublin, Ireland
2024	**Erdogan Kaya** George Mason University
2024	**Phillip Boda** University of California, Berkeley
2024	**David Steele** Alder Graduate School of Education
2025	**Marsha E Simon** University of West Georgia
2025	**Justice T. Walker** University of Texas, El Paso
2025	**Regina McCurdy** Georgia Southern University
	Board Member Liaison
2025	**Sharon Nelson-Barber** WestEd

External Policy and Relations Committee

Final Year	Committee Leadership
2024	**Durdane Bayram-Jacobs** (Chair) Eindhoven University of Technology
	Members
2023	**Henriette Burns** Southern Illinois University, Edwardsville
2023	**Peter Okebukola** Lagos State University, Nigeria
2024	**Xavier Fazio** Brock University, Canada
2024	**Francesca Williamson** Butler University
2024	**Andy Cavagnetto** Washington State University
2025	**Sara Raven** Texas A&M University
2025	**Ellen Granger** Florida State University
	Board Liaison
2024	**Leon Walls** University of Vermont
	Ex Officio Members
2023	**Gillian Roehrig** (President) University of Minnesota
	Lisa Martin-Hansen (Executive Director)

NARST Leadership Committees

Graduate Student Committee

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

Final Year	Committee Leadership
2023	**Theila Smith** (Chair) University of Groningen
2023	**Scott Cohen** (Co-Chair) Georgia State University
	Members
2023	**Sandhya Krishnan** University of Georgia
2023	**Andrea Reeder** Middle Tennessee State University
2023	**Uchechi Agnes Ahanonye** University of the Witwatersrand, Johannesburg
2023	**Jennifer Slavick** West Chester University
2023	**Helena Aptyka** Institute for Biology Education, Germany
2023	**Samantha Ringl** University of Kentucky
2024	**Jared TenBrink** University of Michigan, Ann Arbor
2024	**Justin Andersson** University of Nebraska, Lincoln
2024	**Sabrina Stanley** University of Alabama
2024	**Zhongyan Zhang** University of Leeds
2024	**Ti'Era Worsley** University of North Carolina, Greensboro
	Ex Officio Member
2025	**Jomo Mutegi** (President-Elect) Old Dominion University

Awards Committee

Final Year	Board Liaison
2025	**Amelia Gotwals** Michigan State University

Outstanding Doctoral Research Award

Final Year	Committee Leadership
2023	**Heidi Cian** (Chair) Florida International University
2024	**Julia Plummer** (Co-Chair) Penn State University
	Members
2023	**Juan F Diaz** MAC US
2023	**Terrance Burgess** Michigan State University
2023	**Eve Manz** Boston University
2023	**Jianlan Wang** Texas Tech University
2024	**Judith Lederman** Illinois Institute of Technology
2024	**Jayma Koval** Georgia State University
2024	**Michael Zion** Bar Ilan University, Israel
2024	**Mary E. Short** George Washington University
2025	**Guopeng Fu** East China Normal University
2025	**Eunjin Bahng** Iowa State University
2025	**Nilay Ozturk** Kirsehir Ahi Evran University
2025	**David C. Owens** Georgia Southern University
2025	**Maia Elkana** Washington University, St. Louis

NARST Leadership Committees

Awards Committee (con't)

Early Career Research Award

Final Year	Committee Leadership
2023	**Hsin-Kai Wu** (Chair) National Taiwan Normal University
2024	**Doug Larkin** (Co-Chair) Montclair State University
	Members
2023	**Matthew Weinstein** University of Washington, Tacoma
2023	**Doris Ash** University of California, Santa Cruz
2023	**Anton Puvirajah** University of Western Ontario
2024	**Eleanor Abrahms** University of Massachusetts, Lowell
2025	**Ben Herman** Texas A&M University
2025	**Christine Lotter** University of South Carolina
2025	**Meg Blanchard** North Carolina State University
2025	**Erin Peters-Burton** George Mason University
2025	**Bridget Miller** University of South Carolina
2025	**Larry Yore** University of Victoria

Distinguished Contributions to Science Education Through Research

Final Year	Committee Leadership
2024	**Dana Neidler** (Chair) University of South Florida
2024	**Xiufeng Liu** (Co-Chair) University of Buffalo
	Members
2023	**Agustín Adúriz-Bravo** Universidad de Buenos Aires
2023	**Dale Baker** Arizona State University
2023	**Fouad Abd-El-Khalic** University of North Carolina, Chapel Hill
2024	**Valarie Akerson** Indiana University
2025	**Justin Dillon** Exeter University, UK
2025	**Kathy Trundle** Utah State University
2025	**Mei-Hung Chiu** National Taiwan Normal University

NARST Fellows Award

Final Year	Committee Leadership
2024	**Hosun Kang** (Chair) University of California, Irvine
2024	**Lama Jaber** (Co-Chair) Florida State University
	Members
2023	**Lucy Avraamidou** University of Groningen
2024	**Julie Luft** University of Georgia
2025	**Senay Purzer** Purdue University
2025	**Enrique Suarez** University of Massachusetts, Amherst
2025	**Lezly Taylor** Virginia Polytechnic Institute and State University

NARST Leadership Committees

International Committee

Final Year	International Coordinator
2025	**Mercy Ogunsola-Bandele** (Chair) National Open University of Nigeria
	Committee Leadership
2023	**Gavin Fulmer** (Chair) University of Iowa
2024	**Hayat Hokayem** (Co-Chair) Texas Christian University
	Members
2023	**Sheron Mark** University of Louisville
2023	**Tasneem Anwar** Aga Khan University
2024	**Claudia Vergara** Alberto Hurtado University, Chile
2024	**Irene Drymiotou** University of Cyprus and University of Groningen
2024	**Stefan Sorge** IPN Leibniz Institute for Science and Mathematics Education, Germany
2024	**Lucía Vázquez Ben** Universidad da Coruña, Spain
2024	**Lee Kenneth Jones** Texas Tech University
2025	**Imran Tufail** University of Waikato
2025	**Ranu Roy** Amity University Kolkata
2025	**Aerin W. Benavides** University of North Carolina, Greensboro
2025	**Nuri Balta** Suleyman Demirel University

Membership Committee

Final Year	Committee Leadership
2023	**Elizabeth de los Santos** (Chair) University of Nevada, Reno
2025	**Mihwa Park** (Co-Chair) Texas Tech University
	Members
2023	**K.C. Busch** North Carolina State University
2024	**Tugba Yuksel** Recep Tayyip Erdogan University
2024	**Shiang-Yao Liu** National Taiwan Normal University
2024	**Robert Bennett** Georgia State University
2025	**Melanie Kinskey** Sam Houston State University
2025	**Harini Krishnan** Florida State University
2025	**Harleen Singh** University of Georgia
	Board Liaison
2023	**Brooke Whitworth** Clemson University

NARST Leadership Committees

Program Committee	
Final Year	**Leaders**
2023	**Gillian Roehrig, President** (Chair) University of Minnesota
2024	**Jomo Mutegi** (President-Elect) Old Dominion University
	Ex Officio Member
	Lisa Martin-Hansen (Executive Director)
	Members
2023	**Shannon Navy** Kent State University
2023	**Angela Chapman** University Of Texas, Rio Grande Valley
2023	**Selina Bartels** Valparaiso University
2023	**Jose Pavez** University of Georgia
2023	**Grant Gardner** Middle Tennessee State University
2023	**Eli Tucker-Raymond** Boston University
2023	**Amanda Berry** Monash University, Australia
2023	**Patrick Enderle** Georgia State University
2023	**Jing Lin** Beijing Normal University
2023	**Katharine Wade-Jaimes** University of Nevada
2023	**Preethi Titu** Kennesaw State University
2023	**Gunkut Mesci** Giresun University, Turkey
2023	**Heather Page** New York City Department of Education
2023	**Sanlyn Buxner** University of Arizona
2024	**Xiaoming Zhai** University of Georgia
2024	**Patricia Patrick** Columbus State University
2024	**Karl Jung** University of South Florida
2024	**Elizabeth Lewis** University of Nebraska, Lincoln
2024	**Anita Schuchardt** University of Minnesota
2024	**Neta Shaby** Ben Gurion University of the Negev
2024	**Amal Ibourk** Florida State University
2024	**Julie Bianchini** University of California, Santa Barbara
2024	**Tejaswini Dalvi** Univerity of Massachusetts, Boston
2024	**Kathryn Kirchgasler** University of Wisconsin, Madison
2024	**Richard Lamb** East Carolina University
2024	**Jacob Pleasants** Oklahoma University
2024	**Wardell A. Powell** Framingham State University
2024	**Felicia Leammukda** St. Cloud State University

NARST Leadership Committees

Publications Advisory Committee

Final Year	Committee Leadership
2023	**Dante Cisterna** (Chair) Education Testing Service
2024	**Lindsay Lightner** (Co-Chair) Washington State University Tri-Cities
	Members
2023	**Fouad Abd-El-Khalick** University of North Carolina
2023	**Shakhnoza Kayumova** University of Massachusetts, Dartmouth
2024	**Emily Dare** Florida International University
2024	**Saouma BouJaoude** American University of Beirut, Lebanon
2024	**Carla Johnson** North Carolina State University
2024	**Kent Crippen** University of Florida
2025	**Cesar Delgado** North Carolina State University
2025	**Tina Vo** University of Nevada, Las Vegas
2025	**Li Ke** University of North Carolina, Chapel Hill
2025	**Linda Morell** UC Berkeley
	Board Liaison
2023	**Knut Neumann** Leibniz Institute for Science and Mathematics Education
	Ex Officio Members
2025	**Troy Sadler** (*JRST* Editor) University of North Carolina, Chapel Hill
2025	**Felicia Moore Mensah** (*JRST* Editor) Teachers College, Columbia University
2024	**Gillian Roehrig** (President) University of Minnesota
2024	**Cynthia Crockett** NSTA Research Division Director Harvard University
	Lisa Martin-Hansen (Executive Director)

Research Committee

Final Year	Committee Leadership
2023	**Rouhollah Aghasaleh** (Chair) Humboldt State University
2024	**Sarah Fick** (Co-Chair) Washington State University
	Members
2023	**Lori Andersen** University of Kansas
2023	**Narendra Deshmukh** Tata Institution of Fundamental Research
2023	**Sissy Wong** University of Houston
2024	**Natalie King** Georgia State University
2024	**Jessica Karch** University of Massachusetts, Boston
2024	**Peter Wulff** University of Potsdam, Germany
2024	**Mwenda O Kudumu** North Carolina State University
2025	**James Nyachwaya** North Dakota State University
2025	**Bryan H. Nichols** Florida Atlantic University
2025	**Ezgi Yesilyurt** Weber State University
2025	**Mina Sedaghatjou** Alfred University
2025	**Karen Woodruff** Montclair State University
2025	**Liam Guilfoyle** University of Oxford
	Board Liaison
2024	**Malcolm Butler** University of North Carolina, Charlotte
	NARST Liaison to NSTA
2024	**Michael Bowen** Mount Saint Vincent University

NARST Leadership Committees

Social Media, Website and Communications Committee	
Final Year	**Committee Leadership**
2023	**Len Annetta** (Chair) East Carolina University
2025	**Ryan Cain** (Co-Chair) Weber State University
	Members
2023	**Jaclyn Murray** Augusta University
2023	**Amber Adgerson** University of South Carolina
2024	**Stephanie Teeter** North Carolina State University
2024	**Stanton Belford** University of Tennessee Southern
2024	**Mark Newton** East Carolina University
2024	**Amy Voss Farris** Penn State University
2025	**Anna Maria Arias** Kennesaw State University
2025	**Sarah Frodsham** Oxford Brookes University
2025	**Won Jung Kim** Santa Clara University
	Board Liaison
2023	**Christina Schwarz** Michigan State University

Sponsorship Program for Graduate Student Memberships

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

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

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

NARST Recognizes and Thanks This Year's Graduate Student Sponsors:

Meg Blanchard

Kathryn Hayes

Lisa Martin-Hansen

Felicia Mensah

Jonathan Osborne

Brian Reiser

Gillian Roehrig

Christina Schwarz

Jennifer Slavick

Brooke Whitworth

Become a Graduate Student Sponsor!

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Contact Claudia Acuna
Editor, Social Sciences

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NARST 2024 Conference Theme

Prepared by Jomo W. Mutegi

Science Education for the Rest of Us

William Lutz, in his book *Doublespeak*, describes the various ways that governments and corporations present alternative truths and misrepresent reality. In one of his lectures on the book, Lutz used sugar labeling as an example of doublespeak. After the lecture an audience member explained that he had been diagnosed with diabetes some years prior. The audience member further explained that he and his wife were religious about reading food labels and avoiding food products with added sugar. He then grew solemn as he thanked Lutz and admitted that, "I just learned today that for years I've been eating 'sugar-free' products that actually contain sugar."

This audience member is not alone. A 2017 study in the journal *Preventing Chronic Disease* found that many consumers (anywhere from 25-50%) have difficulty understanding and making decisions based on nutrition labels. Neither is this audience member alone in his struggle against diabetes. In 2012, the CDC estimated that one in every 7 to 8 adults had Type II Diabetes. And this number is growing rapidly. Between 1990 and 2010, the number of people with diabetes tripled.

Diabetes is not the only threat. Lead tainted water, adulterated food, perfluoroalkyl substances, addictive devices, corporate and governmental disinformation, and adverse cultural agendas are among hundreds of threats that accompany STEM advances. Although children spend most of their waking hours in school, studies on public understanding of science consistently show that they are not becoming adults who are able to recognize, understand and successfully navigate these threats. While the threats that result from STEM advances are not caused by STEM educators (and those with a vested interest in STEM education), we may unknowingly be complicit in maintaining them.

One of our biggest challenges may be our longstanding effort to use K-12 science education as a space for producing more scientists. The goal of producing more scientists has been explicitly articulated in every major reform movement from *Sputnik to Science for All Americans*, to the *National Science Education Standards*, to the *Next Generation Science Standards*.

The effort to produce more scientists would not be a problem except that the percentage of scientists is very small. In its Science Report, Towards 2030, the United Nations Educational, Scientific, Cultural Organization (UNESCO) reports that there are 7.8 million full-time science researchers worldwide. While this number may seem large it represents only 0.1% of the world's population. So we are essentially teaching a version of science to all children that amounts to career preparation for 0.1% of the world. At the same time, the rest of us (99.9%) are not gaining an understanding of science that would enable us to enrich our lives.

The conference theme, ***Science Education for the Rest of Us***, is intended to foreground the purpose of science education, and to draw our collective attention to the many socio-scientific issues that are increasingly important in modern society but have yet to find a place in the standard K-12 curriculum. There is no better place to engage in this exciting work than with colleagues at the 2024 NARST Annual Conference.

We welcome your contributions and look forward to seeing you in Denver!

SCIENCE EDUCATION FOR THE REST OF US

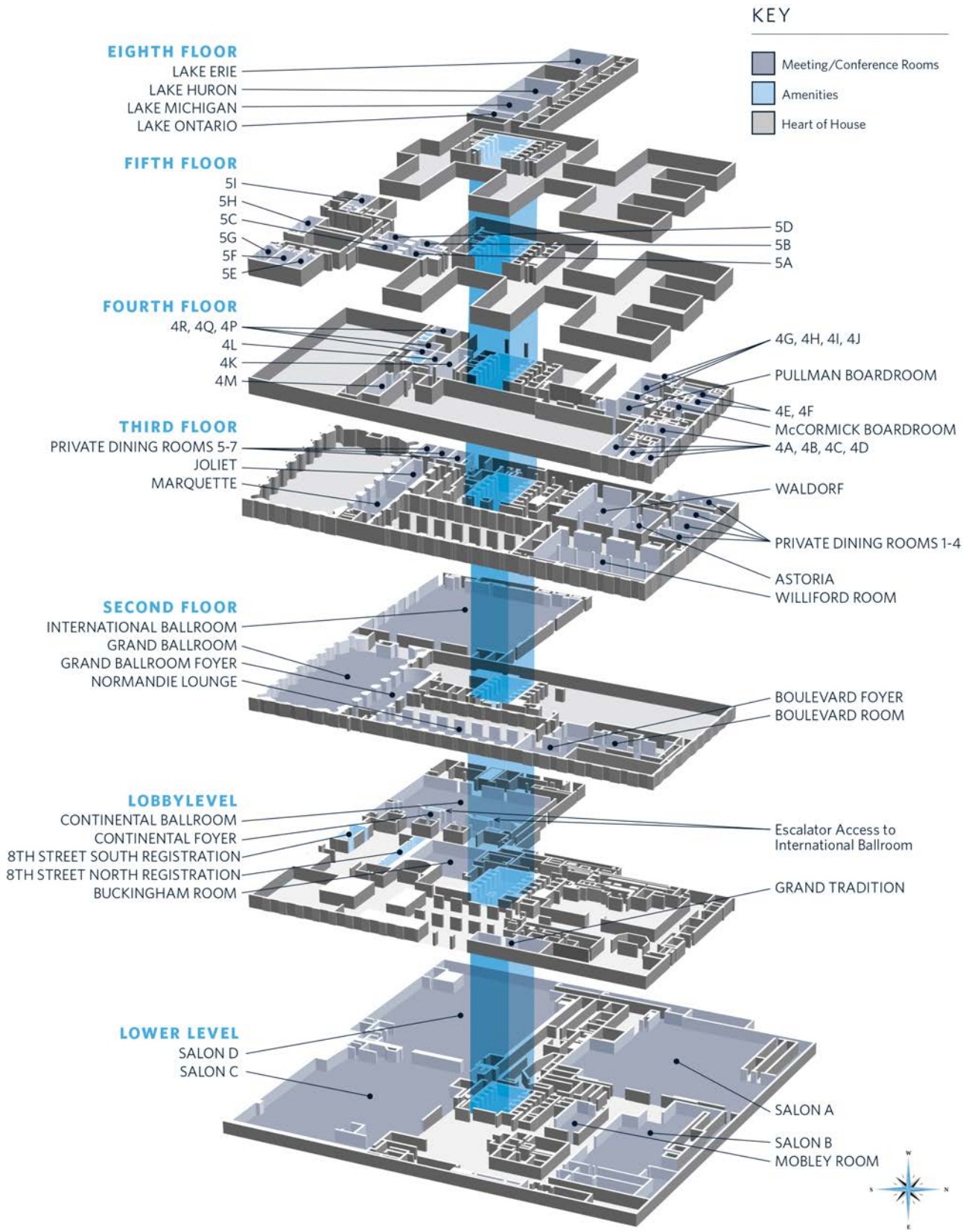
NARST
A global organization for improving science education through research

NARST 2024

97th Annual International Conference

March 17-20
Denver, CO

Hilton Chicago Floor Map



NARST 2023 International Conference
Schedule at a Glance

All times are USA Central Time

Regular Sessions	*Workshops*	*Business Meetings*	*Social Events*
Date/Time	**Event**		**Room**
Monday, April 17			
3:00 pm – 5:00 pm	Registration		8th St. Foyer on Lobby Level [near Business Center]
8:00 am – 5:00 pm	NARST Board Meeting		Waldorf
Tuesday, April 18			
Pre-Conference Events			
7:30 am – 7:00 pm	Registration		2nd floor landing
8:00 am – 12:00 pm	NARST Board Meeting		Waldorf
8:00 am – 9:00 am	Mentor-Mentee Nexus (ticketed event) Sponsor: Membership Committee		Salon A5
9:10 am – 10:10 am	Early Career Faculty Forum (ticketed event) Sponsor: Membership Committee		Salon A5
10:20 am – 11:20 am	Welcome Session (ticketed event) Sponsor: Membership Committee		Salon A5
Pre-Conference Workshops			
8:00 am – 11:45 am	Integrating Science with Computer Science for Linguistically Diverse Classrooms at Upper Elementary Grades via Educational Robotics Sponsor: Research Committee		Salon A1
8:00 am – 11:45 am	Use of cutting-edge technologies in STEM education. Programs and lessons learned with AR, VR, and 3D modeling Sponsor: Research Committee		Salon A2
8:00 am – 11:45 am	Critically theorizing the margins for reform-based equity in science: A disobedient reckoning Sponsor: Equity and Ethics Committee		Salon A3

8:00 am – 11:45 am	Towards Scientific Literacy in Inclusive Science Education – A New Approach to Support Pre- and In-Service Teachers Sponsor: Research Committee	Salon A4
8:00 am – 11:45 am	Observing Integrated STEM Education in K-12 Science and Engineering Classrooms with New Tools and Resources Sponsor: Research Committee	Salon C1-2
8:00 am – 11:45 am	Assessing Early Childhood and Primary Students' Views of Science: Learning to Administer and Score two Valid and Reliable Instruments (Views about Scientific Inquiry- Elementary and Young Children's Views about Science) Sponsor: Research Committee	Salon C3-4
8:00 am – 11:45 am	Dismantling Systemic Inequalities in Indigenous STEM Education Sponsor: ISK-RIG	Spencer Foundation, 625 N Michigan Ave
11:45 am – 1:00 pm	Graduate Student Luncheon [ticketed event]	Salon A5
11:45 am – 1:00 pm	Lunch break	
Conference Begins		
1:00 pm – 1:30 pm	Presidential Welcome: Gillian Roehrig, NARST President	Grand Ballroom
1:30 pm – 2:45 pm	Keynote Address: Dr. Christine Cunningham, Pennsylvania State University *Engineering Science Reform*	Grand Ballroom
3:00 pm – 4:30 pm	Concurrent Session #1	See Program
4:45 pm – 6:15 pm	Concurrent Session #2	See Program
7:00 pm – 8:30 pm	Presidential Reception and Welcome Celebration (appetizers and cash bar)	Grand Ballroom

Wednesday, April 19		
6:00 am – 8:00 am	Mind and Sole Fun Run (off-site) *Not sponsored by NARST*	Meet in Conference Hotel Lobby
7:30 am – 4:30 pm	Registration	2nd floor landing
7:00 am – 8:00 am	RIG Business Meetings [continental breakfast provided beginning at 6:30 am]	Salon A Foyer
	Asian and Pacific Islander Science Education Research [APISER]	Salon A1
	Latino/a RIG [LARIG]	Salon A2
	Contemporary Methods for Science Education Research	Salon A3
	Engineering Education [ENE-RIG]	Salon A4
	Indigenous Science Knowledge [ISK-RIG]	Salon A5
	Research in Artificial Intelligence-involved Science Education [RAISE]	Salon C1-2
	Continental and Diasporic Africa in Science Education RIG (CADASE)	Salon C3-4
8:25 am – 9:55 am	Concurrent Session #3 (includes Roundtables #1)	See Program
9:55am – 10:20am	Coffee break	Salon A Foyer and Normandie Room (2nd Floor)
10:20 am – 11:50 am	Concurrent Session #4	See Program
11:50 pm – 1:00 pm	Lunch break	
1:00 pm – 2:30 pm	Concurrent Session #5	See Program
2:45 pm – 4:15 pm	Awards Dessert Reception (Coffee and dessert provided)	Grand Ballroom
4:30 pm – 6:00 pm	Concurrent Session #6	See Program
6:30 pm – 7:30 pm	Graduate Student Forum	Salon A5
6:30 pm – 7:30 pm	JRST Dinner (by invitation)	Astoria

Thursday, April 20		
7:30 am – 4:30 pm	Registration	2nd floor landing
7:30 am – 8:30 am	Committee Meetings [continental breakfast provided beginning at 7:15 am]	Salon A Foyer
	Elections	Salon A2
	Awards	Salon A3
	Research	Salon A4
	Equity and Ethics	Salon C1-2
	External Policy and Relations	Salon C3-4
	International	Salon C5-6
	Graduate Students	Salon C7-8
	Membership	Salon A1
	Publications Advisory	Salon A5
	Social Media, Website, Communications	Blvd A
	Program [strand coordinators]	Blvd C
8:40 am – 10:10 am	Concurrent Session #7	See Program
10:30 am – 12:00 pm	Concurrent Session #8 (Includes Roundtables #2)	See Program
12:00 pm – 1:10 pm	Lunch break	
1:10 pm – 2:40 pm	Concurrent Session #9	See Program
2:50 pm – 3:35 pm	Poster Session A (coffee and snacks provided)	Grand Ballroom
3:35 pm – 4:20 pm	Poster Session B (coffee and snacks provided)	Grand Ballroom
4:30 pm – 6:00 pm	Concurrent Session #10	See Program
6:10 pm – 9:00 pm	Equity and Ethics Dinner (registration and prepay required)	Off-site

Friday, April 21		
8:00 am -12:00 pm	Registration	2nd floor landing
8:00 am – 8:50 am	Membership and Business Meeting Meet Board of Directors [continental breakfast provided beginning at 7:30 am]	Salon A1
9:00 am – 10:30 am	Concurrent Session #11	See Program
10:45 am – 12:15 am	Concurrent Session #12 (Includes Roundtables #3)	See Program
12:15 pm – 1:45 pm	Lunch break	
1:45 pm – 3:15 pm	Concurrent Session #13	See Program
3:15 pm – 4:15 pm	CLOSING SESSION Looking ahead to the 2024 Conference Showing appreciation for Board and Committee leadership.	Salon A1
5:00 pm – 10:00 pm	NARST Board meeting	Off-site

Note: The Normandie Room on the 2nd Floor is available to use all week as a break room and workspace.

Friday, April 28	**All-Virtual Conference Day**	
7:00 am – 7:30 am	Welcome from President Gill Roehrig and Conference Overview	Zoom A
7:45 am – 8:45 am	Concurrent Session #1	Zoom A and B
8:45 am – 9:15 am	Breakout Discussions	Multiple breakout rooms
9:30 am – 10:30 am	Concurrent Session #2	Zoom A and B
10:45 am – 12:00 pm	Concurrent Session #3	Zoom A and B
12:15 pm – 1:00 pm	Poster Session	Poster Gallery
1:00 pm – 2:00 pm	Lunch break	
2:00 pm – 3:00 pm	Concurrent Session #4	Zoom A and B
3:15 pm – 4:15 pm	Concurrent Session #5	Zoom A and B
4:15 pm – 4:40 pm	Breakout Discussions	Multiple breakout rooms
4:40 pm – 5:00 pm	Closing Session Remarks from outgoing President Gill Roehrig and incoming President Jomo Mutegi	Zoom A

Pre-Conference Workshops

Research Committee
Pre-Conference Workshop
4/18/23, 8:00-11:45, Salon A1 (LL)

Integrating Science with Computer Science for Linguistically Diverse Classrooms at Upper Elementary Grades via Educational Robotics

ORGANIZERS
Erdogan Kaya, George Mason University, USA
Ezgi Yesilyurt, Weber State University, USA
Refika Turgut, University of South Carolina Upstate, SC, USA
Burak Sahin, University of Nevada, Las Vegas, NV, USA
Hasan Deniz, University of Nevada, Las Vegas, NV, USA

Research Committee
Pre-Conference Workshop
4/18/23, 8:00-11:45, Salon A2 (LL)

Use of cutting-edge technologies in STEM education. Programs and lessons learned with AR, VR, and 3D modeling

ORGANIZERS
Sandra Arango-Caro, Donald Danforth Plant Science Center, USA
Kristine Callis-Duehl, Donald Danforth Plant Science Center, USA

Equity And Ethics Committee
Pre-Conference Workshop
4/18/23, 8:00-11:45, Salon A3 (LL)

Critically theorizing the margins for reform-based equity in science: A disobedient reckoning

ORGANIZERS
Philip Boda, University of Illinois, Chicago, IL, USA
Justice Walker, The University of Texas, El Paso, TX, USA
Gary Wright, North Carolina State University, NC, USA

Research Committee
Pre-Conference Workshop
4/18/23, 8:00-11:45, Salon A4 (LL)

Towards Scientific Literacy in Inclusive Science Education - A New Approach to Support Pre- and In-Service Teachers

ORGANIZERS
Lisa Stinken-Rösner, Leuphana University, Lueneburg, Germany
Stefanie Lenzer, Leibniz University, Hannover, Germany
Laura Sührig, Goethe University, Frankfurt, Germany
Andreas Nehring, Leibniz University, Hannover, Germany
Simone Abels, Leuphana University, Lueneburg, Germany

Research Committee
Pre-Conference Workshop
4/18/23, 8:00-11:45, Salon C1-2 (LL)

Observing Integrated STEM Education in K-12 Science and Engineering Classrooms with New Tools and Resources

ORGANIZERS
Emily Dare, Florida International University, FL, USA
Joshua Ellis, Florida International University, FL, USA
Elizabeth Ring-Whelan, St. Catherine University, USA
Gillian Roehrig, University of Minnesota - Twin Cities, MN, USA
Mark Rouleau, Michigan Technological University, MI, USA
Benny Hiwatig, University of Minnesota – Twin Cities, MN, USA
Farah Faruqi, University of Minnesota – Twin Cities, MN, USA
Christopher Irwin, Florida International University, FL, USA

Research Committee
Pre-Conference Workshop
4/18/23, 8:00-11:45, Salon C3-4 (LL)

Assessing Early Childhood and Primary Students' Views of Science: Learning to Administer and Score two Valid and Reliable Instruments (Views about Scientific Inquiry- Elementary and Young Childrens' Views about Science)

ORGANIZERS
Judith Lederman, Illinois Institute of Technology, IL, USA
Selina Bartels, Valparaiso University, IN, USA

Indigenous Science Knowledge (ISK-RIG)
Pre-Conference Workshop
4/18/23, 8:00-11:45, Off-Site

Dismantling Systemic Inequalities in Indigenous STEM Education

ORGANIZERS
Sharon Nelson-Barber, WestEd, USA
Rouhollah Aghasaleh, California State Polytechnic University, Humboldt, CA, USA
Megan Bang, Northwestern University, IL, USA
Pauline Chinn, University of Hawai`i at Mānoa, HI, USA
Josiah Hester, Northwestern University, IL, USA
Julie Robinson, University of North Dakota, ND, USA
Linda Tuhiwai Smith, Te Whare Wānanga o Awanuiārangi, New Zealand
Bhaskar Upadhyay, University of Minnesota, MN, USA
David Zandvliet, Simon Fraser University, Canada

Other Pre-Conference Events

Board of Directors
NARST Board Meeting
4/18/23, 8:00-12:45, Waldorf (L3)

Membership Committee
Sponsored Session: Mentor-Mentee Nexus
4/18/23, 8:00-9:00, Salon A5 (LL)

ORGANIZERS
Elizabeth de los Santos, University of Nevada, USA
Shiang-Yao Liu, National Taiwan Normal University, Taiwan
Harini Krishnan, Florida State University, USA

Membership Committee
Sponsored Session: Early Career Faculty Forum
4/18/23, 9:10-10:10, Salon A5 (LL)

ORGANIZERS
K.C. Busch, North Carolina State University, USA
Harleen Singh
Brooke Whitworth, Clemson University, USA

Membership Committee
Sponsored Session: NARST Welcome Session
4/18/23, 10:20-11:20, Salon A5 (LL)

ORGANIZERS
Tuğba Yüksel, Recep Tayyip Erdogan University, Turkey
Robert Bennett, Georgia State University, USA
Melanie Kinskey, Sam Houston State University, USA

Graduate Student Committee
Social Event: Graduate Student Luncheon
4/18/23, 11:45-13:00, Salon A5 (LL)

CADASE RIG
Sponsored Session: CADASE RIG Meet and Greet
4/18/23, 11:45-13:00, Salon C5-6 (LL)

Opening Session: Presidential Welcome
4/18/23, 13:00-13:30, Grand Ballroom (L2)

Welcome Address by NARST President Gillian Roehrig
Introduction to the NARST Board Members

Keynote Speaker: Keynote Address
4/18/23, 13:30-14:45, Grand Ballroom (L2)

Engineering Science Reform
Christine Cunningham*, Pennsylvania State University, USA

Concurrent Session 1
4/18/23, 15:00-16:30

Indigenous Science Knowledge (ISK-RIG)
Sponsored Session: Exploring the Potential of Locally- and Globally-Valued Knowledges
4/18/23, 15:00-16:30, Salon A5 (LL)

ORGANIZERS
Sharon Nelson-Barber, WestEd, Portland, OR, USA

PANELISTS
David Zandvliet, Simon Fraser, Burnaby, BC, Canada
Julie Robinson, U of North Dakota, Grand Forks, ND, USA
Joshua Hunter, U North Dakota, Grand Forks, ND, USA
Bhaskar Upadhyay, U Minnesota, Minneapolis, MN, USA
Pauline Chinn, U Hawai'i, Mānoa, Mānoa, HI, USA
Paichi Shein, National Sun Yat-sen University, Kaohsiung, Taiwan
Peresang Sukinarhimi, National Sun Yat-sen University, Kaohsiung, Taiwan
Tzu yu Kuo, National Sun Yat-sen University, Kaohsiung, Taiwan

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Strand 1: Science Learning: Development of student understanding
SC-Organized Paper Set: Students' Use of Computational Models and Reasoning
4/18/23, 15:00-16:30, Salon C1-2 (LL)

Do different types of computational models prompt different types of reasoning?
Emil Eidin*, Michigan State University, USA
Jonathan Bowers, Michigan State University, USA

Right but Wrong: The Independence of Mechanistic Reasoning and Canonical Understanding in Studying Diffusion
Tamar Fuhrmann*, Teachers College, Columbia University, USA
Leah Rosenbaum, Teachers College, Columbia University, USA
Adelmo Eloy, Teachers College, Columbia University, USA
Aditi Wagh, MIT, USA
Jacob Wolf, Teachers College, Columbia University, USA
Paulo Blikstein, Teachers College, Columbia University, USA
Michelle Wilkerson, University of California, Berkeley, USA

Supporting Learners to Evaluate Computational Models: Mechanistic Reasoning about Machine Learning
Anna Kim*, Pennsylvania State University, USA
Amy Farris, Pennsylvania State University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Science Teaching & Instruction
4/18/23, 15:00-16:30, Salon C3-4 (LL)

Physics and Wine: an amazing everyday context for science teaching even without alcohol
Lutz Kasper*, University of Education, Physics Dept., Germany
Patrik Vogt, Institute for Teacher Education (ILF), Germany

Qualitative Cases of Science Teaching Practice: Comparing Instruction Based on Value-Added Ratings.
Elif Özülkü*, University of Notre Dame, USA
Matthew Kloser*, University of Notre Dame, USA
Aria Malkani, University of Notre Dame, USA
Spencer Bullinger*, University of Notre Dame, USA
Lauren Ostdiek*, University of Notre Dame, USA
Catherine Wagner*, University of Notre Dame, USA

How Convincing Are Experiments? A Comparison of Eight Interactive Videos
Lion Glatz*, Goethe University Frankfurt, Germany
Roger Erb, Goethe University Frankfurt, Germany
Albert Teichrew, Goethe University Frankfurt, Germany

Science Teachers' Noticing of Science and Engineering Practices: Does Being Out-of-Field Matter?
Harleen Singh*, California State University Stanislaus, USA
Hatice Ozen-Tasdemir, University of Georgia, USA
Yuzi Huang, University of Georgia, USA
Joeseph Deluca, University of Georgia, USA
Julie Luft, University of Georgia, USA
Brooke Whitworth, Clemson University, USA

Strand 4: Science Teaching - Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set: Academic Language, Argumentation, and Science Teaching
4/18/23, 15:00-16:30, Blvd A (L2)

Expanding sensemaking spaces for multilingual students through translanguaging instructional practices
María González-Howard*, The University Of Texas at Austin, USA
Sage Andersen, The University Of Texas at Austin, USA
Karina Méndez Pérez, The University of Texas at Austin, USA

"*The Dead Sea is Dying*" - *Language-Sensitive Science Teaching for Students with Diverging Language Competences*
Robert Gieske*, Freie Universität, Germany
Claus Bolte, Freie Universität, Germany

Evolving Language in Middle School Project-Based Astronomy
Merryn Cole*, University of Nevada, Las Vegas, USA
Tom Ryan*, University of Nevada, Las Vegas, USA
Jennifer Wilhelm*, University of Kentucky, USA

Does learning how to deal with data lead to more scientific argumentation?
Engin Kardas*, Karlsruhe University of Education, Germany
Tobias Ludwig, Karlsruhe University of Education, Germany

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: STEM Student Sense of Belonging and Identity Development
4/18/23, 15:00-16:30, Salon C5-6 (LL)

Factors Associated with Undergraduate Students' Sense of Belonging in STEM Disciplines
Gili Marbach-Ad*, University Of Maryland, USA
Sara Gliese, University Of Maryland, USA
Katerina Thompson, University Of Maryland, USA

Students' sense of belonging in a community of practice fosters scientific literacy and identity formation.
Josie Smith, Colorado State University, USA
Gary McDowell*, Lightoller LLC, USA
Meena Balgopal, Colorado State University, USA
Rebeccah Lijek, Mount Holyoke College, USA

Exploring a Relationships between Students' Science Identities and Achievement Emotions in Physics
Mihwa Park*, Texas Tech University, USA

Introduction to Primary Literature Course: Impacts on undergraduate students' science identity and interest in research
Takunda Maisva*, Syracuse University, USA
Mariah Maxwell*, Syracuse University, USA
Jason Wiles, Syracuse University, USA

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set: Families and Play in Contributing to STEM learning
4/18/23, 15:00-16:30, Blvd C (L2)

How Families' Make Learning Personally Relevant while Using a Pollinator-focused Mobile Augmented Reality (MAR) app
Lucy McClain*, Penn State University, USA
Heather Zimmerman, Penn State University, USA
Susan Land, Penn State University, USA
Stephanie Bowles, Penn State University, USA
Charles Keith, Penn State University, USA
Lillyanna Faimon, Penn State University, USA
Yu-Chen Chiu, Penn State University, USA

Play: The Missing Link for Beginning STEM Learning
Sue Tunnicliffe*, UCL, United Kingdom
Yinka Ogunlade, Ekiti State University, Nigeria
Adekunle Oladejo, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Peter Okebukola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Juma Shabani, University of Burundi, Burundi
Rose Agholor, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Angela Irene, National Universities Commission, Nigeria
Deborah Agbanimu, Africa Centre of Excellence for Innovative and

Transformative STEM Education, Lagos State University, Nigeria
Bugoma Suwadu, University of Burundi, Burundi

Parents as STEM Facilitators: Perspectives following a Parent/Child Workshop Series
Meghan Marrero*, Mercy College, USA
Kristen Napolitano*, Mercy College, USA
Amanda Gunning, Mercy College, USA

Cohetes y Rábanos /Rockets and Radishes: Pilot Participant Perspectives of Parent-Daughter Programs
Peter Rillero*, Arizona State University, USA
Margarita Silva*, UC Davis, USA
Mila Librea-Carden*, University of North Texas, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Supporting Inclusive, Equitable, and culturally responsive Teaching
4/18/23, 15:00-16:30, Salon A2 (LL)

Development and use of assessment tool to understand equity outcomes in a teacher education program
Allyson Rogan-Klyve*, Central Washington University, USA
Adrienne Pinsoneault*, Central Washington University, USA
Danielle Wadlington*, Quetzal Education Consulting, USA
Jennifer Dechaine, Central Washington University, USA

Noticing for Equity: Supporting Preservice Science Teachers for Inclusive and Equitable Teaching
Mutiara Syifa*, The Ohio State University, USA
Sophia Jeong, The Ohio State University, USA
Ashlyn Pierson, The Ohio State University, USA

Exploring Culturally Responsive Teaching in an Urban Teacher Residency Through Program Structures
Elaine Howes*, American Museum of Natural History, USA
Jamie Wallace*, American Museum of Natural History, USA

Investigating Teacher Educator Practices for Pre-Service Teachers' Enactment of Justice-Oriented Science Teaching
Grace Tukurah*, Michigan State University, USA
Matthew Adams*, Michigan State University, USA
Kate Miller*, Michigan State University, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Exploring Knowledge and Pedagogical Content Knowledge Development in Preservice Teacher Education
4/18/23, 15:00-16:30, Salon A3 (LL)

Supporting Preservice Teachers' Science Content Knowledge for Teaching (CKT)
Dustin Van Orman*, Western Washington University, USA
Josie Melton*, Western Washington University, USA
Deborah Hanuscin*, Western Washington University, USA
Daniel Hanley*, Western Washington University, USA

Katherine Castellano, Educational Testing Service (ETS), USA
Jamie Mikeska, Educational Testing Service (ETS), USA
Emily Borda, Western Washington University, USA

Pedagogical content knowledge and content knowledge in elementary in-service teachers.
David Santibáñez*, Universidad Finis Terrae, Chile

The influence of cPCK- and pPCK-Scaffolds on video analysis skills in early pre-service teacher education
Marie Irmer, Ludwig-Maximilians-University, Germany
Dagmar Traub*, Ludwig-Maximilians-University, Germany
Christian Förtsch, Ludwig-Maximilians-University, Germany
Birgit Neuhaus, Ludwig-Maximilians-University, Germany

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Asset Perspectives of In-Service Teacher Education Towards Equitable Teaching
4/18/23, 15:00-16:30, Salon A1 (LL)

Adapting Designed Curriculum to Local Contexts through Professional Learning Communities
Cory Miller*, Michigan State University, USA
Kathryn Bateman*, Michigan State University, USA
Joseph Krajcik, Michigan State University, USA

Using video reflection as research tools to more equitably engage students and families
May Lee*, The Pennsylvania State Univers, USA
Jennifer Cody, The Pennsylvania State Univers, USA
Carla Zembal-Saul, The Pennsylvania State Univers, USA

Envisioning equity: Teacher conceptualization of an inclusive science classroom
Jackson Jackson, The Pennsylvania State University, USA
Brandin Conrath*, The Pennsylvania State University, USA
Scott McDonald, The Pennsylvania State University, USA

Designing a More Socially Just Science Through Community Mapping
Kathryn Bateman*, Michigan State University, USA
Jonathan McCausland*, New Mexico Highlands University, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Promoting quality in science education with evolutionary assessment
4/18/23, 15:00-16:30, Astoria (L3)

The PISA Science Assessment for 2025
Jonathan Osborne*, Stanford University, USA

A data-driven justification for scientific inquiry in promoting students' scientific literacy
Jing Lin*, Beijing Normal University, China

Weiwei He, Beijing Normal University, China
Letong Zhang, Beijing Normal University, China
Ren Liu, Shandong University, China

A new instructionally-meaningful rubric designed for the NGSS
Jill Wertheim*, WestEd, USA
Lauren Stoll, WestEd, USA
Cathy Zozakiewicz, WestEd, USA

Reality Vs Expectations of Assessment in STEM Education: An exploratory case study
Mohamed El Nagdi*, American University in Cairo, Egypt
Gillian Roehrig*, University of Minnesota, Twin Cities, USA

Strand 11: Cultural, Social, and Gender Issues
Symposium: Equity in STEM Education Research and Praxis Post "2020"
4/18/23, 15:00-16:30, Salon A4 (LL)

Equity in STEM Education Research and Praxis Post "2020"
Tia Madkins*, The University of Texas at Austin, USA
Natalie King, Georgia State University, USA
Andrea Dziengue, Georgia State University, USA
Remy Dou*, Florida International University, USA
Heidi Cian*, Florida International University, USA
Terrell Morton*, University of Illinois Chicago, USA
NaTashua Davis, University of Missouri, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Antiracist Science Teaching: Resistance, Conscientization, and Critical Hope
4/18/23, 15:00-16:30, Waldorf (L3)

Relationships as Resistance: Pedagogy and Praxis Among Black STEM Teachers from Alternative Pathways
Mia Pungello*, Davidson College, USA
Brittany Murray, Davidson College, USA
Terrance Burgess, Michigan State University, USA
Jerry Wilson, University of North Carolina, USA

Learning to teach students science in anti-racist Ways: Self-reflection, curricular planning, and interactions
Kathleen Schenkel*, San Diego State University, USA
Lucyann Atkins, San Diego State University, USA

Biking to Uncover Science in Urban Communities: Pre-service Science Teachers' Critical Conscientization of Science-Community
Noemi Waight*, University at Buffalo, USA
Jennifer Tripp*, Buffalo Public Schools, USA
Ryan Rish, University at Buffalo, USA
Monica Miles, Teachers College, USA
Kellyann Ramdath*, University at Buffalo, USA
Sarah Robert, University at Buffalo, USA
Seamus Gallivan, Slow Roll Buffalo, USA

"A Good Stepping Stone": How Novice Teachers Navigate Tensions While Moving Towards Equitable Field-Based Education

Alexandra Race*, University of California, Santa Cruz, USA
Doris Ash, University of California, Santa Cruz, USA

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set: Extended Reality in Teaching and Learning
4/18/23, 15:00-16:30, PDR 2 (L3)

The Food-Energy-Water Nexus: Using [the tool] to Support Undergraduate Students' Learning about Complex Socio-Hydrologic Issues
Silvia-Jessica Mostacedo-Marasovic*, University of Texas at Arlington, USA
Holly White, University of Maine, USA
Cory Forbes, University of Texas at Arlington, USA

Elementary Preservice Teachers Learn Cardiac Form and Function with 3-D, Haptically-Enabled, Virtual Reality
Darby Drageset*, University of Florida, USA
Kent Crippen*, University of Florida, USA
Jeungtae Eom, University of Florida, USA
Hada Herring, University of Florida, USA
Niki Koukoulidis, University of Florida, USA

Home Far Away: Exploring Virtual Field Trips as a Tool for Social Justice-Based Science Education
Bryan Brown*, Stanford University, USA
Kathryn Ribay*, San Jose State University, USA
Kendra Sobomehin*, Stanford University, USA
Tamara Sobomehin*, Stanford University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set: Developing Teachers' NOS Views
4/18/23, 15:00-16:30, Salon C7-8 (LL)

Preservice SPED Teachers' Nature of Science Conceptions and Lesson Planning
Mila Rosa Carden*, University of North Texas, USA
Bridget Mulvey, Kent State University, USA
Laura Corr, Arizona State University, USA

Exploring the view of NOS and PCK of NOS in a group of biology teachers.
Carolina Parraguez*, Universidad Catolica de Valparaiso, Chile
Paola Nuñez, Universidad Catolica de Valparaiso, Chile
Hernan Cofre, Universidad Catolica de Valparaiso, Chile

Leveraging a History and Philosophy of Science Course to Develop PCK for Teaching NOS
Khadija Fouad*, Appalachian State University, USA
Alan King, Appalachian State University, USA
Matthew Lance, Appalachian State University, USA

Pre-Service Teachers' Scientific Content Knowledge and Nature of Science Views after a Socioscientific Issues-based Unit
Savannah Graham*, Texas Christian University, USA
Hayat Hokayem, Texas Christian University, USA

Concurrent Session 2 4/18/23, 16:45-18:15

Contemporary Methods RIG Sponsored Session: Measurement, Methodologies, and Methods in Science Education Research 4/18/23, 16:45-18:15, Salon A5 (LL)

ORGANIZERS
Francesca Williamson, Indiana University School of Medicine, USA
Brock Couch, University of New Hampshire, USA
Robert Talbot, University of Colorado, Denver, USA
Stanley Lo, University of California, San Diego, USA
Glenn Dolphin, University of Calgary, Canada
Joseph Taylor, University of Colorado, Colorado Springs, USA

PANELISTS
Nancy Staus, Oregon State University, USA
Samia Khan, University of British Columbia, Canada
Ben Van Dusen, Iowa State University, USA
Rou-Jia Sung, Carleton College, USA
Tiffany-Rose Sikorski, The George Washington University, USA
Megan Ennes, University of Florida, USA
Haider Ali Bhatti, University of California, Berkeley, USA
John Russell, EL Education, USA
Sophia Jeong, The Ohio State University, USA
Kathryn M. Bateman, The Pennsylvania State University, USA

Strand 1: Science Learning: Development of student understanding SC-Organized Paper Set: Conceptual Understandings in Biological Contexts 4/18/23, 16:45-18:15, Salon C1-2 (LL)

Influence of Self-Assessment and Conditional Metaconceptual Knowledge on Students' Conceptual Understanding of Evolution
Tim Hartelt*, University of Kassel, Germany
Helge Martens, University of Kassel, Germany

Exploring how students evaluate explanations about biological phenomena in different grades of elementary school
Yael Shtechman, Department of Science Teaching, Weizmann Institute of Science, Israel
Marida Ergazaki, Department of Educational Sciences and Early Childhood Education, University of Patras, Greece
Michal Haskel-Ittah*, Department of Science Teaching, Weizmann Institute of Science, Israel

Benefits of learning about the threshold concepts of randomness and probability in biological contexts
Helena Aptyka*, Institute for Biology Education, Faculty of Mathematics and Natural Sciences, University of Cologne, Germany
Daniela Fiedler, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Jörg Großschedl, Institute for Biology Education, Faculty of Mathematics and Natural Sciences, University of Cologne, Germany

Experimentally Comparing Student Interest in, Engagement in, and Comprehension of Expository and Narrative Biology Videos.
Matthew Kloser*, University of Notre Dame, USA
Michael Szopiak, University of Notre Dame, USA
Catherine Wagner*, University of Notre Dame, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Context and Learning Science
4/18/23, 16:45-18:15, Salon C3-4 (LL)

Ties That Bind: Identifying Influential Scholarship in Contextualized Science Learning Research Through Bibliometric Network Analysis
Michael Giamellaro*, Oregon State University, USA

The Importance of Classroom Emotional Climate in STEM Education Research
Felicity McLure*, Charles Darwin University, Australia
Barry Fraser, Curtin University, Australia
Rekha Koul, Curtin University, Australia

Ways to Learning Science are Undergoing Mutation: Would the Culturo-Techno-Contextual Approach be an Effective Variant?
Adekunle Oladejo*, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Peter Okebukola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Juma Shabani, University of Burundi, Burundi
Yinka Ogunlade, Ekiti State University, Nigeria
Bugoma Suwadu, University of Burundi, Burundi
Ibukunolu Ademola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Deborah Agbanimu, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Esther Peter, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Franklin Onowugbeda, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Olasunkanmi Gbeleyi, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria

Interest-Based Differentiated Instruction Through Varied Contextual Tasks in Chemistry Education
Fabien Gueth*, University of Duisburg-Essen, Germany
Helena van Vorst, University of Duisburg-Essen, Germany

Strand 3: Science Teaching - Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set: Modeling in Elementary Science Classrooms and Informal Science
4/18/23, 16:45-18:15, PDR 2 (L3)

Kindergarten Students' Constructed Models as Tools for Modeling-Based Investigations and Learning
Loucas Louca*, European University Cyprus, Cyprus

Modeling to (Re)think Scientific Language: A Case of Preservice Elementary Teachers Building Knowledge
Ayca Fackler*, University of Georgia, USA

Elementary Teachers as Collaborators: Developing Educative Supports for Citizen Science Projects
Sarah Carrier*, North Carolina State University, USA
Jill McGowan, North Carolina State University, USA
Lindsey Sachs*, Horizon Research, Inc., USA
Meredith Hayes, Horizon Research, Inc., USA
P. Smith*, Horizon Research, Inc., USA

The space between: Teacher perceptions of an interformal elementary science education program
Rachel Stronach*, University of Massachusetts Dartmouth, USA
Hamza Malik*, University of Massachusetts Dartmouth, USA
Stephen Witzig*, University of Massachusetts Dartmouth, USA

Strand 4: Science Teaching - Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set: Teacher Professional Identities and Reflective Teaching
4/18/23, 16:45-18:15, Blvd A (L2)

From bench scientist to middle school science educator: Lessons learned from Black STEM PhD holders
Monica Miles*, Teachers College, Columbia University, USA
Patricia Buenrostro*, Lake Forest College, USA

Understanding asset-based pedagogies through funds of knowledge and identity: A case for rural science teaching
Khanh Tran*, Purdue University, USA
Selcen Guzey*, Purdue University, USA

Inquiry (co)Learning: Science teachers' exemplary inquiry-based teaching
Shani Zur*, Technion, Israel
Tali Tal, Technion, Israel

Strand 5: College Science Teaching and Learning (Grades 13-20)
Symposium: Equity Considerations for Post-Secondary STEM Education
4/18/23, 16:45-18:15, Salon C5-6 (LL)

Equity Considerations for Post-Secondary STEM Education
Jennifer Adams*, University of Calgary, Canada
Sarah El Halwany*, University of Calgary, Canada
Kristal Turner, University of Calgary, Canada
Nadia Qureshi, University of Toronto, Canada
Takeshia Pierre*, University of Florida, USA
Rose Pringle, University of Florida, USA
Paulette Vincent-Ruz, New Mexico State University, USA
Katy Hosbein, Middle Tennessee State University, USA

Lucy Avraamidou, University of Groningen, Netherlands
Phillip Boda, University of Illinois Chicago, USA
Geraldine Cochrane, Rutgers, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Formal and informal science curriculum in pre-service science teacher education
4/18/23, 16:45-18:15, Salon A2 (LL)

Integrating non-formal activities in a formal pre-service science teacher education program
Isabel Borges*, Institute of Education - University of Lisbon, Portugal
Isabel Chagas, Institute of Education - University of Lisbon, Portugal

Recomposing the Practice of Teaching Elementary Science
Marti Canipe*, Northern Arizona University, USA

Differential effects of internal and external feedback on different types of teachers' professional knowledge
Büsra Tonyali*, University of Duisburg-Essen, Germany
Mathias Ropohl, University of Duisburg-Essen, Germany
Julia Schwanewedel, University of Hamburg, Germany

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Exploring STEM Research in curriculum and identity development at Teacher Preparation level
4/18/23, 16:45-18:15, Waldorf (L3)

An Overview of STEM in Bachelor of Education Programs in Canada
G. Michael Bowen*, Mount Saint Vincent University, Canada
Dawn Wiseman, Bishop's University, Canada
Marie-Claire Shanahan, University of Calgary, Canada
Samia Khan, University of British Columbia, Canada
Allison Gonsalves, McGill University, Canada
Pratim Sengupta, University of Calgary, Canada
Wendy Simms, Vancouver Island University, Canada
Eva Knoll, Université du Québec à Montréal, Canada
Ashley Carter, Mount Saint Vincent University, Canada

The STEM Problems Distinction Toward STEM Teacher Identity Development of Indonesia Pre-Service Science Teacher
Anjar Utomo*, University of Minnesota, USA
Gillian Roehrig, University of Minnesota, USA

The impact of STEM camp on prospective science teachers' identity development
Danielle Dani*, Ohio University, USA
Courtney Koestler, Ohio University, USA
Lizhen Chen, Ohio University, USA

Allyson Hallman Thrasher, Ohio University, USA
Kayla Heacock, Ohio University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Supporting Beginning through Experienced Science Teachers in Implementing Culturally Relevant Instruction
4/18/23, 16:45-18:15, Salon A3 (LL)

Science Teacher Preparation Through Abolitionist Teaching: A Narrative Inquiry Study
Vanessa Louis, Georgia State University, USA
Natalie King, Georgia State University, USA

Noyce Scholars Retention and Culturally Competent Teaching Practices
Peter Garik*, Boston University, USA
Donald DeRosa, Boston University, USA
Russell Faux, Davis Square Research Associates, LLC, USA
Anna Victoria Garik, Boston University, USA

Promoting culturally responsive STEM education in Indigenous serving schools through in-service teacher professional development.
Pradeep Dass*, Northern Arizona University, USA
Angelina Castagno, Northern Arizona University, USA
Darold Joseph, Northern Arizona University, USA
Chesleigh Keene, Northern Arizona University, USA
Crystal Macias, Northern Arizona University, USA

School-University partnerships in support of equitable primary science education
Maiza Trigo, The University of Luxembourg, Luxembourg
Ragnhild Barbu, The University of Luxembourg, Luxembourg
Sara Wilmes, The University of Luxembourg, Luxembourg
Kerstin te Heesen, The University of Luxembourg, Luxembourg
Christina Siry*, The University of Luxembourg, Luxembourg

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Developing and Assessing Science Teacher Learning
4/18/23, 16:45-18:15, Salon A4 (LL)

Towards a Typology of Science Teachers Engagement in Learning
Irit Vivante*, Ben Gurion University in the Negev, Israel
Dana Vedder-Weiss*, Ben Gurion University in the Negev, Israel

Developing biology teachers' pedagogical content knowledge in evolution: a case study with two experienced teachers
Arlette Bassaber*, Universidad Católica de Valparaiso, Chile
Claudia Vergara, Alberto Hurtado University, Chile
Hernan Cofre, Universidad Católica de Valparaiso, Chile

Exploring power amidst curricular reform through the language of teachers' episodes of pedagogical reasoning
Kevin Fleming*, The George Washington University, USA
Jonathon Grooms*, The George Washington University, USA
Alan Berkowitz, Cary Institute of Ecosystem Studies, USA

Application of implementation criteria to evaluate the outcomes of science teacher action research
Dace Namsone*, University of Latvia, Latvia
Kārlis Greitāns, University of Latvia, Latvia

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Evidence-based designing for science instruction
4/18/23, 16:45-18:15, Astoria (L3)

Fields in middle school energy instruction to support continued learning of energy
Kristin Fiedler*, Leibniz Institute for Science and Mathematics Education, Germany
Marcus Kubsch, Leibniz Institute for Science and Mathematics Education, Germany
Knut Neumann, Leibniz Institute for Science and Mathematics Education, Germany
Jeffrey Nordine, Leibniz Institute for Science and Mathematics Education, Germany

Tracking the Collaborative Design of a Culturally Relevant Environmental Chemistry Unit
Jeffrey Spencer*, University of Michigan, USA
Danielle Maxwell, University of Michigan, USA
Kaare Sikuaq Erickson, Ikaagun Engagement, USA
Linda Nicholas-Figueroa, I_isa_vik College, USA
Kerri Pratt, University of Michigan, USA
Ginger Shultz, University of Michigan, USA

A rose by any other name … COVID-19 and arguments about the use of "Chinavirus"
David Owens*, Georgia Southern University, USA
Michael Reiss, University College London, United Kingdom

Teachers' Descriptions and Rationales of Customizations of Storyline Science Curriculum: Adapting for Their Classroom Contexts
Katherine McNeill*, Boston College, USA
Caitlin Fine, Metropolitan State University of Denver, USA
Benjamin Lowell, Boston College, USA
Renee Affolter, Boston College, USA

Strand 11: Cultural, Social, and Gender Issues
Related Paper Set: Centering the Experiences, Pedagogies, and Needs of Black Women Science Teachers
4/18/23, 16:45-18:15, Salon A1 (LL)

But That's Just Good Science Teaching!: An Argument for Historically Relevant Science Pedagogy
Alexis Riley*, Cal State LA, USA

Racialized Gendered Experiences Black Women Science Teachers Endure Both With and Outside of the Classroom
Olayinka Mohorn-Mintah*, The University of Memphis, USA

The Need for Black Women Only Spaces in Science
Jordan Henley*, University of Georgia, USA
Mary Atwater, University of Georgia, USA

Developing Racial Literacy with a Black Woman Science Teacher: A Counterstory
Felicia Mensah*, Columbia University, USA
Alexis Riley, Cal State University - Los Angeles, USA
Jordan Henley, University of Georgia, USA
Olayinka Mintah, University of Detroit, USA
Althea Hoard, Relay Graduate School of Education, USA

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set: Exploring the urgency of climate change literacy
4/18/23, 16:45-18:15, Blvd C (L2)

"I am very disappointed in humankind." – Students' Perspectives and Emotions on Current Climate Change Education
Andrea Moeller*, University of Vienna, Austria
Johanna Kranz, Center of Excellence for Climate Change Impacts, Germany
Veronika Winter, University of Vienna, Austria

Teachers' rationales and approaches for teaching for climate change actions in secondary science classrooms
Lisa Borgerding*, Kent State University, USA
Breanna Beaver, Kent State University, USA
Adepeju Prince, Kent State University, USA
Jennifer Heisler, Kent State University, USA

Strand 15: Policy, Reform, and Program Evaluation
Related Paper Set: Leadership for the Promotion of Equity in Science and STEM Education
4/18/23, 16:45-18:15, Salon C7-8 (LL)

District Science Coordinators' Conceptions of and Levers for Advancing Equity Agendas
Christa Haverly*, Northwestern University, USA
Elizabeth Davis*, University of Michigan, USA
Angela Lyle, University of Michigan, USA
Emily Seeber, University of Michigan, USA

How Elementary Principals Support Equity-Focused STEM Teaching and Learning
Tia Madkins*, The University of Texas at Austin, USA
Joshua Childs*, The University of Texas at Austin, USA
Ain Grooms*, University of Wisconsin, Madison, USA
Stefanie Marshall, University of Minnesota, USA

Developing Elementary STEM Teacher Leaders
Amanda Gunning*, Mercy College, USA
Kristen Napolitano, Mercy College Center for STEM Education, USA
Elena Nitecki, Mercy College, USA
Meghan Marrero, Mercy College, USA

District Science Coordinators' Promotion of Equity in an Organization
Shaugnessy McCann*, University of Georgia, USA
Yamil Ruiz, Clemson University, USA
Brooke Whitworth, Clemson University, USA
Julie Luft, University of Georgia, USA
Joon Kum, University of Georgia, USA
Presidential Reception
4/18/23, 19:00-20:30, Grand Ballroom (L2)

Presidential Reception

Conference attendees, please join us for a reception in the Grand Ballroom!

Social Event
Mind and Sole Fun Run
4/19/2023 6:00-8:00

Meet in the conference hotel lobby!

Research Interest Group Business Meetings
4/19/2023 7:00-8:15

Salon A1 (LL)
Asian and Pacific Islander Science Education Research (APISER) RIG Meeting

Salon A2 (LL)
Latino/a RIG (LARIG) Meeting

Salon A3 (LL)
Contemporary Methods for Science Education Research RIG Meeting

Salon A4 (LL)
Engineering Education RIG (ENE-RIG) Meeting

Salon A5 (LL)
Indigenous Science Knowledge RIG (ISK-RIG) Meeting

Salon C1-2 (LL)
Research in Artificial Intelligence-Involved Science Education (RAISE) RIG Meeting

Salon C3-4 (LL)
Continental and Diasporic Africa in Science Education RIG (CADASE) Meeting

Concurrent Session 3
4/19/23, 8:25-9:55

Roundtables Session 1
4/19/23, 8:25-9:55, Salon A5 (LL)

Topic 1: Middle School Science

Strand 15: Policy, Reform, and Program Evaluation

Shifting Expectations for Authentic Inquiry in Namibian Junior Secondary Life Science Designated Curriculum

Rachel van Aswegen*, University of Virginia, USA
Lillian Bentley, University of Virginia, USA

Strand 12: Technology for Teaching, Learning, and Research

Enhancing middle school physical science lessons with embodied learning

Jonathan Margolin*, American Institutes for Research, USA
Connie Chandra, American Institutes for Research, USA
Lawrence Friedman, American Institutes for Research, USA
Katherine Guyot, American Institutes for Research, USA
Michaela Labriole, New York Hall of Science, USA
Megan Legault, American Institutes for Research, USA
Amelia Roach, American Institutes for Research, USA
Laycca Umer, New York Hall of Science, USA
Stephen Uzzo, National Museum of Mathematics, USA

Strand 1: Science Learning: Development of student understanding

Comparing Levels of Integration of Visual Representations within US Middle School Life Science Textbooks

Mary Nyaema*, University of Illinois, Chicago, USA
Nurcan Keles, Dicle University, Turkey

Topic 2: Affective issues in teaching and learning

Strand 2: Science Learning: Contexts, Characteristics and Interactions

A qualitative analysis of impostor phenomenon among discipline-based education researchers

Devasmita Chakraverty*, Indian Institute of Management Ahmedabad, India

Strand 2: Science Learning: Contexts, Characteristics and Interactions

Misery Creates Company: Female Student-Developed Support Systems in Physics Classes

Mihwa Park*, Texas Tech University, USA

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

Attention to Student Emotions and Teacher Vulnerability as Tools to Maintain Student Disciplinary Engagement

Jennifer Schellinger*, Florida State University, USA
Lama Jaber*, Florida State University, USA
Sherry Southerland*, Florida State University, USA

Strand 10: Curriculum and Assessment
Embedding Formative Assessment in Inquiry-Based Teaching: Students' Conceptual Learning
Feral Ogan-Bekiroglu*, Marmara University, Turkey
Simay Koksalan, Middle East Technical University, Turkey

Topic 3: Issues in College STEM Teaching

Strand 5: College Science Teaching and Learning (Grades 13-20)
Pedagogical Partnership: Collaborative Design of a Program to Support Pedagogical Improvement for University Engineering Instructors.
Kerry Rose*, University of Alberta, Canada
Mijung Kim*, University of Alberta, Canada
Janelle McFeetors*, University of Alberta, Canada
Qingna Jin*, University of Alberta, Canada

Strand 5: College Science Teaching and Learning (Grades 13-20)
Scientific Caricatures in Online Science Classrooms: Alternative Assessment Effectiveness in Virtual Environments
Renee Clary*, Mississippi State University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
Teaching Biology: A review about the contribution of Research
Claudia Vergara*, Alberto Hurtado University, Chile
Beatriz Becerra, Universidad Catolica de Valparaiso, Chile
Paola Nuñez, Universidad Catolica de Valparaiso, Chile
David Santibanez, Finnis Terrea University, Chile
Hernan Cofre*, Universidad Catolica de Valparaiso, Chile

Topic 4: Clarifying the Nature of Science

Strand 13: History, Philosophy, Sociology, and Nature of Science
Definition vs. Objective: A Century Old Struggle of Nature of Science Framework
Caglin Akillioglu *, Middle East Technical University, Turkey
Semra Sungur, Middle East Technical University, Turkey
Jale Cakiroglu, Middle East Technical University, Turkey

Strand 13: History, Philosophy, Sociology, and Nature of Science
An image of science practices from an ethnography of professional coffee roasters
Bradley Davey*, Northwestern University, USA
Reed Stevens, Northwestern University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
Representation of social-institutional aspects of science in the science textbooks: Textbook analysis and teachers' views
Beyza Okan*, Bogazici University, Turkey
Ebru Kaya, Bogazici University, Turkey

Concurrent Session 3, 4/19/23, 8:25-9:55

Topic 5: Science Teacher Preparation

Strand 7: Pre-service Science Teacher Education

Feeling Like a First Year Teacher All Over Again: Teaching Elementary Science Methods During Covid-19
Valarie Akerson*, Indiana University, USA
Ingrid Carter, Metropolitan State University of Denver, USA
Claire Cesljarev, Indiana University, USA

Strand 7: Pre-service Science Teacher Education

Preparing Pre-Service Chemistry Teachers to Teach STEM Skills in Chemistry Classes
Aviva Klieger*, Beit Berl College, Israel
Tamar Yaron, Beit Berl College, Israel

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

A Science Teacher Looks in the Mirror
Kady Lane*, Indiana University, USA

Strand 1: Science Learning: Development of student understanding SC-Organized Paper Set: Data and Investigations in Scientific Inquiry
4/19/23, 8:25-9:55, Salon C7-8 (LL)

Promoting students' writing in the context of scientific inquiry
Jan-Martin Österlein*, University of Duisburg-Essen, Germany
Mathias Ropohl, University of Duisburg-Essen, Germany
Sebastian Habig, University of Erlangen-Nuremberg, Germany
Miriam Morek, University of Duisburg-Essen, Germany

Balancing Authenticity and Personal Relevance of Science Through Student-Driven Neuroscience Investigations
Ido Davidesco, University of Connecticut, USA
Steven Azeka, Columbia University Teachers College, USA
Jimmy Couzens, University of Worcester, United Kingdom
Eric Loken, University of Connecticut, USA
Steven Carter, Columbia University, USA
Emma Laurent, Harvard University, USA
Henry Valk, Pison Technology, Inc, USA
Suzanne Dikker, New York University, USA
Wendy Suzuki, New York University, USA
Sarah Gilmore, University of Connecticut, USA

A Comparison of Undergraduate Students' Thinking about Carbon Cycling in Trees Using a Picture Walk
Rebecca Krall*, University of Kentucky, USA
Katherine Sharp*, Stephens College, USA
Sagan Goodpaster, University of Kentucky, USA
Moria Peel, University of Kentucky, USA
Amber Keene, University of Kentucky, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions Related Paper Set: Rethinking Epistemic Agency: Examining tensions and perspectives among scholars, teachers, and students
4/19/23, 8:25-9:55, Salon C1-2 (LL)

Do we have the same definition? Variations in published transcripts showcasing students' epistemic agency
Christina Krist*, University of Illinois Urbana-Champaign, USA

Nitasha Mathayas, Indiana University Bloomington, USA

What do Different Figured Worlds Mean for Epistemic Agency in Science Class?
Jessica Alzen*, University of Colorado Boulder, USA
Kelsey Edwards*, Northwestern University, USA
Jason Buell, Northwestern University, USA
Chris Griesemer, University of California Davis, USA
Cynthia Passmore, University of California Davis, USA
William Penuel, University of Colorado Boulder, USA
Brian Reiser, Northwestern University, USA

Conceptualizing teacher learning for supporting students' epistemic agency in science as an ideological process
Mon-Lin Monica Ko*, University of Illinois Chicago, USA
Christina Krist*, University of Illinois Urbana Champaigne, USA
Barbara Hug*, University of Illinois Urbana Champaigne, USA
Nessrine Machaka, University of Illinois Urbana Champaigne, USA

How teachers' high-level goals related to supporting student epistemic agency change during professional learning
Cynthia Passmore*, University of California, Davis, USA
Jason Buell, Northwestern University, USA
Jessica Alzen, University of Colorado Boulder, USA
Kelsey Edwards, Northwestern University, USA
Chris Griesemer, University of California, Davis, USA
William Penuel, University of Colorado Boulder, USA
Brian Reiser, Northwestern University, USA

Using classroom artifacts to build epistemic agency over time
Jason Buell*, Northwestern University, USA
Jessica Alzen, University of Colorado Boulder, USA
Kelsey Edwards, Northwestern University, USA
Chris Griesemer, University of California Davis, USA
Cynthia Passmore, University of California Davis, USA
William Penuel, University of Colorado Boulder, USA
Brian Reiser, Northwestern University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Culturally Responsive and Inclusive STEM Instruction
4/19/23, 8:25-9:55, Salon A1 (LL)

Culturally Responsive Undergraduate Science Education (Cruse): A Pedagogical Training Framework for Academic Biology
Hillary Barron*, Bemidji State University, USA

A Framework for Equitable, Student-centered Undergraduate STEM Instruction
Daniel Hanley*, Western Washington University, USA
Shannon Warren, Western Washington University, USA
Dustin Van Orman*, Western Washington University, USA

Xyan Neider, Whatcom Community College, USA
Alyssa Cavazos, University of Texas- Rio Grande Valley, USA
Shevell Thibou, Western Washington University, USA

Learning from the Past; Building a Framework of Physics Identity
Alia Hamdan*, University of Arizona, USA
Sanlyn Buxner, University of Arizona, USA

Investigating Active Learning and Inclusive Practices in Introductory College Science Courses
Mojtaba Khajeloo*, University of Nebraska Lincoln, USA
Deepika Menon, University of Nebraska Lincoln, USA
Deef Allah Al Shorman, University of Nebraska Lincoln, USA

Strand 6: Science Learning in Informal Contexts
Symposium: Once upon a time… The use of narratives in informal learning environments
4/19/23, 8:25-9:55, PDR 2 (L3)

Once upon a time… The use of narratives in informal learning environments
Neta Shaby*, University of Southampton, United Kingdom
Orit Ben Zvi Assaraf*, Ben Gurion University of the Negev, Israel
Maya Barzilay, Ben Gurion University of the Negev, Israel
Palmyre Pierroux*, University of Oslo, Norway
Rolf Steier, OsloMet University, Norway
Ran Peleg*, University of Southampton, United Kingdom
Muriel Grenon, National University of Ireland Galway, Ireland
Scott Pattison*, TERC, USA
Gina Svarovsky, University of Notre Dame, USA
Justin Dillon, University College London, United Kingdom

Strand 7: Pre-service Science Teacher Education
Related Paper Set: Operationalizing Justice-Centered Science Education By Teaching Through Science and Engineering Practices
4/19/23, 8:25-9:55, Salon A4 (LL)

Planning Enacting and Reflecting Science and Engineering Practices in K-5 Classrooms: Towards Justice-Oriented Science Teaching
Meenakshi Sharma*, Mercer University, USA

Elementary Preservice Teachers' Becomings Towards Equitable and Inclusive Science Teaching
Sophia Jeong*, The Ohio State University, USA

Pre-service Science Teachers of Color: Connecting the NGSS Practices with Justice-Centered Science Pedagogy
Valerie Valdez*, Stevenson University, USA
Matthew Bennett, University of California, Santa Barbara, USA
Royce Olarte, University of California, Santa Barbara, USA
Cameron Dexter Torti, University of California, Santa Barbara, USA
Donald McNish, University of California Santa Barbara, USA

Liliana Garcia, University of California, Santa Barbara, USA
Sarah Roberts, University of California, Santa Barbara, USA
Julie Bianchini, University of California, Santa Barbara, USA

Working to Hear Diverse Ways of Knowing: Development of Skills for Enacting Justice-Centered Science Pedagogy
Tierney Hinman*, Auburn University, USA
Alison Mercier, University of Wyoming, USA

Symmetry in Learning: Using Methods Courses to Model Justice-centered Science Education Approaches for Pre-service Teachers
David Steele*, Alder Graduate School of Education, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Approaches of Preservice Teachers Developing Self-efficacy & Motivation for Science Learning and Teaching
4/19/23, 8:25-9:55, Waldorf (L3)

Elementary PSTs' summer field experience: Developing self-efficacy and science best practices
Jacquelyn Duran*, Teachers College, USA
Alison Matthews*, Teachers College, USA
Minjung Lee, Old Dominion University, USA
Allison Bookbinder, Teachers College, USA

The Effects of Work and Academic Experiences on Paraeducator Preservice Teachers' Science Teaching Self-Efficacy
Lindsay Lightner*, Washington State University, USA

Pre-service biology teachers' development of research competence and motivation affected by (non-)restrictive learning opportunities
Lea Gussen*, Institute for Biology Education, Faculty of Mathematics and Natural Sciences, University of Cologne, Germany
Fabian Schumacher, Center for Teaching and Learning (ZLL) / University Teaching and Instructional Development, Bielefeld University, Germany
Laura Ferreira González, Chair of Educational Support and Social-Emotional Development, Department of Special Education and Rehabilitation, Faculty of Human Sciences, University of Cologne, Germany
Kirsten Schlüter, Institute for Biology Education, Faculty of Mathematics and Natural Sciences, University of Cologne, Germany
Jörg Großschedl, Institute for Biology Education, Faculty of Mathematics and Natural Sciences, University of Cologne, Germany

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Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Strengthening Science Teachers' NGSS-Aligned Instruction by Focusing on Students
4/19/23, 8:25-9:55, Salon C5-6 (LL)

Building on Students' Assets in Science and Engineering Classrooms
Selcen Guzey*, Purdue University, USA
Khanh Tran*, Purdue University, USA
Soo Won Shim*, Purdue University, USA
William Walker*, Purdue University, USA
Sedef Cabazoglu Bilici, Gazi University, Turkey

Science Teachers' Assessment Strategies of their Students' Models
Alexis Gonzalez, University of British Columbia, Canada
Samia Khan*, University of British Columbia, Canada

Make Graphs? A Survey of Teachers on How Their Students Analyze and Interpret Data
Omiya Sultana*, University of Tennessee, USA
Joshua Rosenberg, University of Tennessee, USA
Elizabeth Schultheis, Michigan State University, USA
Melissa Kjelvik, Michigan State University, USA
Aaron Reedy, Data CLassroom, USA

Teacher-driven Adaptations: Seeding Productive Uncertainty and Moving Toward Equity-Oriented Practices
Emily Adah Miller, University of Georgia, USA
Susan Kelly*, Michigan State University, USA
Selin Akgun, Michigan State University, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Assessments to promote reform based science education
4/19/23, 8:25-9:55, Salon C3-4 (LL)

New NGSS-aligned Early Childhood Assessment Instrument: An Exploratory Rasch/IRT Analysis of theKinderSci
Christopher Wojciechowski*, University of Toledo, USA
Susanna Hapgood, University of Toledo, USA
Charlene Czerniak, University of Toledo, USA
Scott Molitor, University of Toledo, USA
Joan Kaderavek, University of Toledo, USA
Grant Wilson, University of Toledo, USA

Measuring Claim-Evidence-Reasoning Using Scenario-based Assessments Grounded in Real-world Issues
William Romine*, Wright State University, USA
Ankita Agarwal, Wright State University, USA
Emily Burwell, Wright State University, USA
Maha Kareem, University of Missouri, USA
Amy Lannin, University of Missouri, USA

Assessing Data Practices in High School Science Courses
Peter Rich*, Brigham Young University, USA
Erin Peters-Burton, George Mason University, USA
Timothy Cleary, Rutgers University, USA
Anastasia Kitsantis, George Mason University, USA
Laura Laclede, George Mason University, USA

Jessica Yauney, Brigham Young University, USA
Connor Reynolds, Brigham Young University, USA

Development and evaluation of a competence test in organic chemistry at university level

Martin Steinbach*, University of Duisburg-Essen, Germany
Carolin Eitemüller, University of Duisburg-Essen, Germany
Marc Rodemer, University of Duisburg-Essen, Germany
Maik Walpuski, University of Duisburg-Essen, Germany

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Breaking Barriers: Broadening the Contextualization of Science Pedagogies and Professional Development
4/19/23, 8:25-9:55, Salon A2 (LL)

Declining Achievement in STEM Gasping for Breath –Longitudinal Study of Choking Impact of Culturo-Techno-Contextual Approach

Peter Okebukola*, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Juma Shabani, University of Burundi, Burundi
Adekunle Oladejo, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Ibukunolu Ademola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Deborah Agbanimu, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Olasunkanmi Gbeleyi, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Franklin Onowugbeda, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Fred Awaah, University of Professional Studies, Ghana
Rose Agholor, STEM International Research Group, Nigeria
Angela Irene, National Universities Commission, Nigeria
Ibiyinka Ogunlade, University of Ado-Ekiti, Nigeria

Combating Students' Anxiety and Promoting Meaningful Learning of Computer Networking: Should we trust CTCA?

Esther Peter*, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Peter Okebukola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
David Peter, Lagos State University, Nigeria
Deborah Agbanimu, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Franklin Onowugbeda, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria

Olasunkanmi Gbeleyi, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Sue Dale Tunnicliffe, University College London, United Kingdom
Fred Awaah, University of Professional Studies, Ghana
Adekunle Oladejo, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Ibukunolu Ademola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Fiacre Muhimpundu, Universite du Burundi, Burundi

Socio-Scientific Modeling as an Approach Towards Equitable Modeling
Rebecca Lesnefsky*, University of North Carolina, USA
Eric Kirk, University of North Carolina, USA
Troy Sadler, University of North Carolina, USA
Li Ke, University of North Carolina, USA
Jasmyne Yeldell, University of North Carolina, USA

Talking STEM in the hallways: Professional development for engaging students in SSI and social justice
Lisa Marco-Bujosa*, Villanova University, USA
Becky Mathers-Lowery*, Arcadia Unversity, USA
Joseph Johnson*, Mercyhurst University, USA
Victoria Araco, Villanova University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Enacting Social Justice in Science and STEM Classrooms
4/19/23, 8:25-9:55, Salon A3 (LL)

STEM, Equity, and Justice: Trends from the last decade in science education research
Rachel Gisewhite*, University of Southern. Mississippi, USA
Fatlume Berisha, University of Prishitina "Hasan Prishtina", Albania
Hannah McDuffie, University of Southern Mississipi, USA

Strengthening visions of equity through science and math integration
Andrew Gilbert*, George Mason University, USA
Jennifer Suh, George Mason University, USA

Investigating the Effects of an At-home, Justice-centered STEM Curriculum: A Pilot Study
Margaret Blanchard*, NC State University, USA
Karen Collier*, NC State University, USA
Donna Farland-Smith, The Ohio State University, USA
Ana-Marie Topliceanu, North Carolina State University, USA

Culturally Responsive Early Science Education—Perceptions and Practices of Bedouin Minority Teachers
Ornit Spektor-Levy*, Bar Ilan University, Israel
Idit Shaul, Bar Ilan University, Israel

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set: Extended Reality to Support Science Learning
4/19/23, 8:25-9:55, Blvd A (L2)

How Do Chemistry Students Bridge Macro-Micro Scale with Magnetic Models and Immersive Virtual Reality?
Dewi Ungu*, Curtin University, Australia
Mihye Won, Curtin University, Australia
David Treagust, Curtin University, Australia
Mauro Mocerino, Curtin University, Australia
Henry Matovu, Curtin University, Australia
Chin-Chung Tsai, National Taiwan Normal University, Taiwan
Roy Tasker, Western Sydney University, Australia

Influence of an immersive virtual reality experience on students' understanding of the shape of snowflakes
Henry Matovu*, Curtin University, Australia
Won Mihye, Curtin University, Australia
David Treagust, Curtin University, Australia
Mauro Mocerino, Curtin University, Australia
Dewi Ungu, Curtin University, Australia
Chin-Chung Tsai, National Taiwan Normal University, Taiwan
Roy Tasker, University of Western Sydney, Australia

Using Extended Reality Technologies Within a Socioscientific Issues Unit on Climate Change
Mark Newton*, East Carolina University, USA
Len Annetta*, East Carolina University, USA
Denise Bressler*, Educational Testing Services, USA

Social Interactions in Immersive Virtual Reality: How Students Negotiate and Contribute to Learn Science
Mihye Won*, Curtin University, Australia
Henry Matovu, Curtin University, Australia
Dewi Ungu, Curtin University, Australia
David Treagust, Curtin University, Australia
Chin-Chung Tsai, National Taiwan Normal University, Taiwan
Mauro Mocerino, Curtin University, Australia
Roy Tasker, Western Sydney University, Australia

Strand 14: Environmental Education and Sustainability
Related Paper Set: Preparing for a warming world: Modeling and promoting climate literacy
4/19/23, 8:25-9:55, Blvd C (L2)

What is needed? Investigating drivers for students' climate-friendly intentions to act
Carola Garrecht*, IPN – Leibniz-Institute for Science and Mathematics Education, Germany
Jesper Haglund, Karlstad University, Sweden
Ute Harms, IPN – Leibniz-Institute for Science and Mathematics Education, Germany

Climate action in the eyes of young activists – from direct individual to collective indirect actions
Niklas Gericke*, Department of Environmental and Life Sciences, Karlstad University, Sweden
Nina Christenson, Department of Geography, Media and Communication, Karlstad University, Sweden

Carola Garrecht, IPN - Leibniz Institute for Science and Mathematics Education, Germany

Preparing teachers for a warming future – an interdisciplinary approach to address Climate Literacy
Kathryn Leve*, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Ute Harms, IPN - Leibniz Institute for Science and Mathematics Education, Germany

Dilemmas in teaching climate change - preservice science teachers beliefs
Mikael Rydin*, Department of Environmental and Life Sciences, Sweden
Niklas Gericke, Department of Environmental and Life Sciences, Sweden
Nina Christenson, Department of Geography, Media and Communication, Sweden
Jesper Haglund, Department of Engineering and Physics, Sweden

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Strand 15: Policy, Reform, and Program Evaluation
SC-Organized Paper Set: Standards and Policy
4/19/23, 8:25-9:55, Astoria (L3)

Testing the Assumption of Equivalence of State Science Standards
Eugene Judson*, Arizona State University, USA

Changing science education standards: How the policy environments changed from NSES to NGSS
Laura Pirkle Howd*, The Pennsylvania State University, USA

Restructuring Middle School Science Education around the Grand Challenges
David Fortus*, Weizmann Institute of Science, Israel
Jeffrey Nordine, University of Iowa, USA

Funding Patterns of the National Science Foundation's ITEST Program in the Affective Domain: 2002-2022
Gavin Fulmer*, University of Iowa, USA
Asli Sezen-Barrie, National Science Foundation, USA
Jennifer Noll, National Science Foundation, USA

Concurrent Session 4
4/19/23, 10:20-11:50

Continental and Diasporic Africa in Science Education (CADASE) Sponsored Session: Reflecting on Reform: Movements that Value and Expand the Science Education Experiences of African People and People of African Descent
4/19/23, 10:20-11:50, Grand Ballroom (L2)

ORGANIZERS
Mary Atwater, University of Georgia, Athens, GA, USA
Rona Robinson-Hill, Ball State University, Muncie, IN, USA
Brenda Brand, Virginia Tech, Blacksburg, VA, USA

PANELISTS
Peter Okebukola, Lagos State University, Nigeria

Board of Directors Sponsored Session: International collaborative study of Sustainability and Social Justice in Science Education
4/19/23, 10:20-11:50, Salon A5 (LL)

ORGANIZERS
Tali Tal, Technion, Israel Institute of Technology, Haifa, Israel
Gail Richmond, Michigan State University, East Lansing, MI, USA
Joseph Krajcik, Michigan State University, East Lansing, MI, USA
Irene Bayer, Michigan State University, East Lansing, MI, USA
Orit Ben-Zvi Assaraf, Ben Gurion University of the Negev, Israel
Heather Toomey Zimmerman, Pennsylvania State University, PA, USA

PANELISTS
Efrat Nativ Ronen, Technion-Israel Institute of Technology, Israel
Anat Shauly, Technion-Israel Institute of Technology, Israel
Yael Eshed Silver, Technion-Israel Institute of Technology, Israel
Abir Saleh, Technion-Israel Institute of Technology, Israel
Avivit Arvatz, Technion-Israel Institute of Technology, Israel
Odelia Schrire, Technion-Israel Institute of Technology, Israel
Tamar Ginzburg, Technion-Israel Institute of Technology, Israel
Anna Pshenichny Mamo, Technion-Israel Institute of Technology, Israel
Lulu Garah, Technion-Israel Institute of Technology, Israel
Yaron Charka, Technion-Israel Institute of Technology, Israel
Ruth Edri, Technion-Israel Institute of Technology, Israel
Jonathan Bowers, Michigan State University, USA
Maggie Demarse, Michigan State University, USA
Kara Haas, Michigan State University, USA
Kayla Bartz, Michigan State University, USA
Lydia Bradford, Michigan State University, USA
Tatiana Iretskaia, Michigan State University, USA
Jaime Garcia Vila, Michigan State University, USA
Roberta Hunter, Michigan State University, USA
Renee Bayer, Michigan State University, USA

Consuelo Morales, Michigan State University, USA

National Science Teaching Association (NSTA)
Sponsored Session: Translating (Y)our Research into Forms that are Useful to K-12 Science Educators
4/19/23, 10:20-11:50, Waldorf (L3)

ORGANIZERS
G. Michael Bowen, Mount Saint Vincent University, Halifax, Nova Scotia, Canada

PANELISTS
Julie Luft, University of Georgia, GA, USA
Valarie Akerson, Indiana University, IN, USA
David Crowther, University of Nevada, Reno, NV, USA
Judith Lederman, Illinois Institute of Technology, IL, USA
Victor Sampson, University of Texas, Austin, TX, USA
Kathy Trundle, Utah State University, UT, USA

Strand 1: Science Learning: Development of student understanding
SC-Organized Paper Set: Evaluating Information and Transforming Learning in Science Classrooms
4/19/23, 10:20-11:50, Salon C7-8 (LL)

Students' Evaluations of Science (Dis)Information
Daniel Pimentel*, Stanford University, USA

Geoscience for justice: a pedagogical model of transformative science learning
Shondricka Burrell*, Morgan State University, USA

Affordances for Multimodal Representations in a Photosynthesis Unit: Tale of Two Linguistically Diverse Classrooms.
Preetha Menon*, Stanford University, USA

Students' Use of Crosscutting Concepts to Develop Questions from an Anchoring Phenomenon
Daniel Voss*, Northwestern University, USA
Brian Reiser*, Northwestern University, Learning Sciences, USA
Joe Kremer, Denver Public Schools, USA
Jamie Noll*, BSCS Science Learning, USA
Dawn Novak, Northwestern University, USA
Michael Novak*, Northwestern University, USA
Nicole Vick, Northwestern University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Students' Ways of Learning Science
4/19/23, 10:20-11:50, Salon C1-2 (LL)

Preschool-age Children's Use of Spatial Thinking When Making Sense of Astronomical Phenomena
Hannah Lewis*, Wesleyan University, USA
Julia Plummer*, The Pennsylvania State University, USA

Elementary Children Learn Astronomy Through Drawing
Qingna Jin*, University of Alberta, Canada
Mijung Kim*, University of Alberta, Canada

A Case Study of How Fifth Grade Students Develop Their 21st-Century-Skills during Integrated STEM Unit
Muhammad Purwanto*, University of Minnesota, USA
Gillian Roehrig, University of Minnesota, USA
Elizabeth Stretch, University of Minnesota, USA

Interest and Effort: Exploring the Ways Students Obtain and Evaluate COVID-19 Information
Eric Kirk*, University of North Carolina at Chapel Hill, USA
Jamie Elsner, University of North Carolina at Chapel Hill, USA
William Romine, Wright State University, USA
Li Ke, University of Nevada, Reno, USA
Laura Zangori, University of Missouri Columbia, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA

Strand 4: Science Teaching - Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set: Instructional Approaches and Strategies for Learning Chemistry
4/19/23, 10:20-11:50, PDR 2 (L3)

How Different Approaches to Science Teaching Affect Content Knowledge-Linking Concerning the Energy Concept
Dennis Dietz*, Freie Universität Berlin, Germany
Claus Bolte, Freie Universität Berlin, Germany

Teaching High School Students about Brønsted-Lowry Acid-Base Reactions
Rita Krebs*, University of Vienna, Austria
Marvin Rost, University of Vienna, Austria
Anja Lembens, University of Vienna, Austria

Exploring high school students' systems thinking and explanation of chromatography through analogy
Yu-Jan Tseng*, Institute of Education, National Sun Yat-sen University, Taiwan
Huann-shyang Lin, Centre for General Education, National Sun Yat-sen University, Taiwan
Zuway-R Hong, Centre for General Education, Kaohsiung Medical University, Taiwan

The Wonders of CTCA in Making Learning of Science Easy: A study of Nuclear Chemistry
Ibukunolu Ademola*, Lagos State University, Africa Centre of Excellence for Innovative and Transformative STEM Education, Nigeria
Peter Okebukola, Lagos State University, Africa Centre of Excellence for Innovative and Transformative STEM Education, Nigeria
Olasunkanmi Gbeleyi, Lagos State University, Africa Centre of Excellence for Innovative and Transformative STEM Education, Nigeria
Sue Tunnicliffe, University College London, United Kingdom
Adekunle Oladejo, Lagos State University, Africa Centre of Excellence for Innovative and Transformative STEM Education, Nigeria
Franklin Onowugbeda, Lagos State University, Africa Centre of Excellence for Innovative and Transformative STEM Education, Nigeria

Deborah Agbanimu, Lagos State University, Africa Centre of Excellence for Innovative and Transformative STEM Education, Nigeria
Esther Peter, Lagos State University, Africa Centre of Excellence for Innovative and Transformative STEM Education, Nigeria
David Byamungu, University of Burundi, Burundi
Chinyere Ikpah, Lagos State University, Africa Centre of Excellence for Innovative and Transformative STEM Education, Nigeria

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Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Graduate Student Professional Development
4/19/23, 10:20-11:50, Blvd A (L2)

Learning and Leading: Doctoral Students' Perceptions of Imposterism and Academic Challenges in an Interdisciplinary Program
M. Gail Jones*, NC State University, USA
Julianna Nieuwsma, NC State University, USA
Rebecca Ward, NC State University, USA
Kathleen Bordewieck, NC State University, USA
Emma Refvem, NC State University, USA

Supports and Challenges in the Phases of Doctoral Education: Physical Science Doctoral Student Perspectives
Anne McAlister*, University at Buffalo, USA
Sarah Lilly*, University of Virginia, USA

Graduate Students' Interpersonal Communication Skills: Assessing an Online Course
Yehudit Judy Dori*, Technion, Israel
Shahaf Rocker Yoel, Technion, Israel

Teaching Assistant Talk Move Sequences Associated with Rigorous Elicitation Discussions in an Undergraduate Biology Laboratory
Evan Barnes, Northern Arizona University, USA
Ron Gray, Northern Arizona University, USA
Anna Grinath*, Idaho State University, USA

Strand 7: Pre-service Science Teacher Education
Related Paper Set: Using Principles of Engineering Design to Advance Elementary Science Teacher Preparation
4/19/23, 10:20-11:50, Salon A1 (LL)

Integrating Learning of Science with Engineering Design in a Physics Course for Elementary Preservice Teachers
N. Sanjay Rebello*, Purdue University, USA
Zeynep Akdemir, Purdue University, USA

The Impact of Engineering Design on Elementary Preservice Teachers' Achievement in Science
Selcen Guzey*, Purdue University, USA

Measuring Elementary Preservice Teachers' Conceptualizations of Engineering and Perceived Abilities to Teach Science Using Design
Yue Li*, Miami University, USA
Brenda Capobianco, Purdue University, USA

Elementary Preservice Teachers' Shifts as Learners to Teachers to Designers
Brenda Capobianco*, Purdue University, USA
Jenna Gist, Purdue University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Communities of Practice: Sites for Teacher Learning
4/19/23, 10:20-11:50, Salon C5-6 (LL)

Communities of Practice to Enhance Preschool Teachers' Science Ways of Seeing and Identity
Jenny Ingber*, American Museum of Natural History, USA
Veena Vasudevan, University of Pittsburgh School of Education, USA
Jacqueline Horgan, American Museum of Natural History, USA

Responding to High School Physics Teachers' Needs in a Professional Community of Practice
Hamideh Talafian*, University of Illinois at Urbana Champaign, USA
Tim Stelzer, University of Illinois at Urbana Champaign, USA

Identifying Valued Outcomes of Science Teacher Leaders' Participation in Communities of Practice
Michelle Phillips*, Exploratorium, USA
Sara Heredia, University of North Carolina Greensboro, USA

It's the First Time it's Authentic: Developing Rightful Presence within a Critical Community of Practice
Desiré Whitmore, Exploratorium, USA
Ti'Era Worsley*, The University of North Carolina at Greensboro, USA
Rita Barrera, Stockton Unified School District, USA
Eric Cross, San Diego Unified, USA
Melody Ewey, Davis Joint Unified School District, USA
Camille Fowler, San Diego Unified, USA
Amy Kraft, Sacramento County Office of Education, USA
Tara Sikorski, Santa Clara County Office of Education, USA
Sara Heredia, The University of North Carolina at Greensboro, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Science Teacher Learning through Professional Development Opportunities: Planning for and Reflecting on What Teachers Learned
4/19/23, 10:20-11:50, Blvd C (L2)

The design of science teacher professional development intervention through linkage of science teacher learning needs
Kārlis Greitāns*, University of Latvia, Latvia
Dace Namsone, University of Latvia, Latvia

Insight Into How Professionals Develop: Examining Teachers' Reflection and Sensemaking During Professional Development
Danielle Rhemer*, Florida State University, USA
Miray Tekkumru-Kisa, Florida State University, USA
Sherry Southerland, Florida State University, USA

Science teachers' conceptualization of student resources during and after involvement in curriculum-based professional development
Sarah Fogelman*, Boston College, USA
Samuel Lee*, Boston College, USA
Katherine McNeill*, Boston College, USA
Caitlin Fine*, Metropolitan State University of Denver, USA

What Constitutes Program Success? An exploration of findings 2.5 years after a Teacher Professional Development
Joanna Philippoff*, University of Hawaii at Manoa, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Transforming curriculum and assessment for teacher professional development
4/19/23, 10:20-11:50, Salon C3-4 (LL)

Towards assessment for playful learning in early childhood: Influences on teachers' science assessment practices
Cristina Guarrella*, The University of Melbourne, Australia
Jan van Driel, The University of Melbourne, Australia
Caroline Cohrssen, University of New England, Australia

Educative Curriculum Materials for Science Teacher Educators: Uptake of Different Types of Educative Supports
Deborah Hanuscin*, Western Washington University, USA
Josie Melton*, Western Washington University, USA
Dustin Van Orman*, Western Washington University, USA

High School Science Resources on Teachers Pay Teachers: Buyers and Sellers
Adepeju Prince*, Kent State University, USA
Shannon Navy*, Kent State University, USA

Grading and Retention in CS Service Courses: A Systematic Review
Robert Lightfoot*, Texas A&M University, USA
Saira Anwar, Texas A&M University, USA
Tracy Hammond, Texas A&M University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Inclusion in STEM Higher Education: (Re)evaluating Pedagogies, Programs, and Research Instruments
4/19/23, 10:20-11:50, Salon A2 (LL)

Gender Differences in a Physics Research Experience for Undergraduates Program
Andrea Ratcliff*, University of Kentucky, USA
Tracy Gastineau-Stevens*, University of Kentucky, USA
Cameron Richards, University of Kentucky, USA
Jennifer Wilhelm, University of Kentucky, USA

Investigating Motivational Supports for Graduate Students through Structural Equation Modeling
Karen Collier*, North Carolina State University, USA
Margaret Blanchard*, North Carolina State University, USA

I am (sort of) a STEM person: College STEM students' self-assessment of STEM identities
Heidi Cian*, Florida International University, USA
Remy Dou, Florida International University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Supporting Multilingual and Refugee Learners through Translanguaging and Culturally Sustaining Pedagogies
4/19/23, 10:20-11:50, Salon A3 (LL)

Shifting between languages during inquiry process
Lulu Garah*, Technion - Israel Institute of Technology, Israel
Shulamit Kapon, Technion - Israel Institute of Technology, Israel

The Role of Language in Understanding Abstract Chemical Concepts in Multilingual Classrooms
Salwa Ali*, American University of Beirut, Lebanon
Saouma BouJaoude*, American University of Beirut, Lebanon

Insights on culturally sustaining science pedagogy in an after school program for refugee youth.
Bolaji Bamidele*, Utah State University, USA
Sarah Braden, Utah State University, USA
Tino Nyawelo, University of Utah, USA
Sherry Marx, Utah State University, USA
Aryn Dotterer, Utah State University, USA
Raquel Goldrup, Utah State University, USA
Melanie Valera, Utah State University, USA
Ricardo Gonzalez Montalvo, University of Utah, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set: Issues & Trends in NOS Research
4/19/23, 10:20-11:50, Astoria (L3)

Review of the Research on Teaching, Learning, and Assessment of Nature of Science: 2013–2021
Fouad Abd-El-Khalick*, University of North Carolina at Chapel Hill, USA
Norman Lederman, Illinois Institute of Technology, USA

A Systematic Review of NOS Research in Science Education: Varieties of Scholarship, Trends and Considerations
Noushin Nouri*, University of Texas Rio Grade Valley, USA
William McComas*, University of Arkansas, USA
Maryam Saberi, Ministry of education, Iran, Islamic Republic of

Synthesis of Variations in Nature of Science (NOS) Among Adult Learners
Joseph Watts*, University of Florida, USA
Kent Crippen, University of Florida, USA

Nature of Science Assessment Efforts: Interplay Between Contemporary Frameworks and Curricular Tensions
Alex Sobotka*, Texas A&M University, USA
Michael Clough, Texas A&M University, USA

Strand 15: Policy, Reform, and Program Evaluation
Symposium: Elementary Science and Teacher Education Standards in the U.S.: Implementation and Future Directions
4/19/23, 10:20-11:50, Salon A4 (LL)

Elementary Science and Teacher Education Standards in the U.S.: Implementation and Future Directions

Katie Brkich, Georgia Southern University, USA
Terrance Burgess, Michigan State University, USA
Iliana De La Cruz*, Texas A&M, USA
Melissa Luna, West Virginia University, USA
TJ McKenna, Boston University, USA
Alesia Mickle Moldavan, Georgia Southern University, USA
Bailey Nafzinger, Georgia Southern University, USA
Christina Schwarz, Michigan State University, USA
Meenakshi Sharma, Mercer University, USA
Mary Starr, Michigan Math and Science Leadership Network, USA

Concurrent Session 5
4/19/23, 13:00-14:30

Publications Advisory Committee Sponsored Session: Publishing, Reviewing, and Writing for JRST
4/19/23, 13:00-14:30, Salon A5 (LL)

ORGANIZERS
Felicia Mensah, Teachers College, Columbia University, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA
Li Ke, University of North Carolina at Chapel Hill, USA

PANELISTS
Lucy Avraamidou, University of Groningen, Netherlands

Strand 1: Science Learning: Development of student understanding
SC-Organized Paper Set: Uncertainty and Sensemaking in Science Classrooms
4/19/23, 13:00-14:30, Salon C1-2 (LL)

A Bayesian Approach to Making Sense of Uncertainty in the Science Classroom
Marcus Kubsch*, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Joshua Rosenberg, University of Tennessee, USA
Eric-Jan Wagenmakers, University of Amsterdam, Netherlands
Mine Dogucu, University of California, USA

Conceptual Framework for Incorporating Student Uncertainties Into Science Learning
Ying-Chih Chen, Arizona State University, USA
Jongchan Park*, Arizona State University, USA
Emily Starrett, Arizona State University, USA
Michelle Jordan, Arizona State University, USA
Carlos Meza-Torres, Arizona State University, USA

A Case Study of Undergraduate Biology Students' Engagement in Blended Sensemaking During Mathematical Modeling Tasks
Desi*, University of Minnesota, USA
Gillian Roehrig, University of Minnesota, USA
Anita Schuchardt, University of Minnesota, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: The Role of Sensemaking in Learning Science
4/19/23, 13:00-14:30, Salon C7-8 (LL)

Exploring opportunities for Students' Sensemaking Across Investigation Types in a Storyline Curriculum
Sage Andersen*, The University of Texas at Austin, USA
Karina Méndez Pérez*, The University of Texas at Austin, USA
María González-Howard*, The University of Texas at Austin, USA

Supporting the Enactment of Ecological Concepts in Sense-making of Ecological Phenomena
Heesoo Ha*, Center for Educational Research, Seoul National University, Korea, Republic of
Yunhee Choi, Ewha Womans University, Korea, Republic of

Sensemaking as a balance between dialogic tension and making sense
Ylva Hamnell-Pamment*, Lund University, Sweden

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set: Patterns of Participation in Youth Informal Science Learning
4/19/23, 13:00-14:30, Blvd C (L2)

Strategies for broadening participation of historically underrepresented groups: A meta-synthesis of informal STEM education programs
Bobby Habig*, American Museum of Natural History, USA
Franny Geller, CUNY, USA
Preeti Gupta, American Museum of Natural History, USA
Jennifer Adams, University of Calgary, Canada
Mandë Holford, CUNY Hunter College, USA

Nature Capital Effects on Middle School Nature Identities
Laura Wheeler*, Utah State University, USA
Kathy Trundle*, Utah State University, USA
Rita Hagevik*, University of North Carolina Pembroke, USA
Katherine Vela, Utah State University, USA
David Joy, Wahlquist Jr. High School, USA
Michelle Parslow, Utah State University, USA

Pipeline Schmipeline: Exploring Youth Pathways in Science
Anna MacPherson*, American Museum of Natural History, USA
Rachel Chaffee, American Museum of Natural History, USA
Peter Bjorklund, University of California San Diego, USA
Alan Daly, University of California San Diego, USA
Jennifer Adams, University of Calgary, Canada
Preeti Gupta, American Museum of Natural History, USA
Karen Hammerness, American Museum of Natural History, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Approaches to Exploring Learning and Teaching about socio-scientific issues
4/19/23, 13:00-14:30, Salon A2 (LL)

Assessing preservice science teachers' socioscientific argumentation
Moritz Krell*, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Carola Garrecht, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Nina Minkley, Ruhr-Universität Bochum, Germany
Understanding Preservice Teacher's Knowledge and Emotions Related to Climate Change
Catherine Bohn-Gettler*, College of St. Benedict, USA
Diana Fenton*, College of St. Benedict, USA
Carly Mastrian, College of St. Benedict, USA

Using News Articles about COVID-19 as a Context for Promoting Pre-service Science Teachers' Argumentation Skills
Resmiye Uzun*, Hacettepe University, Turkey
Metin Şardağ, Van Yüzüncü Yıl University, Turkey
Gültekin Çakmakcı, Hacettepe University, Turkey

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Exploring How Preservice Teachers Engage with Engineering Practices Across Different Contexts
4/19/23, 13:00-14:30, Salon A3 (LL)

"I 100% see myself teaching engineering": An exploration of elementary PSTs' intentions to integrate engineering
Min Jung Lee*, Old Dominion University, USA
Pilar Pazos-Lago, Old Dominion University, USA
Jennifer Kidd, Old Dominion University, USA
Kristie Gutierrez, Old Dominion University, USA
Francisco Cima, Old Dominion University, USA
Stacie Ringleb, Old Dominion University, USA
Krishnanand Kaipa, Old Dominion University, USA
Orlando Ayala, Old Dominion University, USA

Preservice Elementary Teachers' Understandings of Science and Engineering Practices as Vehicles for Sensemaking
Amy Ricketts*, California State University, Long Beach, USA
Michele Korb*, California State University, East Bay, USA

Preservice Middle Grades Teachers Supporting English Learners in Science and Engineering
Romola Bernard*, University of North Georgia, USA
Lorraine Ramirez Villarin, University of North Georgia, USA
Max Vazquez Dominguez, University of North Georgia, USA
Sheri Hardee, University of North Georgia, USA
Magda Guzman, University of North Georgia, USA
Maggie Lewis, University of North Georgia, USA
Victoria Hunter, University of North Georgia, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Science Teacher Learning about Science Learning in Social Contexts
4/19/23, 13:00-14:30, Waldorf (L3)

Exploring Urban Educators' Entry and Early Trajectories Into Place-Based and "Place-Powerful" Teaching and Learning.
Roberta Hunter*, Michigan State University, USA
Gail Richmond, Michigan State University, USA

Teachers' meaning making of cultivating learners to become scientifically literate citizens
Mandi Collins*, University of Nevada, Reno, USA
Elizabeth de los Santos, University of Nevada, Reno, USA

Middle Grades STEM Teachers' Socioscientific Perspective Taking Concerning Socioscientific Issues
Melanie Kinskey*, Sam Houston State University, USA

Description of personal preconceptions and dispositions about climate change in science teachers in Chile
Veronica Abasto*, Universidad Catolica de Valparaiso, Chile
Antonia Larrain, Universidad Alberto Hurtado, Chile
Hernan Cofre, Universidad Catolica de Valparaiso, Chile

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Expanding technology-enhanced pathways for science assessment
4/19/23, 13:00-14:30, Salon C3-4 (LL)

Automatically Assess Elementary Students' Hand-Drawn Scientific Models Using Machine Learning: Is It Possible?
Tingting Li*, Michigan State University, USA
Feng Liu, Michigan State University, USA
Joseph Krajcik, Michigan State University, USA

Exploring student responses in the context of automated-generated feedback on science reasoning patterns
Dante Cisterna*, ETS, USA
Lei Liu, ETS, USA
David Baidoo-Anu, Queen's University, Canada
Devon Kinsley, ETS, USA
Yi Qi, ETS, USA

Scientific modeling of the solar system (SMSS) version 2.0: Developing an instrument from four-element process
Letong Zhang*, Beijing Normal University, China
Jing Lin, Beijing Normal University, China
Weiwei He, Beijing Normal University, China

Assessing curriculum representations in pre-service physics teachers' teaching reports with machine learning
Peter Wulff*, Heidelberg University of Education, Germany
Lukas Mientus, University of Potsdam, Germany
Anna Nowak, University of Potsdam, Germany
Andreas Borowski, University of Potsdam, Germany

Strand 11: Cultural, Social, and Gender Issues
Related Paper Set: Consequential Arrangements for Becoming: Considering Identity Work in STEM Across Social, Institutional, and Practice Spaces
4/19/23, 13:00-14:30, Salon A1 (LL)

Weaving in-and-out of School Experiences to Craft STEM Identities
Carrie Allen*, University of North Texas, USA

Using familial STEM identity to understand identity development through social units
Remy Dou*, Florida International University, USA
Heidi Cian*, Florida International University, USA

"Those kinds of students": Designing for Teachers' Sensemaking of Students' STEM Identities
Sara Heredia*, University of North Carolina at Greensboro, USA
Carrie Allen, University of North Texas, USA

Contextual Cues of Learning Experiences and their Influences on Expressions and Development of STEM Identities
Heidi Cian*, Florida International University, USA
Remy Dou*, Florida International University, USA

Informal STEM Education Spaces as Frames for Women's STEM Identity Stories
Roxanne Hughes, National High Magnetic Field Laboratory, USA
Amal Ibourk*, Florida State University, USA
Lauren Wagner, Florida State University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Inclusion in k-12 Science Education: What does it look like? What can it look like?
4/19/23, 13:00-14:30, Salon A4 (LL)

What happens to the students at the margins? Inclusion at a time of curriculum reform.
Lydia Burke*, University of Toronto, Canada

Literature Review: Tools for Assessment of Inclusive Practices
Natalia Franca*, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, University of Missouri-Columbia, USA
Hai Nguyen, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, University of Missouri-Columbia, USA
Ritesh Sharma, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, University of Missouri-Columbia, USA
Saaedah Albishi, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, University of Missouri-Columbia, USA
Courtney Ngai, Empowered Consulting, United Kingdom
Marcelle Siegel, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, and Department of Biochemistry, University of Missouri-Columbia, USA

Linking Science and Literacy Through Multimodal Text Sets: Student Perspectives
William Romine*, Wright State University, USA
Heba Abdelnaby*, University of Missouri-Columbia, USA
Delinda van Garderen, University of Missouri-Columbia, USA
Tracey Milarsky, University of Missouri-Columbia, USA
Cassandra Smith, University of Missouri-Columbia, USA
Amy Lannin, University of Missouri-Columbia, USA
William Folk, University of Missouri-Columbia, USA

Downplaying Achievement and Retention of (HiS) in STEM! What can (CTCA) do in Logic Gate?
Olasunkanmi Gbeleyi*, Lagos State University, Nigeria
Peter Okebukola, Lagos State University, Nigeria
Ibukunolu Ademola, Lagos State University, Nigeria
Agbanimu Deborah, Lagos State University, Nigeria
Peter Esther, Lagos State University, Nigeria
Franklin Onowugbeda, Lagos State University, Nigeria
Bugoma Suwadu, University of Burundi, Burundi
Juma Shabani, University of Burundi, Burundi
Adekunle Oladejo, Lagos State University, Nigeria
David Byamungu, University of Burundi, Burundi
Fiacre Muhimpundu, University of Burundi, Burundi

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set: Assessment and Evaluation of Learning
4/19/23, 13:00-14:30, Salon C5-6 (LL)

Development And Usability Evaluation of an App for Inquiry-Based Science Education
Toma Bogdan*, University of Burgos, Spain
Meneses Villagrá Ángel, University of Burgos, Spain

Social network analysis shows equal numbers of public, educators, and scientists within an online world
Lisa Lundgren*, Utah State University, USA
Man Zhang, Utah State University, USA

Assessing an Online Module to Support Nature of Technology Learning of Preservice Teachers
Jerrid Kruse*, Drake University, USA
Marco Arreola, Drake University, USA
Mitch Klocke, Drake University, USA
Sarah Voss*, Drake University, USA
Isaiah Kent-Schneider, Drake University, USA

Assessing students' motivation to learn in technology-enhanced science classes through a sociocultural lens
Tamar Ginzburg*, Technion - Israel Institute of Technology, Israel
Miri Barak, Technion - Israel Institute of Technology, Israel

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Strand 15: Policy, Reform, and Program Evaluation
SC-Organized Paper Set: Teacher Education
4/19/23, 13:00-14:30, Blvd A (L2)

The "Moneyball" Problem in Teacher Education: Predictor Variables to Build a Better Teacher
Joanne Olson*, Texas A&M University, USA
Allison Esparza*, Texas A&M University, USA
Syahrul Amin*, Texas A&M University, USA
Jacob Pleasants, The University of Oklahoma, USA
Iliana De La Cruz, Texas A&M University, USA

Results of an Impact Evaluation Study of Early Career Teachers Engaging in Summer Modeling Institutes

Sanlyn Buxner*, Planetary Science Institute, USA
Larry Horvath, San Francisco State University, USA
Bridina Lemmer, American Institutes for Research, USA
Melissa Yisak, American Institutes for Research, USA
Maya Bakerman, Planetary Science Institute, USA
Jennifer Nelson, San Francisco State University, USA

Which Organizational Conditions Predict the Translation of Professional Development to Science Instructional Practice?
Kathryn Hayes*, California University East Bay, USA
Jessica Gladstone, Virginia Commonwealth University, USA
Brit Toven-Lindsey, UCLA, USA
Christine Bae, Virginia Commonwealth University, USA
Eric Nolan, California University East Bay, USA

Nature of Engineering in the Framework and the Next Generation Science Standards
Hasan Deniz*, University of Nevada Las Vegas, USA
Erdogan Kaya, George Mason University, USA
Ezgi Yesilyurt, Weber State University, USA

Social Event

Awards Desert Reception

4/19/23, 14:45-16:15, Grand Ballroom (L2)

Please join us in the Grand Ballroom in celebration of recipients of the Distinguished Contributions to Research Award (DCRA), Early Career Research Award (ECRA, Outstanding Dissertations Research Award (ODRA), and NARST Fellows.

Concurrent Session 6
4/19/23, 16:40-18:00

Research in Artificial Intelligence-Involved Science Education (RAISE) Sponsored Session: Research in Artificial Intelligence-involved Science Education
4/19/23, 16:30-18:00, Salon A5 (LL)

ORGANIZERS
Xiaoming Zhai, University of Georgia, Athens, GA, USA
Kent Crippen, University of Florida, FL, USA

PANELISTS
Joseph Krajcik, Michigan State University, USA
Knut Neumann, Leibniz Institute for Science and Mathematics Education, Germany

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Strand 1: Science Learning: Development of student understanding SC-Organized Paper Set: Disciplinary Knowledge and Technology in Science Classes
4/19/23, 16:30-18:00, Salon A4 (LL)

Lebanese Students' Reasoning of the Immune System in Grades 8 and 12
Ihsan Ghazal*, Texas Christian University, USA
Hayat Hokayem, Texas Christian University, USA

Accessing Quantum Mechanics in the Secondary Classroom
Zac Patterson*, The Ohio State University, USA
Lin Ding, The Ohio State University, USA

Computer Studies Made Easy: Improving Students Achievement through the Culturo-Techno-Contextual Approach
Chinyere Ikpah*, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Peter Okebukola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Rasheed Sanni, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Adekunle Oladejo, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Deborah Agbanimu, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Olasunkanmi Gbeleyi, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Franklin Onowugbeda, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Ibukunolu Ademola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Esther Peter, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Henry Okorie, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Fred Awaah, University of Professional Studies, Ghana

Examining Student Perceptions of Accountable Disciplinary Knowledge in their Science Class versus Data Jam
Isabel Delgado*, The Learning Partnership, USA
Steven McGee*, The Learning Partnership, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Impact of Interactions on Learning Science
4/19/23, 16:30-18:00, Blvd C (L2)

Positioning in small groups around a Black Woman and equipment handling in physics lab
Mark Akubo*, Cornell University, USA
Emily Stump, Cornell University, USA
Natasha Holmes, Cornell University, USA

How positioning affects students' engineering experience during small group engineering design activities
Minyoung Gil*, Penn State University, USA
Gregory Kelly, Penn State University, USA
Matthew Johnson, Penn State University, USA

Noticing Beyond Disciplinary Ideas Prompts Re-imagination of Classroom Interactions that Foreground Students' Classroom Experience
Laura Blue*, Dublin City Schools, USA
Sophia Jeong*, The Ohio State University, USA
Ashlyn Pierson, The Ohio State University, USA

Strand 4: Science Teaching - Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set: Student Engagement, Epistemology, and Socioscientific Approaches
4/19/23, 16:30-18:00, PDR 2 (L3)

Stimulating Students' Socio-Scientific Perspective Taking through Personas
Dury Bayram Jacobs*, Eindhoven University of Technology, Netherlands
Ineke Henze, Radboud University, Netherlands
Erik Barendsen, Radboud University, Netherlands

"Creative vibes:" Using a comic in science curriculum and teaching to promote student engagement
Consuelo Morales*, Michigan State University, USA
Tania Jarosewich, Censeo Group, USA
Hildah Makori*, Michigan State University, USA
Maria Salinas, Michigan State University, USA
Irene Bayer, Michigan State University, USA

Designing and Enacting Lessons to Promote Students' Epistemic Agency in a Middle School Biology Classroom
Ozlem Akcil-Okan*, Florida State University, USA
Miray Tekkumru-Kisa, Florida State University, USA
Sherry Southerland, Florida State University, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Student Development of Research Skills
4/19/23, 16:30-18:00, Salon C7-8 (LL)

Research Deconstruction: A Scalable Model for Promoting Scientific Literacy Skills in Introductory Biology Classes
Casey Shapiro*, UCLA, USA
Brit Toven-Lindsey*, UCLA, USA
Marc Levis-Fitzgerald*, UCLA, USA
Ira Clark, UCLA, USA

Understanding how a college instructor led science majors to write using a situated learning perspective
Austin Heil*, University of Georgia, USA
Julie Kittleson, University of Georgia, USA

College Student Conceptions of Experimental Design and Argumentation in the Earth Sciences
Danielle Ford*, University of Delaware, USA
Christy Metzger*, University of Delaware, USA

Critical Thinking: Perceptions and Experiences of Science and Engineering Instructors and Students
Carmella Shahab, The Technion Israel Institute of Technology, Israel
Miriam Barak*, The Technion Israel Institute of Technology, Israel

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Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Understanding the use of models and representations in science learning
4/19/23, 16:30-18:00, Salon A2 (LL)

Exploring Elementary Preservice Teachers' Use of Drawings to Reason about Force-Related Phenomena
Teresa Leavens*, College of Education, North Carolina State University, USA
James Minogue, College of Education, North Carolina State University, USA

Supporting Pre-Service Science Teachers in Designing and Reflecting on Coherent Instruction
Stefan Sorge*, IPN - Leibniz-Institute for Science and Mathematics Education, Germany
Dustin Schiering, IPN - Leibniz-Institute for Science and Mathematics Education, Germany
Mathias Ropohl, University of Duisburg-Essen, Germany
Christopher Like, University of Iowa, USA
Jeffrey Nordine, University of Iowa, USA

Analysis of Pre-Service Teachers' Choices of Multiple Visual Representations for Teaching about the Cardiovascular System
Narendra Deshmukh*, Homi Bhabha Centre for Science Education, TIFR, India
Eunice Nyamupangedengu, Marang Centre for Mathematics and Science Education, School of Education, Wits University, South Africa

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Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: The role of Creativity, Computational & Design Thinking in pre-service teacher learning
4/19/23, 16:30-18:00, Salon C1-2 (LL)

Using artificial intelligence (AI) to foster preservice teachers' understandings of computational thinking (CT) and AI
Jeffrey Radloff*, SUNY Cortland, USA
Ibrahim Yeter, National Institute of Education (NIE), Singapore, Singapore
Gregorio Robles, University of Madrid, Spain

Design Thinking for Human-Centered Engineering: Preservice Teachers' Engineering Design Projects for Underserved Communities
Myunghwan Shin*, California State University, Fresno, USA
Jane Lee, Michigan State University, USA

Supporting Preservice Teachers to Conceptualize Computational Thinking as a Sensemaking Practice in an Engineering Course
Gozde Tosun*, Penn State University, USA
Amy Farris, Penn State University, USA

Fostering Preservice Teachers' Creativity and Innovation Through 3D Printing: Individual and Group Outcomes
Shannon Navy*, Kent State University, USA
Elena Novak, Kent State University, USA
Ilker Soyturk, Kent State University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Professional Learning Communities Supporting Science Teacher Learning
4/19/23, 16:30-18:00, Salon A1 (LL)

Understanding science teacher perceptions of the influence of vertically and horizontally aligned collaborative teams
Sharfun Islam Nancy*, University of South Florida, USA
Karl Jung*, Bradley University, USA
David Rosengrant, University of South Florida, USA
Allan Feldman, University of South Florida, USA

The Value of Participation in Professional Learning Communities (PLCs) for High-School Chemistry Teachers
Anat Shauly*, Technion - Israel institute of technology, Israel
Shirly Avargil, Technion - Israel institute of technology, Israel

Navigating Tensions Between Social Justice Theory and Practice in a Chemistry Education Professional Learning Community
Kathryn Ribay*, San Jose State University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Personal Dynamics of Learning for Elementary Science Teachers
4/19/23, 16:30-18:00, Salon C3-4 (LL)

Now I'm a Science Teacher: Shifting Professional Identities of Elementary Teachers in Long-Term PD

Linda Preminger*, California State University East Bay, USA
Kathryn Hayes, California State University East Bay, USA
Dawn O'Connor, Alameda County Office of Education, USA
Christine Lee Bae, Virginia Commonwealth University, USA

Toward a Future Science Teacher: Using Teaching Debriefs to Support a Veteran Elementary Teacher
Terrance Burgess*, Michigan State University, USA

Agency of In-Service Elementary Science Teachers During a Global Pandemic
Anica Miller-Rushing*, University of Maine, USA
Christine Goonan, In-service teacher, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Curricular innovations supporting new age learning outcomes
4/19/23, 16:30-18:00, Salon C5-6 (LL)

Investigating the impact of a STEAM program on group scientific creativity
Hye-Eun Chu*, Macquarie University University, Australia
Ei-Seul Kim, Seoul National University, Korea, Republic of
Hyong-Moon Lee, Seoul National University, Korea, Republic of
Sonya Martin, Seoul National University, Korea, Republic of

Remote-Accessible Quantum Photonics Lab for Improving Learning Outcomes
Sahil Patel*, University of California, Santa Barbara, USA
Max Shen, University of California, Santa Barbara, USA
Quynh Dang, University of California, Irvine, USA
Galan Moody, University of California, Santa Barbara, USA

Implementing engineering aspects in chemistry lessons using a nanoscience student lab
Tim Goebel*, University of Kassel, Germany
David-S. Di Fuccia, University of Kassel, Germany

Strand 11: Cultural, Social, and Gender Issues
Symposium: Justice Centered Ambitious Science Teaching (JuST): Ways Core Practices Can Center Justice
4/19/23, 16:30-18:00, Salon A3 (LL)

Symposium: Justice Centered Ambitious Science Teaching (JuST): Ways Core Practices Can Center Justice
April Luehmann*, University of Rochester, USA
Todd Campbell, University of Connecticut, USA
Yang Zhang, University of Rochester, USA
Dé Scipio, University of Washington, USA
Priya Pugh, University of Washington, USA
Kyle Sullivan, University of Rochester, USA
Hannah Cooke, University of Connecticut, USA
Gena Merliss, University of Rochester, USA
Jessica Thompson, University of Washingon, USA
Veronica Cassone McGowan, University of Washington Bothell, USA

Lenora Crabtree, University of North Carolina, USA
Angela Calabrese Barton, University of Michigan, USA
Day Greenberg, Indiana University, USA
Scott McDonald, Pennsylvania State University, USA
Jonathan Mccausland, New Mexico Highlands University, USA
Jennifer Jackson, Pennsylvania State University, USA
Hosun Kang, University of California Irvine, USA
Heather Clark

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set: NOS and Decision-Making
4/19/23, 16:30-18:00, Waldorf (L3)

The Impact of Understanding Nature of Scientific Knowledge and Scientific Inquiry on Learning about Evolution
Juan Jimenez*, University of Talca, Chile
Norman Lederman, Illinois Institute of Technology, USA

Beyond the Science: Factors that Influence University Biology Students' COVID-19 Actions and Vaccine Acceptance
Benjamin Herman*, Texas A&M University, USA
Michael Clough, Texas A&M University, USA
Asha Rao, Texas A&M University, USA
Alex Sobotka, Texas A&M University, USA
Ben Janney, Texas A&M University, USA
Alister Olson, Texas A&M University, USA
Aaron Kidd, Texas A&M University, USA
Sarah Poor, Texas A&M University, USA

Patterns for managing potential conflict between religion and evolution among Muslim undergraduate biology students
Rahmi Aini*, Middle Tennessee State University, USA
Sara Brownell, Arizona State University, USA
M. Elizabeth Barnes, Middle Tennessee State University, USA

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set: Building pedadogical capacity in preservice teachers
4/19/23, 16:30-18:00, Blvd A (L2)

Helping Preservice Teachers Develop an Expanded Functional Scientific Literacy Using an Online Module
Sarah Voss*, Drake University, USA
Lucas Menke, Drake University, USA
Jerrid Kruse*, Drake University, USA
Colin Coulter, Drake University, USA
Isaiah Kent-Schneider, Drake University, USA

Using Photovoice to Prompt Preservice Science Teachers' Reasoning Skills
Conghui Liu*, Indiana University, USA
Gayle Buck, Indiana University, USA

Indonesian Preservice Teachers and Climate Change: Awareness, Beliefs, Values, and Behaviors
Kathy Trundle*, Utah State University, USA
Rita Hagevik*, UNC-Pembroke, USA
Laura Wheeler*, Utah State University, USA
Ryan Knowles, Utah State University, USA
Sary Silvhiany, Sriwijaya University, Indonesia

Rita Rudi, Sriwijaya University, Indonesia
Hartono Hartono, Sriwijaya University, Indonesia
Sofendi Sofendi, Sriwijaya University, Indonesia

Graduate Student Committee
Sponsored Session: Graduate Student Forum
4/19/23, 18:30-19:30, Salon A5 (LL)

Social Event: JRST Dinner
4/19/23, 18:30-19:30, Astoria (L3)
By invitation.

Committee Meetings
4/20/2023 7:00-8:00

Salon A1 (LL): *Membership Committee*

Salon A2 (LL): *Elections Committee*

Salon A3 (LL): *Awards Committee*

Salon A4 (LL): *Research Committee*

Salon A5 (LL): *Publications Advisory Committee*

Salon C1-2 (LL): *Equity and Ethics Committee*

Salon C3-4 (LL): *External Policy and Relations Committee*

Salon C5-6 (LL): *International Committee*

Salon C7-8 (LL): *Graduate Student Committee Meeting*

Blvd A (L2): *Social Media, Website, and Communications Committee*

Blvd C (L2): *Program Committee*

Concurrent Session 7
4/20/23, 8:40-10:10

Equity And Ethics Committee
Sponsored Session: Basu Scholars Symposium - Presentation of the 2022 Basu Scholars
4/20/23, 8:40-10:10, Salon A5 (LL)

ORGANIZERS
María González-Howard, U Texas - Austin, Austin, TX, USA
Sara Salloum, University of Balmand, Lebanon, Tripoli, Al Koura, Lebanon
Regina McCurdy, Georgia Southern University, Statesboro, GA, United Kingdom

PANELISTS
Takeshia Pierre, U of Florida, Gainesville, FL, USA
Alexis Riley, Cal State U - Los Angeles, Los Angeles, CA, USA
Miguel Rodriquez, California State University Dominguez Hills, Carson, CA, USA
Tatiane Russo-Tait, U of Georgia, Athens, GA, USA
Caroline Spurgin, U California, Merced, Merced, CA, USA
Hong Tran, U of Georgia, Athens, GA, USA
Selene Willis, U of South Florida, Tampa, FL, USA
Ti'Era Worsley, U North Carolina, Greensboro, Greensboro, NC, USA
Gary Wright III, North Carolina State U, Raleigh, NC, USA

Awards Committee
Sponsored Session: A Celebration of NARST Award Recipients: Distinguished Contributions to Research Award [DCRA]
4/20/23, 8:40-10:10, Waldorf (L3)

ORGANIZERS
Amelia Gotwals, Michigan State University, East Lansing, MI, USA

PANELISTS
Dana Zeidler, University of South Florida, USA

Strand 1: Science Learning: Development of student understanding
Related Paper Set: Explanations in biology: Obstacles and opportunities for teaching and learning
4/20/23, 8:40-10:10, Salon C3-4 (LL)

Revealing reasoning patterns in students' explanations using analytic grading rubrics and cluster analysis
Moriah Ariely*, Weizmann Institute of Science, Israel
Tanya Nazaretsky, Weizmann Institute of Science, Israel
Giora Alexandron, Weizmann Institute of Science, Israel
Anat Yarden, Weizmann Institute of Science, Israel

Explanatory black boxes in the biological mechanisms
Michal Haskel-Ittah*, Department of Science Teaching, Weizmann Institute of Science institute of science, Israel
Gur Livni Alcasid, Department of Science Teaching, Weizmann Institute of Science institute of science, Israel

Teaching about the structure of evolutionary and developmental explanations in secondary schools
Kostas Kampourakis*, University of Geneva, Switzerland

Epistemic aims, explanation types, and evolution learning
Ross Nehm*, Stony Brook University, USA
Evan Abreu, Stony Brook University, USA
Gena Sbeglia, Stony Brook University, USA

Applying a classroom simulation with chatbot to support pre-service biology teachers' diagnostic competence in evolution
Daniela Fiedler*, IPN Kiel, Germany
Daniel Schönle, Furtwangen University, Germany
Christoph Reich, Furtwangen University, Germany
Ute Harms, IPN Kiel, Germany

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Dialogue and Argumentation in Learning Science
4/20/23, 8:40-10:10, Salon A2 (LL)

Displaying uncertainty in collaborative interaction: a turning point in students' making sense of SSI online
Anne Solli*, University of Gothenburg, Sweden
Miranda Rocksen, University of Gothenburg, Sweden

Pair Dialogue in the Context of Computational Modeling
Linsey Brennan*, Michigan State University, USA
Namsoo Shin, Michigan State University, USA
Emil Eidin, Michigan State University, USA
Daniel Damelin, The Concord Consortium, USA
Joseph Krajcik, Michigan State University, USA

Developing Middle School Students' Socioscientific Reasoning through Integrated STEM Education
Nilay Ozturk*, Bahcesehir University, Turkey
Gillian Roehrig, University of Minnesota, USA

To evoke or not to evoke students' preconceptions in argumentation-based inquiry
Lena Lenz*, University of Education, Germany
Tobias Ludwig, University of Education, Germany

Strand 3: Science Teaching - Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set: Supporting Science Content Knowledge for Elementary Teachers
4/20/23, 8:40-10:10, Salon C1-2 (LL)

Exploring how Lived Experiences Mediate Science Identity and Agency of Induction Phase Elementary Teachers
Swarna Mahapatra*, University of Missouri, USA
Rebekah Snyder*, University of Missouri, USA
Sara Bridgewater, University of Missouri, USA

Laura Zangori*, University of Missouri, USA

Preservice Elementary Teachers' Initial Knowledge for Teaching of the Crosscutting Concepts within Three-Dimensional Teaching
Anna Maria Arias*, Kennesaw State University, USA
Soon Lee*, Kennesaw State University, USA

Exploring Elementary Teachers' Subject Matter Knowledge Development in the First Year of Teaching
Ryan Nixon*, Brigham Young University, USA
Adam Bennion*, Brigham Young University, USA
Alexandra Swain, Brigham Young University, USA
Elizabeth Tagg, Brigham Young University, USA

Understanding Teachers' Transition to Knowledge Generation Environments after a Professional Development Program
Jale Ercan-Dursun*, The University of Alabama, USA
Ercin Sahin, University of Iowa, USA
Jee Suh, The University of Alabama, USA
Qi Si, The University of Alabama, USA
Brian Hand, University of Iowa, USA
Gavin Fulmer, University of Iowa, USA

Strand 3: Science Teaching - Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set: Supporting Elementary Teachers to Teach Science
4/20/23, 8:40-10:10, Blvd C (L2)

Elementary Science Teachers' Explicit and Implicit Verbal Support of STEM+CS in an NGSS-Aligned Project
Sarah Lilly*, University of Virginia, USA
Anne McAlister, The State University of New York at Buffalo, USA
Jennifer Chiu, University of Virginia, USA

Teaching science through dialogue and argumentation: practices and challenges identified by Chilean educators and researchers
Florencia Gomez Zaccarelli*, Pontificia Universidad Catolica de Chile, Chile
Natalia Candido Vendrasco, Pontificia Universidad Catolica de Chile, Chile

An Exploratory Study: Understanding Teachers' Use of Decomposition
Ali Asif*, University of Massachusetts Dartmouth, USA
Hamza Malik*, University of Massachusetts Dartmouth, USA
Chandra Orrill, University of Massachusetts Dartmouth, USA
Ramprasad Balasubramanian, University of Massachusetts Dartmouth, USA
Shakhnoza Kayumova, University of Massachusetts, USA

Strand 4: Science Teaching - Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set: NGSS Implementation: Inquiry, Science and Engineering Practices
4/20/23, 8:40-10:10, PDR 2 (L3)

Multiple Case Study of Science and Engineering Integration in Secondary School Across Six School Districts

Elizabeth Hasseler*, University of Nebraska-Lincoln, USA
Elizabeth Lewis, University of Nebraska-Lincoln, USA

Balancing Standards Alignment with Educator Needs
Craig Kohn*, Waterford Union High School, USA
Abigail Helmke, Waterford Union High School, USA
Joseph Hendricks, Waterford Union High School, USA

Understanding of Scientific Inquiry and Its' Relation to Academic Achievement: A Large Scale Study
Cigdem Han Tosunoglu, Marmara University, Turkey
Ozgur Dogan, Marmara University, Turkey
Nevin Aslan, Marmara University, Turkey
Mustafa Cakir*, Marmara University, Turkey
Serhat Irez, Marmara University, Turkey

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Undergraduate Research Experiences
4/20/23, 8:40-10:10, Salon A4 (LL)

From Sepsis Case to Course-based Undergraduate Research Experience: Student Learning Outcomes and Views
Katherine Sharp*, Stephens College, USA
Rebecca Krall*, University of Kentucky, USA
Robin Cooper, University of Kentucky, USA
Melody Danley, University of Kentucky, USA
Jate Bernard, University of Kentucky, USA

Development of a Measure of Science Teams for NSF CUREs
Joi Walker, East Carolina University, USA
Richard Lamb*, East Carolina University, USA
Heather Vance-Chalcraft, East Carolina University, USA

Instructor conceptions and implementation of course-based undergraduate research experience (CURE) features
Kristine Callis-Duehl*, Donald Danforth Plant Science Center, USA
Ruth Kaggwa, Donald Danforth Plant Science Center, USA
Lisa Walsh, Donald Danforth Plant Science Center, USA

Examining the Activities Associated With Students' Career Clarification During Undergraduate Research Experiences
Alicia Batailles*, Florida State University, USA
Sherry Southerland, Florida State University, USA

Scientific Reasoning Competencies: Fostering and Analyzing Procedural, Content-related and Laboratory-Technical Components in the Undergraduate Lab
Marco Reith*, Institute for Science Education, Leibniz Universität Hannover, Germany
Andreas Nehring, Institute for Science Education, Leibniz Universität Hannover, Germany

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Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Supporting Science Teacher Learning through Interactions with Science Research
4/20/23, 8:40-10:10, Salon A1 (LL)

Creating a community of K-8 teachers to co-design moth research with students
David Stroupe*, Michigan State University, USA
Megan Walser, Michigan State University, USA

Fostering STEM Career Pathways by Creating a Geoscience Education Community Around Local Geologic Phenomena
Tina Vo*, University of Nevada, USA
Adjoa Mensah, University of Nevada, USA
Mayra Marquez-Mendez, University of Nevada, USA
Monique North, University of Nevada, USA
Kristoffer Carroll, Clark County School District, USA
Pamela Burnley, University of Nevada, USA

Research Experiences for Teachers: A Review of the Literature
Karen Woodruff*, Kean University, USA
Suzanne Patzelt*, Montclair State University, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Professional development and support
4/20/23, 8:40-10:10, Salon C7-8 (LL)

Making informed decisions: Documenting how physics programs shift towards a culture of assessment
Diana Sachmpazidi*, University of Maryland, USA
Chandra Turpen, University of Maryland, USA
Robert Dalka, University of Maryland, USA
Fatima Abdurrahman, University of Maryland, USA

The Research and Engagement Academy: A Model for STEM Faculty Development
Eleanor Abrams*, University of Massachusetts Lowell, USA

Responsive collaborative design of 3D assessments with science teachers
Miray Tekkumru-Kisa, RAND Corporation, USA
Jill Wertheim*, WestEd, USA
Ozlem Akcil Okan, Florida State University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Beyond Binaries: Interrogating Normativity, Marginality, and (Un)Belonging in STEM Higher Education
4/20/23, 8:40-10:10, Salon A3 (LL)

A qualitative exploration of Latinx students' impostor experiences in science
Devasmita Chakraverty*, Indian Institution of Management Ahmedabad, India

Transgender and Minority Gender Students' Sense of Belonging in Higher Education
Tulana Ariyaratne*, Indiana University, USA
Gayle Buck, Indiana University, USA

Queering the glass ceiling: Gender hierarchies in academic physical science
Katherine Doerr*, Malmö University, Sweden

Movement expressiveness in a chemistry lab as embodied knowledge or off-task behavior
Molly Weinburgh*, Texas Christian University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Centering STEM Faculty: Supporting Persistence and Leveraging Perspectives toward Antiracist Work
4/20/23, 8:40-10:10, Salon C5-6 (LL)

Female Perceptions of STEM: Reflecting on why they matter
Mary Curtis*, Independent Researcher, USA
Carol Waters*, University of Houston-Clear Lake, USA

Reflections on Inclusive Pedagogy among STEM Faculty during Teaching TRIOS Peer Observation Process
O. Theresa Ayangbola*, Middle Tennessee State University, USA
Sarah Bleiler-Baxter, Middle Tennessee State University, USA
Fonya Scott, Middle Tennessee State University, USA
Olena James, Middle Tennessee State University, USA
Amanda Lake Heath, Middle Tennessee State University, USA
Grant Gardner, Middle Tennessee State University, USA
Gregory Rushton, Middle Tennessee State University, USA

Building Equity-minded Science Educators and STEM-C Faculty: Faculty Learning Communities (FLCs) in Postsecondary Environments
Shari Watkins*, American University-CTRL, USA
Meg Bentley, American University, USA
Ellen Feder*, American University, USA
Nate Harshman, American University, USA
Lauren Weis*, American University, USA
Amy Butler, American University, USA
Kathryn Water-Conte, American University, USA

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set: Using Computational and System Thinking to Support Science Learning
4/20/23, 8:40-10:10, Blvd A (L2)

CT Integration with science and math curricula through teacher-researcher co-design
Amanda Peel*, Northwestern University, USA
Delan Hao, Northwestern University, USA
Michael Horn, Northwestern University, USA
Uri Wilensky, Northwestern University, USA

K-5 Accessible, Computational Thinking-Integrated Science Education: A Conceptual Framework
Janice Mak*, Arizona State University, USA
Lin Yan, Arizona State University, USA
Man Su, Arizona State University, USA

Kristina Kramarczuk, University of Maryland, USA
Ebony Terrell Shockley, University of Maryland, USA
Diane Jass Ketelhut, University of Maryland, USA

Asynchronous Online or Blended/ Hybrid: Implementing Learning Experience Design to Support Students Learning Behaviors
Joseph Wong*, university of california, irvine, USA
Lindsey Richland, university of california, irvine, USA
Brad Hughes, university of california, irvine, USA

Fostering Pre-service Science Teachers' Systems Thinking via an Asynchronous Online Course
Dov Dori*, MIT, USA
Roee Peretz, Technion, Israel
Yehudit Judy Dori, Technion, Israel

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set: Considering teacher development at the secondary school level
4/20/23, 8:40-10:10, Astoria (L3)

Cross-national survey of science teachers' perceptions of school communities: Implications for curriculum and teacher development
Xavier Fazio*, Brock University, Canada

Unpacking the connections between climate literacy and sense of place among Bedouin teachers in Israel.
Shaima Alokbe*, Ben-Gurion University, Israel
Orit Ben Zvi Assaraf*, Ben-Gurion University, Israel
Wisam Sedawi, Ben-Gurion University, Israel

School-Based Outdoor Science Education K-11 Teachers' Declared Practices in the Province of Québec, Canada
Jean-Philippe Ayotte-Beaudet, Université de Sherbrooke, Canada
Metzisochil Boily-Ortéga, Université de Sherbrooke, Canada
Asmaa Khayat, Université de Sherbrooke, Canada
Élise Rodrigue-Poulin, Université de Sherbrooke, Canada
Marie-Claude Beaudry*, Université de Sherbrooke, Canada
Valérie Vinuesa, Université de Sherbrooke, Canada
Félix Berrigan, Université de Sherbrooke, Canada

Concurrent Session 8
4/20/23, 10:30-12:00

Publications Advisory Committee Sponsored Session: NARST/NSTA Annual Research Worth Reading Recognition
4/20/23, 10:30-12:00, Salon C1-2 (LL)

ORGANIZERS
Dante Cisterna, Educational Testing Service, USA
Lindsay Lightner, Washington State University, Tri-Cities, USA
Emily Dare, Florida International University, USA
G. Michael Bowen, Mount Saint Vincent University, Halifax, Nova Scotia, Canada
Cynthia Crockett, Harvard-Smithsonian Center for Astrophysics, USA
Knut Neumann, IPN-Leibniz-Institute for Science and Mathematics Education, Kiel, Germany

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Awards Committee Sponsored Session: A Celebration of NARST Award Recipients: Early Career Research Award [ECRA], Outstanding Dissertation Research Award [ODRA], and NARST Fellows Award.
4/20/23, 10:30-12:00, Waldorf (L3)

ORGANIZERS
Amelia Gotwals, Michigan State University, East Lansing, MI, USA

PANELISTS
Heidi Cian, Florida International University, USA
Hsin-Kai Wu, National Taiwan Normal University, Democratic People's Republic of Korea
Hosun Kang, University of California - Irvine, USA

Roundtables Session 2
4/20/23, 10:30-12:00, Salon A5 (LL)

Topic 1: Supporting beginning teachers

Strand 8: In-service Science Teacher Education
Collaboration as a Key Factor in Secondary Science Teacher Induction
Dennis Sunal*, The University of Alabama, USA
Cynthia Sunal*, The University of Alabama, USA
Sabrina Stanley, The University of Alabama, USA
Marsha Simon, University of West Georgia, USA

Strand 8: In-service Science Teacher Education
"I would go crazy without them": Narrative inquiry into novice science teacher community of practice
Sabrina Stanley*, The University of Alabama, USA

Strand 8: In-service Science Teacher Education
Understanding Science Teacher Persistence: Examining intersections of instructional Quality and Teaching Contexts
Danielle Rhemer*, Florida State University, USA
Jennifer Schellinger, Florida State University, USA
Miray Tekkumru-Kisa, Florida State University, USA
Sherry Southerland, Florida State University, USA

Concurrent Session 8, 4/20/23, 10:30-12:00

Topic 2: Re-situating Science Teaching and STEM Identities within Community and Politicized Care

Strand 11: Cultural, Social, and Gender Issues

We Need Something to Last: Exploring Funds of Knowledge and Community Cultural Wealth

Katherine Wade-Jaimes*, University of Nevada, USA

Strand 11: Cultural, Social, and Gender Issues

Science for Community Well-being, Liberation and Social Transformation: Transformative Learning and Actions for Change

Bhaskar Upadhyay*, University of Minnesota, USA
Marina Aleixo, University of Minnesota, USA

Strand 11: Cultural, Social, and Gender Issues

With Care and in Community: Humanizing STEM for Black and Latina Girls

Laura Peña-Telfer*, Georgia State University, USA
Natalie King, Georgia State University, USA

Strand 7: Pre-service Science Teacher Education

Determination of Integrated STEM Teacher Competencies

Feral Ogan-Bekiroglu*, Marmara University, Turkey
Fatma Caner, Marmara University, Turkey

Topic 3: Informal Science and STEM learning

Strand 6: Science Learning in Informal Contexts

Cultivating Equitable STEM Participation Through an Equity Focused Learning Progression

Lezly Taylor*, Virginia Tech, USA
George Glasson, Virginia Tec, USA
Brenda Brand, Virginia Tech, USA

Strand 6: Science Learning in Informal Contexts

Children's Epistemic Agency in Everyday Family Science Engagement

Irit Vivante*, Ben Gurion University in the Negev, Israel
Dana Vedder-Weiss, Ben Gurion University in the Negev, Israel
Neta Shaby, University of Southampton, United Kingdom

Strand 6: Science Learning in Informal Contexts

Genetic Technology & the Use of an Oral Debate Method to Question Ethics in the Classroom

Chaley Cleckley*, Lamar University, USA
Mamta Singh, Lamar University, USA

Strand 15: Policy, Reform, and Program Evaluation

Development and Evaluation of an Archaeological Afterschool Program to Promote Science Learning

Amber Simpson*, Binghamton University, USA
Laurie Miroff, Binghamton University, USA

Topic 4: Teaching and Learning NOS from Kindergarten through Graduate School

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

NOS Conceptions and Identity Development among Graduate Students in Science Education

Andrea Phillips*, Indiana University, USA

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

Influence of engaging texts and immersive experiences on kindergarten students' conceptions of observations and inferences

Valarie Akerson*, Indiana University, USA
Kristen Poindexter, Allisonville Elementary School, USA

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

College Students' Views of the Nature of Science

Stephanie Rothman*, Indiana University, USA
Jason Rothman, UC Irvine, USA

Strand 1: Science Learning: Development of student understanding
SC-Organized Paper Set: Engineering Design and Self-Efficacy to Promote Student Learning
4/20/23, 10:30-12:00, Salon C3-4 (LL)

Reasoning through iteration: How do engineering design projects promote student learning and self-efficacy?

Senay Purzer*, Purdue University, USA
Rundong Jiang, Institute for Future Intelligence, USA
Isaac Lyss-Loren, Purdue University, USA
Filiz Demirci, Purdue University, USA
Jenny Quintana-Cifuentes, University of Louisiana Moroe, USA

A New Model of the Engineering Design Process from A Conceptual Change Approach

Christine McGrail*, University of Massachusetts Amherst, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Computational Modeling and Data Analysis in Learning Science
4/20/23, 10:30-12:00, Blvd A (L2)

Telling atoms how to react: Students' learning through computational modeling of chemical reactions using MMM-React

Asnat Zohar, The University of Haifa, Israel
Sharona Levy*, The University of Haifa, Israel

The More, the Better? Influence of Different Data Amounts on Cognitive Load and Learning Outcomes

Gregor Benz*, Karlsruhe University of Education, Germany
Tobias Ludwig, Karlsruhe University of Education, Germany
Amy Masnick, Hofstra University, USA

What dimensions do students notice through computational modeling and data analysis?: An investigation using [Anonymous]

Aditi Wagh*, Massachusetts Institute of Technology, USA
Adelmo Eloy, Columbia University, USA

Tamar Fuhrmann, Columbia University, USA
Leah Rosenbaum, Columbia University, USA
Paulo Blikstein, Columbia University, USA
Michelle Wilkerson, University of California, Berkeley, USA

A Systematic Review of the Literature on Graphing Statistical Data in STEM Education
Verena Ruf*, Technische Universität Kaiserslautern, Germany
Sarah Malone, Saarland University, Germany
Dominik Thüs, Saarland University, Germany
Stefan Küchemann, Ludwig-Maximilians-Universität, Germany
Sebastian Becker-Genschow, University of Cologne, Germany
Markus Vogel, Pädagogische Hochschule Heidelberg, Germany
Roland Brünken, Saarland University, Germany
Jochen Kuhn, Ludwig-Maximilians-Universität, Germany

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set: Honoring Learners' Lives in Informal Science learning
4/20/23, 10:30-12:00, PDR 2 (L3)

Creating accessible and inclusive science camp for deaf students
Scott Cohen*, Georgia State University, USA

Supporting Multilingual Children's Learning at Science Museum through Science Talk
Wahyu Setioko*, The Ohio State University, USA
Lin Ding, The Ohio State University, USA

Towards Epistemic Justice in Socio-scientific Decision-Making: How Youth Make Sense of Lively COVID -19 Data
Wisam Sedawi*, University of Michigan, USA
Angela Barton, University of Michigan, USA

Exploring queer and science identities of LGBTQ+ community and citizen science participants
Todd Harwell*, University of California, Davis, USA
Russanne Low, Institute for Global Environmental Strategies, USA
Allison Mattheis, California State University, Los Angeles, USA
Kelly Riedinger, STEM Research Center, Oregon State University, USA
Heather Fischer, STEM Research Center, Oregon State University, USA

Strand 7: Pre-service Science Teacher Education
Related Paper Set: Investigating How Preservice Teachers Learn to Facilitate Argumentation-Focused Discussions through Online Simulations
4/20/23, 10:30-12:00, Salon A2 (LL)

Elementary Preservice Teachers' Use of Prompts to Encourage Student-to-Student Talk during Scientific Argumentation Discussions
Heidi Masters*, University of Wisconsin - La Crosse, USA
Pamela Lottero-Perdue*, Towson University, USA

Examining Preservice Secondary Teachers' Question Patterns in Support of Argumentation-Focused Discussions in Science and Mathematics
Laura Zangori*, University of Missouri, USA
Meredith Park Rogers*, Indiana University, USA
Ronald Hermann, Towson University, USA
Rachel Snider, TNCJ The College of New Jersey, USA
Tracy Hargrove, University of North Carolina Wilmington, USA
Shelby Morge, University of North Carolina Wilmington, USA
Calii Shekell, Thiel College, USA
Heather Howell, ETS, USA

Preservice Teachers Noticing and Positioning Students as "Knowers" in Equitable Argumentation-Based Discussions
Amanda Benedict-Chambers*, Missouri State University, USA
Lauren Madden*, The College of New Jersey, USA

Examining Preservice Teachers' Performances Facilitating Argumentation in a Teaching Simulator
Meredith Park Rogers*, Indiana University, USA
Kady Lane*, Indiana University, USA
Taiwo Ogundapo*, Indiana University, USA
Dionne Cross Francis, University of North Carolina - Chapel Hill, USA
Pavneet Kaur Bharaj, University of North Carolina - Chapel Hill, USA
Arya Karumanthra, Indiana University, USA
Kraig Kitts, Indiana University, USA
Spencer Perry, Indiana University, USA
Adam Maltese, Indiana University, USA
Jamie Mikeska, ETS, USA
Calli Shekell, Thiel College, USA

Examining What and How Secondary Science Preservice Teachers Learn from Using Online Simulated Teaching Experiences
Calli Shekell, Thiel College, USA
Jamie Mikeska*, ETS, USA
Pavneet Kaur Bharaj, University of North Carolina, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Teacher Learning around the Epistemic Work of Science
4/20/23, 10:30-12:00, Salon A1 (LL)

Investigating Science Teachers' Professional Vision of Science and Engineering Practices
Yuxi Huang*, University of Georgia, USA
Hong Tran, University of Georgia, USA
Joseph Deluca, University of Georgia, USA
Jose Pavez, Western Illinois University, USA
William Gorton, University of Georgia, USA
Julie Luft, University of Georgia, USA
Brooke Whitworth, Clemson University, USA

Do Epistemological Beliefs Matter? Investigating Mentor Teachers' Perceptions & Approaches to Supporting Model-Based Science Teaching
Grace Carroll*, North Carolina State University, USA
Matt Reynolds, North Carolina State University, USA
Soonhye Park, North Carolina State University, USA

Amanda Hall, North Carolina State University, USA
Scott Ragan, North Carolina State University, USA
Jason Painter, North Carolina State University, USA

Exploring Teachers' Epistemological and Ontological Views throughout a Professional Development
Ercin Sahin*, University of Iowa, USA
Jee Suh, University of Alabama, USA
Jale Dursun, University of Alabama, USA
Brian Hand, University of Iowa, USA
Gavin Fulmer, University of Iowa, USA

Productive Struggle and Epistemic Empathy: Developing Teachers' Modeling Orientation in a Community Science Context
Lauren Saenz*, Bowdoin College, USA
Alison Miller*, Bowdoin College, USA
Christine Voyer, Gulf of Maine Research Institute, USA
Meggie Harvey, Gulf of Maine Research Institute, USA
Sarah Clarke, Bowdoin College, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Examining student performance in science learning
4/20/23, 10:30-12:00, Salon C7-8 (LL)

Examining Aspects of Integrated STEM Education and Student Attitudes
Benny Mart Hiwatig*, University of Minnesota, USA
Gillian Roehrig, University of Minnesota, USA
Mark Rouleau, Michigan Technological University, USA

Diagnosing Middle School Students' Scientific Modeling: Cognitive Diagnostic Modeling Approach
Yu Zhang*, Northeast Normal University, China
Peng He*, Michigan State University, USA
Tingting Li*, Michigan State University, USA

Multi-level Structural Equation Modelling for the Factors Affecting Korean Middle School Students' Science Achievement
Gyeong-Geon Lee*, Seoul National University, Korea, Republic of
Heesoo Ha, Seoul National University Center for Educational Research, Korea, Republic of
Hun-Gi Hong, Seoul National University, Korea, Republic of

A Curriculum Analysis of The Sources of Data and Data Engagements of Science Students
Amanda Garner*, University of Tennessee, USA
Joshua Rosenberg, University of Tennessee, USA

Strand 11: Cultural, Social, and Gender Issues
Related Paper Set: Rethinking Language in Science, Engineering, and Environmental Education: Historical Dangers and Transformative Possibilities
4/20/23, 10:30-12:00, Salon C5-6 (LL)

Racialized as distant-from-science: U.S. science education research and the pathologization of linguistic diversity
Kathryn Kirchgasler*, University of Wisconsin–Madison, USA

Chushan Wu, University of Wisconsin–Madison, USA
Cynthia Baeza, University of Wisconsin–Madison, USA
Diego Román, University of Wisconsin–Madison, USA

Inclusive STEM Education for "English Learners": Racializing Bi/Multilingual Students as Not-From-Here
Cynthia Baeza*, University of Wisconsin-Madison, USA
Sam Evans*, University of Wisconsin-Madison, USA

Multicompetent Learners in engineering: Towards linguistic and cultural justice in design
Greses Pérez*, Tufts University, USA

Situating African American Language within science teacher education
Quentin Sedlacek*, Southern Methodist University, USA
Catherine Lemmi, California State University, Chico, USA
Kimberly Feldman, University of Maryland, Baltimore County, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Examining the intersections of students' ethnic, racial and science identities in college and beyond
4/20/23, 10:30-12:00, Salon A3 (LL)

Towards understanding the science experiences and identity formation of FilAm students
Johan Tabora*, University of Illinois Chicago, USA

Student Heterogeneity and STEM Identity Development in the HBCU Context
Karen Marshall*, Oakwood University, USA
Carmen Bucknor, Oakwood University, USA
Valeisha Ellis, Spelman College, USA
Danielle Dickens, Spelman College, USA
Sylvia Butterfield*, National Science Foundation, USA
Christyn Byrd, Oakwood University, USA

A critical approach to examine the racial and science identity formation of Latinx students
Danielle Maxwell*, University of Michigan, USA
Kathryn Hosbein, Middle Tennessee State University, USA
Paulette Vincent-Ruz, New Mexico State University, USA
Ginger Shultz, University of Michigan, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
Symposium: The role of nature of science in tackling societal emergencies: An international perspective
4/20/23, 10:30-12:00, Blvd C (L2)

The role of nature of science in tackling societal emergencies: An international perspective
Wonyong Park*, University of Southampton, United Kingdom
Hagop Yacoubian, American University of Armenia, Armenia
Alison Cullinane, University of Edinburgh, United Kingdom
Haira Gandolfi, University of Cambridge, United Kingdom

Noemi Waight, University at Buffalo, USA
Shakhnoza Kayumova, University of Massachusetts, Dartmouth, USA
Jennifer Tripp, University at Buffalo, USA
Feyza Achilova, Dartmouth High School, USA
Andreia Guerra, Centro Federal de Educação Tecnológica Celso Suckow da Fonseca, Brazil
Cristiano Moura, Centro Federal de Educação Tecnológica Celso Suckow da Fonseca, Brazil

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Strand 15: Policy, Reform, and Program Evaluation
SC-Organized Paper Set: STEM and Problem-Based Instruction
4/20/23, 10:30-12:00, Salon A4 (LL)

The Experiences of Undergraduate Saudi Students in the STEM Trajectory: Major Choice and Persistence Intentions
Manal Almalki*, Western Michigan University, USA

A Systematic Review and Meta-Analysis of the 5E Instructional Model for Improving STEM Educational Outcomes
Joshua Polanin, American Institutes for Research, USA
Megan Austin, American Institutes for Research, USA
Joseph Taylor*, American Institutes for Research, USA
Rebecca Steingut, American Institutes for Research, USA
Melissa Rodgers, American Institutes for Research, USA

Impacts of Problem-Based Instruction on Undergraduate Students' Epistemological Beliefs
May Lee*, University of Groningen, Netherlands
Cormac Larkin, University of Groningen, Netherlands
Steven Hoekstra, University of Groningen, Netherlands

Elementary school science: Building a case for urgent action.
Zoubeida Dagher*, University of Delaware, USA
Tamara Turski, University of Delaware, USA

Concurrent Session 9
4/20/23, 13:10-14:40

Equity And Ethics Committee Sponsored Session: Elevating Voices of Ethnically and Linguistically Diverse Learners: Interrogating Dominant Deficit-oriented Perspectives across Reforms, Policy and Practices in Science Education
4/20/23, 13:10-14:40, Salon A4 (LL)

ORGANIZERS
Sara Salloum, Ohio University, Athens, OH, USA
Regina McCurdy, Geogia Southern University, Statesboro, GA, USA
Marsha Simon, Georgia Western University, Carrollton, GA, USA
Roshni Bano, University of Illinois at Chicago, IL, USA

PANELISTS
Terrell Morton, University of Illinois, Chicago, IL, USA
Peter Okebukola, Lagos State University, Lagos, Nigeria
Sara Wilmes, The University of Luxembourg, Luxembourg

Graduate Student Committee Sponsored Session: Graduate Student Research Symposium
4/20/23, 13:10-14:40, Salon A5 (LL)

ORGANIZERS
Scott Cohen, Georgia State University, Georgia, USA
Theila Smith, University of Groningen, Netherlands
Ti'Era Worsley, University of North Carolina at Greensboro, USA
Sage Andersen, University of Texas at Austin, Texas, USA
Helen Aptyka, University of Cologne, Cologne, North Rhine-Westphalia, Germany
Klaudja Caushi, University of Massachusetts Boston, Massachusetts, USA
Cathy Cullicott, Arizona State University, Arizona, USA
Savannah Graham, Texas Christian University, Texas, USA
Roxanne Gutowski, University of Cologne, Cologne, North Rhine-Westphalia, Germany
Suzanne Poole Patzelt, Montclair State University, New Jersey, USA
Andrea Reeder, Middle Tennessee State University, Tennessee, USA
Hong Tran, University of Georgia, Georgia, USA

PRESENTERS
Eric Antwi Akuoko, University of Iowa
Amanda Andersen, University of California, Santa Barbara
Ryan Coker, Florida State University
Diana Crespo Camacho, Oregon State University
Bradley Davey, Northwestern University
Iliana De La Cruz, Texas A&M
Desi, University of Minnesota
Sarah Dodoo, University of Illinois, Urbana-Champagne
Hannah Douglas, University of Arizona
Lilana Garcia, University of California, Santa Barbara
Rachel Garcia, Patton College of Education, Ohio University
Emily Helton, West Virginia University
Benjamin Janney, Texas A&M
Ruveyde Kaya, Florida State University
Heather Killen, University of Maryland-College Park
Samuel Lee, Boston College
Nelly Marosi, University of Groningen

Adjoa Mensah, University of Nevada, Las Vegas
Allison Metcalf, Florida State University
Aparajita Rajwade, North Carolina State University
Gerardo Sanchez Gutierrez, University of Texas-Austin
Chelsea Sexton, University of Georgia
Soo Won Shim, Purdue University
Annabel Stoler, Boston University
Joineé Taylor, Florida International University
Lauren Wanger, Florida State University

Strand 1: Science Learning: Development of student understanding
Symposium: Learning Progressions in Science: What have we learnt and where next?
4/20/23, 13:10-14:40, Salon C7-8 (LL)

Learning Progressions in Science: What have we learnt and where next?
Linda Morell*, University of California, USA
Jonathan Osborne*, Stanford University, USA
Kristin Gunckel*, University of Arizona, USA
Richard Lehrer*, Vanderbilt University, USA
Mark Wilson*, University of California, USA
Alicia Alonzo*, Michigan State University, USA
Tiffany-Rose Sikorski, George Washington University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Related Paper Set: Critical Pedagogies of Science and Technology
4/20/23, 13:10-14:40, Salon C5-6 (LL)

Building Community Agency through Participatory Tech Education
Sepehr Vakil*, Northwestern University, USA
Alisa Weith, Northwestern University, USA
Natalie Melo*, Northwestern University, USA

Seeking Truth Through Technology - Pre-Service Science Teachers' Political Use of Technology in Scientific Inquiry
Natalie De Lucca*, Vanderbilt University, USA
Jessica Watkins, Vanderbilt University, USA
Serena Pao, Vanderbilt University, USA

Middle Grades Students as Ethical World-Builders: The Cilantro Filter Engineering Challenge
Alejandra Frausto*, Northwestern University, USA

The Promise and Pedagogy of Scientific Instruments for Linking NGSS with Teaching for Social Justice
Daniel Morales-Doyle*, University of Illinois Chicago, USA
Alejandra Frausto Aceves*, Northwestern University, USA
Mindy Chappell*, Portland State University, USA
Tiffany Childress Price*, University of Illinois Chicago, USA
Shelby Hatch*, Northwestern University, USA
Nina Hike*, University of Illinois Chicago, USA

Strand 4: Science Teaching - Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set: NGSS Implementation: Three-Dimensional Learning and Crosscutting Concepts
4/20/23, 13:10-14:40, Blvd A (L2)

An analysis of supports in OpenSciEd curriculum materials focused on use of the Crosscutting Concepts
Megan McLean, Washington State University, USA
Sarah Fick*, Washington State University, USA
Abraham Lo, BSCS Science Learning, USA

Patterns in Conceptions of Crosscutting Concepts in Secondary Teachers
Sarah Fick*, Washington State University, USA
Chloe Dydasko, Washington State University, USA
Chad Gotch, Washington State University, USA
Kira Carbonneau, Washington State University, USA

Integrating Scientific Investigations from Three Dimensions? Can We Specify What Goes in the Pedagogy?
Lin Zhang*, Providence College, USA
Zhushan Li, Boston College, USA
Jihang Chen, Boston College, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Faculty Knowlege and Beliefs about Instruction
4/20/23, 13:10-14:40, Astoria (L3)

Exploring the Relationship between Teacher Beliefs and Teacher Discourse Approaches in Undergraduate STEM Learning Environments
Abdi Warfa*, University of Minnesota, USA

Impacts of Perceived Leadership on Teacher Identity and Mediation of Student-Centered Practices in College STEM
Sule Aksoy*, Graduate Center, CUNY, USA

Characterizing PCK development among early-career undergraduate biology instructors
Alexander Waugh*, University of Georgia, USA
Tessa Andrews, University of Georgia, USA

Faculty Development to Support Learning about Science Assessments: A Collaborative Self-Study
Lyndsay Munro*, University of Nevada, Reno, USA
Elizabeth de los Santos*, University of Nevada, Reno, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Beliefs/ Perceptions about science teaching and learning across different contexts
4/20/23, 13:10-14:40, Salon A1 (LL)

Elementary Preservice Teachers' Beliefs about the NGSS Science Practices
Elsun Seung*, Indiana State University, USA
Vance Kite, North Carolina State University, USA
Soonhye Park, North Carolina State University, USA

Aeran Choi, Ewha Womans University, Korea, Republic of

Exploring Changes in Pre-Service Science Teachers' Attitudes and Beliefs about Gender & Sexual Diversity-Inclusive Science Teaching
Gary Wright*, North Carolina State University, USA
Cesar Delgado, North Carolina State University, USA

Pre-service biology teachers' conceptions about what it means to understand biology: A phenomenographic study
Gregory Thomas*, The University of Alberta, Canada

What matters?: Beginning secondary science teachers' perceptions of what influences their instructional practice
Matthew Wilsey*, Stanford University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Resiliency and Retention of Science Teachers
4/20/23, 13:10-14:40, Salon A3 (LL)

Inservice Elementary Teachers' Science and Engineering Teaching Self-Efficacy: A Synthesis of the Literature
Jeanna Wieselmann, Southern Methodist University, USA
Deepika Menon*, University of Nebraska - Lincoln, USA
Sarah Haines, Towson University, USA
Sumreen Asim, Indiana University Southeast, USA

The case of new science teachers building up resilience in their early years of teaching.
Jose Pavez*, Western Illinois University, USA
Shannon Navy, Kent State University, USA
Julie Luft, University of Georgia, USA
Adepeju Prince, Kent State University, USA
Elizabeth Ayano, University of Georgia, USA
Kelly Kulp, University of Georgia, USA
Lisa Borgerling, Kent State University, USA
Bo Idsardi, Eastern Washington University, USA

The role of kinship in the retention of science teachers in Kingfisher School District
Suzanne Patzelt*, Montclair State University, USA
Douglas Larkin, Montclair State University, USA
Liz Carletta, Montclair State University, USA
Mayra Munoz, Montclair State University, USA

Strand 8: In-service Science Teacher Education
Related Paper Set: Supporting teacher learning in integrated STEM Education
4/20/23, 13:10-14:40, Waldorf (L3)

Positioning teachers as active co-researchers examining PBL in STEM Education (Paper 1)
Kathleen (Kathy) Smith*, Monash University, Australia
Jennifer Mansfield*, Monash University, Australia
Amanda Berry*, Monash University, Australia

Peter Ellerton, University of Queensland, Australia
Nicoleta Maynard, Monash University, Australia
Deborah Corrigan, Monash University, Australia
Tabetha Spiteri, Monash University, Australia
Tim Smith, University of Queensland, Australia

Using Design-Based Research as a Means to Build STEM Teacher Collaboration
Tamara Moore*, Purdue University, USA
Kristina Tank*, Iowa State University, USA
S Guzey*, Purdue University, USA
Anne Ottenbreit-Leftwich, Indiana University, USA
Jennifer Kersten Olsen, Richfield High School, USA

A Study of Complex Curriculum Implementation Supported by a Comprehensive Professional Learning Plan
Janet Carlson*, CSET, Stanford University, USA
Rebecca Deutscher, CSET, Stanford University, USA

A complex collection of knowledges: the opportunities and challenges of preparing teachers for STEM education
Emma Stevenson*, The University of Melbourne, Australia

Exploring the Nature of Integrated STEM Throughout a STEM Curriculum Unit
Gillian Roehrig*, University of Minnesota, USA
Emily Dare*, Florida International University, USA
Joshua Ellis*, Florida International University, USA
Elizabeth Ring-Whalen, St. Catherine University, USA
Mark Rouelau, Michigan Technological University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: How Teachers' Linguistic Beliefs and Practices Impact the Science Identities and Epistemic Agency of Multilingual Learners
4/20/23, 13:10-14:40, Salon A2 (LL)

Multilingual Identity: A Novel Intersectional Construct to Elucidate Students' STEM Experiences
Margaret Jeong*, University of Illinois at Chicago, USA
Roshni Bano*, University of Illinois at Chicago, USA
Minjung Ryu, University of Illinois at Chicago, USA

Multilingual Learners' Science Identities through the Lenses of Recognition, Funds of Knowledge, and Classroom Experience
Molly Staggs*, University of Florida, USA
Julie Brown*, University of Florida, USA

Customizing science curriculum for multilingual learners: Teachers' language beliefs and their customization decisions
Caitlin Fine*, Metropolitan State University of Denver, USA
Samuel Lee, Boston College, USA
Katherine McNeill*, Boston College, USA

Making Space for Multilingual Student Epistemic Agency in Science Classrooms
Shakhnoza Kayumova*, Univeristy of Massachusetts Dartmouth, USA
Akira Harper*, University of Massachusetts Dartmouth, USA
Eleanor Richard, University of Massachusetts Dartmouth, USA

Strand 11: Cultural, Social, and Gender Issues
Symposium: Centering a Conversation Around Approaches to Studying and Conceptualizing Teachers' Agency
4/20/23, 13:10-14:40, Salon C1-2 (LL)

Centering a Conversation Around Approaches to Studying and Conceptualizing Teachers' Agency
Alison Mercier*, University of Wyoming, USA
Anica Miller-Rushing*, University of Maine, USA
Felicia Moore Mensah, Teachers College, Columbia University, USA
Elizabeth Hufnagel, University of Maine, USA
Meena Balgopal, Colorado State University, USA
Jenny Martin, Australian Catholic University, Australia
Megan Bang, Northwestern University, USA
Carrie Tzou, University of Washington Bothell, USA
Leah Bricker, Spencer Foundation, USA
Jordan Sherry-Wagner, University of Washington Seattle, USA
Veronica McGowan, University of Washington Bothell, USA
Asli Sezen-Barrie, National Science Foundation, USA
Jennifer Lingle, University of North Carolina at Greensboro, USA

Strand 12: Technology for Teaching, Learning, and Research
Symposium: Distributing Epistemic Functions and Tasks – Towards a Methodological Approach for Using ML in Science Education
4/20/23, 13:10-14:40, PDR 2 (L3)

Distributing Epistemic Functions and Tasks – Towards a Methodological Approach for Using ML in Science Education
Marcus Kubsch*, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Christina Krist, University of Illinois at Urbana-Champaign, USA
Joshua Rosenberg, University of Tennessee, USA
Stefan Sorge, IPN – Leibniz Institute for Science and Mathematics Education, Germany
Peter Wulff, PH Heidelberg, Germany
Xiaoming Zhai, University of Georgia, USA
Ross Nehm, Stony Brook University, USA
Eugene Cox, University of Illinois Urbana-Champaign, USA
Barbara Hug, University of Illinois Urbana-Champaign, USA
Kevin Hall, University of Illinois Urbana-Champaign, USA
Elizabeth Dyer, University of Tennessee, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
SC-Organized Paper Set: New Contexts for NOS Teaching and Learning
4/20/23, 13:10-14:40, Blvd C (L2)

Cognitive and Epistemic Account of Nature of Engineering: Implications for Science Education in Schools
Miri Barak*, Technion, Israel
Tamar Ginzburg, Technion, Israel
Sibel Erduran, University of Oxford, United Kingdom

Development of chemical experiments for the explicit reflection of Nature of Science
Janne-Marie Bothor*, University of Kassel, Germany
David-Samuel Di Fuccia, University of Kassel, Germany

E-VNOS: Analysis Framework for Characterizing Enacted Views of the Nature of Science in Student Theses
Annelies Pieterman-Bos*, University Medical Center Utrecht, Netherlands
Marc van Mil, University Medical Center Utrecht, Netherlands

Examining Middle School Students' Nature of Science Views
Dilara Goren*, Bo_aziçi University, Turkey
Ebru Kaya, Boğaziçi University, Turkey

Strand 14: Environmental Education and Sustainability
Related Paper Set: Promoting Socio-ecological Caring Practices in Science Education: Models, Possibilities, and Complexities
4/20/23, 13:10-14:40, Salon C3-4 (LL)

Restorying Nature-Culture Relations Towards Multispecies Ecological Caring Across Scales of Implementation
Philip Bell*, University of Washington, USA
Nancy Price, University of Washington, USA

How children engage in just worlding through multispecies design and radical care in engineering education
Anastasia Sanchez*, University of Washington, USA

Socio-ecological Minding: Examining methodological conundrums & neglected narratives with youth
Kelsie Fowler*, University of Washington, USA

Can there be a science of the sacred?
Sara Tolbert*, University of Canterbury, New Zealand

Poster Session A
4/20/23, 14:50-15:35, Grand Ballroom (L2)

Strand 1: Science Learning: Development of student understanding
On Critiques to Learning Progression Research
Hui Jin*, Georgia Southern University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Understanding Science Texts is Specific: Cognitive and Motivational Characteristics as Predictors of Students' Text Comprehension
Hendrik Härtig*, University of Duisburg-Essen, Germany
Nadine Cruz Neri, University of Hamburg, Germany
Sascha Bernholt, Leibniz Institute for Science and Mathematics Education - IPN, Germany
Anke Schmitz, Leuphana University, Germany
Jan Retelsdorf, University of Hamburg, Germany

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Research on Embedded Engineering Education in Science Settings (2011-2021)
Allison Antink-Meyer*, Illinois State University, USA
Melisa Brown, Illinois State University, USA
Margaret Parker, Illinois State University, USA
Jennifer Smith, Illinois State University, USA
Mike Jones, Illinois State University, USA
Ryan Brown, Illinois State University, USA

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
Elementary Daily Schedules: Comprehensiveness, Frequency, and Consistency of Science
Elizabeth Davis*, University of Michigan, USA
Christa Haverly, Northwesteren University, USA

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
Representations of Astronomy in Children's Picture Books
Julia Plummer*, The Pennsylvania State University, USA
Alison Allen, Rockman et al Cooperative, USA

Strand 3: Science Teaching — Primary School (Grades preK-6): Characteristics and Strategies
My "go-to" person: Social networks and teaching practice in an elementary science professional learning program
Peter Bjorklund, University of California at San Diego, USA
Bridget Murray, American Museum of Natural History, USA
Jenny Ingber, American Museum of Natural History, USA
Colleen Owen, American Museum of Natural History, USA
Hudson Roditi, American Museum of Natural History, USA
Shannon Haas, New York Botanical Garden, USA
Barbara Kurland, Brooklyn Botanic Garden, USA
Marnie Rackmill, Queens Botanical Garden, USA
Lauren Tecosky, American Museum of Natural History, USA

Poster Session A, 4/20/23, 14:50-15:35

Anna MacPherson, American Museum of Natural History, USA

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

The Burning Matter: Investigating Data Representations in Wildfire Learning

Brandin Conrath*, The Pennsylvania State University, USA
Scott McDonald, The Pennsylvania State University, USA
Amy Farris, The Pennsylvania State University, USA
Amy Pallant, The Concord Consortium, USA

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

Draw an Earth Scientist: Investigating Undergraduate Students' Conceptions of Earth Scientists

Deef Al Shorman*, University of Nebraska-Lincoln, USA
Deepika Menon*, University of Nebraska-Lincoln, USA
Peggy McNeal, Towson University, USA
Paulina Schaefer, Towson University, USA

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

Interdisciplinary Science and Converging Identities: Minority Graduate Student Experiences in Convergence Settings

Kathleen Bordewieck*, North Carolina State University, USA
M Gail Jones, North Carolina State University, USA

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

Course-based undergraduate research experiences (CUREs) to advance science communication (SciComm) skills: A systematic review

Ebenezer Korkor*, Illinois State University, USA
Rebekka Darner, Illinois State University, USA

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

Departmental fit impacts adoption of evidence-based practices in STEM classes for Tenure and Non-Tenure Professors

Trisha Douin*, University of Louisville, USA
Raymond Chastain, University of Louisville, USA
Marci DeCaro, University of Louisville, USA
Jeffrey Hieb, University of Louisville, USA
Linda Fuselier, University of Louisville, USA

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

General Chemistry Students' Language Fluency in the Context of a Precipitation Reaction

James Nyachwaya*, North Dakota State University, USA
Teri Tran, Georgia State University, USA
Tarah Dahl, West Fargo High School, USA
Krystal Grieger, North Dakota State University, USA

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

Faculty and Graduate Student Perspectives on STEM Undergraduate Education

Veronika Rozhenkova*, University of California, Irvine, USA
Elizabeth Park, Westat, USA
Brian Sato, University of California, Irvine, USA

Poster Session A, 4/20/23, 14:50-15:35

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

Learning from Peers: Patterns of Talk and Metacognition in a Peer Learning Assistant-supported Biology Course

Brittney Ferrari*, University of Georgia, USA
Masha Kurbatova, Bard College, USA
Julie Kittleson, University of Georgia, USA

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

Becoming a Field Biologist: Perspectives of Mentors and Undergraduate Researchers in a Summer REU Program

Stephen Burgin*, University of Arkansas, USA
Zephaniah Greenwell, University of Arkansas, USA

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

Re-designing Infrastructure to Implement Active Learning in Undergraduate Chemistry

Jonathan Hall*, California State University, San Bernardino, USA
Lisa Lundgren*, Utah State University, USA
Todd Campbell*, University of Connecticut, USA

Strand 6: Science Learning in Informal Contexts

Museum Facilitators of VR Experiences for Middle School Students Approach Constructivist Pedagogy

Leah Metcalf*, The University of North Carolina at Chapel Hill, USA
Janice Anderson, The University of North Carolina at Chapel Hill, USA
Jill Hamm, The University of North Carolina at Chapel Hill, USA

Strand 6: Science Learning in Informal Contexts

Discoveries in Earth science for students with blind and visual impairments

Rhea Miles*, East Carolina University, USA
Alana Zambone, East Carolina University, USA
Alex Manda, East Carolina University, USA
Margaret Blome, East Carolina University, USA

Strand 6: Science Learning in Informal Contexts

Success of Gender-Based STEM Summer Camps: Co-Ed vs Same-Gender

Miriam Sanders*, Texas A&M University, USA
Niyazi Erdogan*, Texas A&M University, USA
Julia Calabrese, Texas A&M University, USA
Mary Capraro, Texas A&M University, USA

Strand 6: Science Learning in Informal Contexts

Towards more individualized support in science competitions: Profiles of participants in the Physics Olympiad

Paul Tschisgale*, Leibniz Institute for Science and Mathematics Education, Germany
Anneke Steegh, Leibniz Institute for Science and Mathematics Education, Germany
Marcus Kubsch, Leibniz Institute for Science and Mathematics Education, Germany
Stefan Petersen, Leibniz Institute for Science and Mathematics Education, Germany
Knut Neumann, Leibniz Institute for Science and Mathematics Education, Germany

Poster Session A, 4/20/23, 14:50-15:35

Strand 6: Science Learning in Informal Contexts

Studying Floor Facilitator Conversations in a Natural History Museum

Preeti Gupta*, American Museum of Natural History, USA
Rachel Chaffee*, American Museum of Natural History, USA
Kevin Crowley, University of Pittsburgh, USA
Karen Knutson, University of Pittsburgh, USA
Abby Perez, American Museum of Natural History, USA

Strand 7: Pre-service Science Teacher Education

"But what can I do?": Science Teaching for Racial and Environmental Justice

Jenny Tilsen*, University of Minnesota, USA
Stefanie Marshall*, University of Minnesota, USA

Strand 7: Pre-service Science Teacher Education

Preservice Teachers' Reflective Practices on Developing Action Research Skills

Seema Rivera, Clarkson University, USA
Preethi Titu*, Kennesaw State University, USA

Strand 7: Pre-service Science Teacher Education

Evaluating divergent thinking and problem discovery among German Chemistry student teachers

Swantje Müller*, Martin-Luther-Universität Halle-Wittenberg, Germany

Strand 8: In-service Science Teacher Education

Inquiry-Based Science Teaching Efficacy of Middle School Science Teachers in a Professional Learning Community

Aeran Choi*, Ewha Womans University, Korea, Republic of
Elsun Seung, Indiana State University, USA
Soonhye Park, North Carolina State University, USA
Soojeong In, Ewha Womans University, Korea, Republic of

Strand 8: In-service Science Teacher Education

Relationships of PCK to Teacher Quality, Teaching Practice, and Student Outcomes: A Systematic Literature Review

Soonhye Park*, North Carolina State University, USA
Kennedy Kam Ho Chan, The University of Hong Kong, Hong Kong

Strand 8: In-service Science Teacher Education

Mapping the Terrain: Using Actor Network Mapping to Help Science Teacher Leaders Understand Their Systems

Sarah Stallings*, University of North Carolina at Greensboro, USA
Sara Heredia, University of North Carolina at Greensboro, USA
Michelle Phillips, Exploratorium, USA

Strand 8: In-service Science Teacher Education

Are We Moving toward Equity in Science Talk?: Evaluating Timing and Positioning of Talk Moves

Sierra Morandi*, Florida State University, USA
Sherry Southerland*, Florida State University, USA

Strand 8: In-service Science Teacher Education

Changes in Rural Science and Mathematics Teachers' Conceptions of Teacher Leadership and Professional Identity

Christine Lotter*, University of South Carolina, USA
Jan Yow, University of South Carolina, USA
Steve Barth, University of South Carolina, USA
Denae Kizys, University of South Carolina, USA

Strand 8: In-service Science Teacher Education

High School Teachers' Use of Technology: Portraiture in Educational Action Research

Gerald Tembrevilla*, Mount Saint Vincent University, Canada
Kimberley Gomez, University of California - Los Angeles, USA
Marina Milner-Bolotin, University of British Columbia, Canada

Strand 10: Curriculum and Assessment

Preservice Teachers' Answer Changing Behaviors on a Content Knowledge for Teaching Science Assessment across Timepoints

Jamie Mikeska*, ETS, USA
Katherine Castellano, ETS, USA
Steven Holtzman, ETS, USA

Strand 11: Cultural, Social, and Gender Issues

A Framework for Making Sense of Acts of Resistance and Coalition-Building in Secondary Science Classrooms

Linsey Brennan*, Michigan State University, USA
Christina Schwarz, Michigan State University, USA

Strand 11: Cultural, Social, and Gender Issues

Virtual Reality for Distance Culturally Revitalizing Pedagogy

Jared Tenbrink*, University of Michigan, USA

Strand 11: Cultural, Social, and Gender Issues

Defining Justice-Oriented Science Teaching: A Domain Model

Megan Walser*, Michigan State University, USA

Strand 11: Cultural, Social, and Gender Issues

Language of science versus language for science: Centering multilingual students' languaging practices in science education

María González-Howard*, The University of Texas at Austin, USA
Sage Andersen, The University of Texas at Austin, USA
Karina Méndez Pérez, The University of Texas at Austin, USA
Samuel Lee, Boston College, USA

Strand 11: Cultural, Social, and Gender Issues

The impact of various spaces on science majors' science identities

Allyson Randall*, Boise State University, USA
Sara Hagenah, Boise State University, USA
Karen Viskupic, Boise State University, USA

Strand 12: Technology for Teaching, Learning, and Research

Research-based practice regarding delivery of K-12 science instruction online: A systematic literature review

Carla Johnson*, NC State University, USA
Janet Walton, NC State University, USA

Strand 12: Technology for Teaching, Learning, and Research

Machine Learning to Predict Science Student Outcomes Using Neurological Data

Richard Lamb*, East Carolina University, USA
Knut Neumann, IPN, Germany

Strand 12: Technology for Teaching, Learning, and Research
Using technology to promote student metacognition in large enrollment STEM courses
Ted Clark*, The Ohio State University, USA

Strand 12: Technology for Teaching, Learning, and Research
The T in STEM Education: "ICT", "T" or "t"?
Heba EL-Deghaidy*, American University in Cairo, Egypt
Mohamed El Nagdi, American University in Cairo, Egypt

Strand 13: History, Philosophy, Sociology, and Nature of Science
Effectively Teaching Nature of Science in a Way that Coexists with Religious Principles
Tina Stamper*, Indiana University, USA
Nicole Conrad Nelson, Indiana University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
The role of designed educational purposes in raising the accessibility of authentic scientific purposes
Haya Ben Simon*, Technion, Israel
Michal Dvir, Technion, Israel
Dina Tsybulsky, Technion, Israel

Strand 14: Environmental Education and Sustainability
Psychosocial determinants of pro-environmental behaviors studied in the last decade: A systematic review of research.
Aparajita Rajwade*, North Carolina State University, USA
K.C. Busch, North Carolina State University, USA

Strand 14: Environmental Education and Sustainability
Connecting an Environmental Education Center & Science Standards: A Document Analysis
Hamza Malik*, University of Massachusetts Dartmouth, USA
Rachel Stronach*, University of Massachusetts Dartmouth, USA
Stephen Witzig*, University of Massachusetts Dartmouth, USA

Strand 14: Environmental Education and Sustainability
Narratives of change: Fostering Transformation Toward Sustainability Through Science Education
Giulia Tasquier*, University of Bologna, Italy
Alfredo Jornet, University of Oslo, Norway
Erik Knain, University of Oslo, Norway

Strand 14: Environmental Education and Sustainability
Cultivating Climate Change Awareness: Increasing Knowledge and Changing Attitudes
Carol Waters*, University of Houston-Clear Lake, USA
Michelle Peters, University of Houston-Clear Lake, USA

Strand 15: Policy, Reform, and Program Evaluation
Developing a District Science Assessment: A Case Study of a Local Reform Effort
Elizabeth de los Santos*, University of Nevada, Reno, USA
Lyndsay Munro*, University of Nevada, Reno, USA
Sylvia Scoggin*, Washoe County School District, USA

Poster Session A, 4/20/23, 14:50-15:35

Rebecca Curtright*, Washoe County School District, USA
Dustin Coli*, Washoe County School District, USA

Poster Session B
4/20/23, 1535-16:20, Grand Ballroom (L2)

Strand 1: Science Learning: Development of student understanding

A Multiple Case Study of K-2 Students' Understanding of Sequencing

Kristina Tank*, Iowa State University, USA
Tamara Moore, Purdue University, USA
Anne Ottenbreit-Leftwich, Indiana University, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions

Do students engage in motivated reasoning when evaluating evidence related to socioscientific issues?

Rachel Sparks*, University of Nebraska-Lincoln, USA
Jenny Dauer, University of Nebraska-Lincoln, USA

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

Parents' Expectancy Value Factors: Measuring Future Science Task Value and Science Achievement Value

M. Gail Jones*, NC State University, USA
Katherine Chesnutt, App State University, USA
Megan Ennes, University of Florida, USA
Daniel Macher, University of Graz, Austria
Manuela Paechter, University of Graz, Austria

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

Learning about the Water Cycle: Establishing an Out-of-School Laboratory in Primary Education

Annika Krüger*, University Duisburg-Essen, Germany
Marc Rodemer, University Duisburg-Essen, Germany
Stefan Rumann, University Duisburg-Essen, Germany

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

Investigating how Ambitious Science Teaching and Responsive Moves Support a Science-as-Practice Teaching Approach

Sahar Vali*, West Virginia University, USA
Melissa Luna, West Virginia University, USA

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

Seeing the Forest Through the Trees: Enhancing Phenomenon-based Science Teaching Through Contextualization

Kraig Wray*, Pennsylvania State University, USA
Jonathan McCausland*, New Mexico Highlands University, USA
Emma Jacobson, Pennsylvania State University, USA
Scott McDonald, Pennsylvania State University, USA
Amy Pallant, The Concord Consortium, USA

Poster Session B, 4/20/23, 15:35-16:20

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

Success Conditions of effective Problem Solving in Physics and Chemistry Education: A Systematic Review

Adrian Schmidt*, Institut für Didaktik der Mathematik und Physik, Leibniz Universität Hannover, Germany

Gunnar Friege, Institut für Didaktik der Mathematik und Physik, Leibniz Universität Hannover, Germany

Rüdiger Tiemann, Fachdidaktik Chemie, Humboldt-Universität zu Berlin, Germany

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

The Impact of an International Research Experience on Undergraduate and Graduate Students' Understandings about Science

Mika Munakata, Montclair State University, USA

SuSan Lim*, Montclair State University, USA

Carlos Molina, Montclair State University, USA

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

Development and Validation of an Instrument Measuring Motivation Among Undergraduate Anatomy and Physiology Students

Joey Marion*, North Carolina State University, USA

Soonhye Park, North Carolina State University, USA

Marta Klesath, North Carolina State University, USA

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

Meta-Agency in Problem-Based Learning: How Do Students Exercise Their Agency?

Jongchan Park*, Arizona State University, USA

Yuli Deng, Arizona State University, USA

Garima Agrawal, Arizona State University, USA

Ying-Chih Chen, Arizona State University, USA

Huan Liu, Arizona State University, USA

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

The Effect of Gestures in Teaching and Learning Anatomy and Physiology

Stephanie Wallace*, Texas Christian University, USA

Hayat Hokayem, Texas Christian University, USA

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

Developing a Clicker Question Sequence (CQS) to Improve Students' Understanding in Quantum Mechanics

Peter Hu*, University of Pittsburgh, USA

Yangqiuting Li, University of Pittsburgh, USA

Chandralekha Singh, University of Pittsburgh, USA

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

Authoritative Discourse Used in Math Integrated Science Instruction and Sensemaking Opportunities

Kristine Squillace Stenlund*, University of MN, USA

Anita Schuchardt, University of MN, USA

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

Distance dilemma: The impacts of the COVID-19 pandemic on student impressions of science instruction

Benedict Thoms-Warzecha, St. Cloud State University, USA
Felicia Leammukda*, St. Cloud State University, USA

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

Impact of Study Strategies on Knowledge and Exam Performance in Medical School

Markia Black, Wright State University, USA
William Romine*, Wright State University, USA
Molly Simonis, Wright State University, USA
Jeff Peters, Wright State University, USA
Volker Bahn, Wright State University, USA
Amber Todd, Wright State University, USA

Strand 6: Science Learning in Informal Contexts

Science Museum Educators' Teaching Self-Efficacy For Online Programming

Megan Ennes*, University of Florida, USA

Strand 6: Science Learning in Informal Contexts

Learning Talk Among Middle School Students at a Science Museum Exhibit

Ross Ramsey*, The University of North Carolina at Chapel Hill, USA
Mengyi Mao, The University of North Carolina at Chapel Hill, USA
Leah Metcalf, The University of North Carolina at Chapel Hill, USA
Janice Anderson, The University of North Carolina at Chapel Hill, USA
Jill Hamm, The University of North Carolina at Chapel Hill, USA

Strand 6: Science Learning in Informal Contexts

Space & Place: How Afrofuturism and Sense of Place Can Revolutionize Outdoor Science Education

Brandi Cannon-Force*, Stanford University, USA

Strand 6: Science Learning in Informal Contexts

Measuring Student and Program Success in STEM Undergraduate Research Programs

Jennifer Wilhelm*, University of Kentucky, USA
Molly Fisher, University of Kentucky, USA
Abigayle Parham, University of Kentucky, USA
Andrea Weidman, University of Kentucky, USA

Strand 6: Science Learning in Informal Contexts

Informal Science Educators' Perspectives on DEI: Implications for Teaching Beyond the Classroom

Eleanor Kenimer*, Michigan State University, USA
Gail Richmond*, Michigan State University, USA

Strand 6: Science Learning in Informal Contexts

"I prefer gaming": Engaging young children in coding in an out-of-school STEAM-enriched programme

Theila Smith*, University of Groningen, Netherlands
Jennifer Adams, University of Calgary, Canada
Mónica López López, University of Groningen, Netherlands

Strand 7: Pre-service Science Teacher Education

Interdisciplinary Pre-service Teacher Training

Argyris Nipyrakis*, University of Crete, Greece
Berta Barquero, University of Barcelona, Spain

Laura Branchetti, University of Milan, Italy
Viviane Durand-Guerrier, University of Montpelier, France
Athanasia Kokolaki, University of Crete, Greece
Dimitris Stavrou, University of Crete, Greece
Olivia Levrini, University of Bologna, Italy

Strand 7: Pre-service Science Teacher Education

Implementation of Site-based Middle Grades Physical Science Methods Courses: Lessons Learned over a 6-year Period
Diarra Mosley*, Hilsman Middle School, USA
Shaughnessy McCann, University of Georgia, USA
David Jackson, University of Georgia, USA

Strand 7: Pre-service Science Teacher Education

Using Service-Learning to Prepare Preservice Elementary Teachers to Support Scientific Research in the Elementary Classroom
Matthew Perkins Coppola*, Purdue University Fort Wayne, USA

Strand 8: In-service Science Teacher Education

Newly Hired Science Teachers Professional Learning 4.0: A Conceptual Model
Julie Luft*, University of Georiga, USA

Strand 8: In-service Science Teacher Education

Using community tours and mapping to develop a culturally relevant pedagogy
Nicole Walsh, Cascades High School, USA
Joshua Shipman, James Madison High School, USA
Sarah Lucas, State College Area High School, USA
Noah Shultz, Slippery Rock Area High School, USA
Sarah Bevilacqua, State College Area High School, USA
Cassidy Camplese, Dr. Henry A. Wise, Jr. High School, USA
Molly Mowatt, MESA Charter High School, USA
Kevin Toney, Independent, USA
Jonathan McCausland, New Mexico Highlands University, USA
Kathryn Bateman, The Pennsylvania State University, USA

Strand 8: In-service Science Teacher Education

Construction of agency spaces by elementary science teachers in low autonomy curricular environments
Daniela Scarpa*, University of São Paulo, Brazil
Amanda Magalhães, University of São Paulo, Brazil
Danusa Munford, Federal University of ABC, Brazil

Strand 8: In-service Science Teacher Education

Examining Changes in District Science Coordinators' Communities of Practice
Jennifer Bateman*, Clemson University, USA
Meredith Schwendemann*, Clemson University, USA
Brooke Whitworth, Clemson University, USA
Julie Luft, University of Georgia, USA

Strand 8: In-service Science Teacher Education

"The piece that we were looking for": catalyzing lenses for science teachers' equity-centered unit design
Monica Sircar*, Stanford University, USA

Poster Session B, 4/20/23, 15:35-16:20

Strand 10: Curriculum and Assessment
Using the STEM-OP to explore master teachers' implementation of Naval STEM tasks
Jeffrey Radloff*, SUNY Cortland, USA
Dominick Fantacone, SUNY Cortland, USA

Strand 10: Curriculum and Assessment
Measuring Science Teacher Knowledge of Models and Modeling in Science: Development and Validation
Grace Carroll*, North Carolina State University, USA
Soonhye Park, North Carolina State University, USA
Matt Reynolds, North Carolina State University, USA
Amanda Hall, North Carolina State University, USA
Scott Ragan, North Carolina State University, USA
Jason Painter, North Carolina State University, USA

Strand 11: Cultural, Social, and Gender Issues
Teachers Negotiating Professional Vision around Equity through Material Representations
Kathryn Bateman*, The Pennsylvania State University, USA
Jonathan McCausland*, New Mexico Highlands University, USA
Nicole Walsh, Cascades High School, USA

Strand 11: Cultural, Social, and Gender Issues
How well do undergraduate biology syllabi address culturally responsive curriculum?
Katie Nolan*, The Pennsylvania State University, USA

Strand 11: Cultural, Social, and Gender Issues
The Impact of Professional Development on A Physics Teachers Identity Towards Equitable Instruction.
Clausell Mathis*, Michigan State University, USA

Strand 11: Cultural, Social, and Gender Issues
Taking the Lead from Harriet Tubman. Black Women Overcoming STEM Deficits Through Dialogical Relationships.
Teresa Massey*, Georgia State University, USA

Strand 11: Cultural, Social, and Gender Issues
Homeless Students and the Right to Science Education: Lessons learned from Street Schools
Matthias Fischer*, University of Education Heidelberg, Germany
Manuela Welzel-Breuer, University of Education Heidelberg, Germany

Strand 11: Cultural, Social, and Gender Issues
A bibliometric image of the JRST
Ozgur Dogan*, Marmara University, Turkey

Strand 12: Technology for Teaching, Learning, and Research
An Analysis of Resources Available to Guide Teachers' use of Bee-Bots in Early Learning Settings
G. Michael Bowen*, Mount Saint Vincent University, Canada
Eva Knoll, Université du Québec à Montréal, Canada
Amy Willison, Independent Consultant, Canada

Poster Session B, 4/20/23, 15:35-16:20

Strand 12: Technology for Teaching, Learning, and Research
A Task Awareness Approach to the Assessment of Virtual Learning Environments (VLEs)
Rob Monahan*, NC State University, USA
James Minogue*, NC State University, USA
Amanda MacCormac, NC State University, USA
Emily Brunsen, NC State University, USA
Tabitha Peck, Davidson College, USA
David Borland, RENCI, USA

Strand 12: Technology for Teaching, Learning, and Research
Untethering Science Interest from Reading Proficiency: Pilot Results from a Microsoft HoloLens Science Reading Intervention
Denise Bressler*, ETS, USA
Leonard Annetta, East Carolina University, USA
Michael Tutwiler, University of Rhode Island, USA

Strand 12: Technology for Teaching, Learning, and Research
Quickstart Spaceship Programming for Developing Physical Intuition
Jacob Kelter*, Northwestern University, USA
Amanda Peel, Northwestern University, USA
Bradley Davey, Northwestern University, USA
Michael Horn, Northwestern University, USA
Uri Wilensky, Northwestern University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
The Intersection of NOS and NGSS: A High School Science Educator's Perspective
Mary Johnston*, Indiana University, USA
Valerie Akerson, Indiana University, USA

Strand 14: Environmental Education and Sustainability
Healing Relationships with the Natural World Through Critical Place Inquiry
Alexandra Schindel*, University at Buffalo-SUNY, USA
Ryan Rish, University at Buffalo-SUNY, USA
Kellyann Ramdath, University at Buffalo-SUNY, USA
Dave Mawer, University at Buffalo-SUNY, USA
Kendra Ormerod, University at Buffalo-SUNY, USA

Strand 14: Environmental Education and Sustainability
Community Science Data Talks: The Intersection of Justice, Emotion, and Place
Imogen Herrick*, University of Southern California, USA
Michael Lawson, Kansas State University, USA
Ananya Matewos, St. Norbert College, USA

Strand 14: Environmental Education and Sustainability
Pre-service Teachers' Plausibility Perceptions of Global Climate Change: Results of the updated Plausibility Perception Measure
Melike Hanedar*, Bogazici University, Turkey
Gizem Ozyazici*, Bogazici University, Turkey
Gaye Ceyhan, Bogazici University, Turkey

Strand 15: Policy, Reform, and Program Evaluation
A Framework for K-12 Classroom-Based Opportunity to Learn in Science

Poster Session B, 4/20/23, 15:35-16:20

Dante Cisterna*, ETS, USA
Farah Qureshi, ETS, USA

Strand 14: Environmental Education and Sustainability

Rural Administrators and STEM Education: Their Perceptions and Decision-Making

Devan Jones*, Clemson University, USA
Julianne Wenner, Clemson University, USA

Concurrent Session 10
4/20/23, 16:30-18:00

Asian and Pacific Islander Science Education Research (APISER) Sponsored Session: Science Education Research Involving Learners of Asian And Pacific Islander (API) Heritage
4/20/23, 16:30-18:00, Salon A4 (LL)

ORGANIZERS
Ling Liang, La Salle University, Philadelphia, PA, USA
Xiufeng Liu, University at Buffalo, State University of New York, NY, USA
Xinying Yin, California State University-San Bernardino, CA, USA

PANELISTS
Pauline Chinn, University of Hawaii at Manoa, USA
Jennifer Tripp, University at Buffalo, SUNY, USA
Lei Liu, Educational Testing Service, USA
Mihwa Park, Texas Tech University, USA

Latino/a RIG (LARIG) Sponsored Session: Voices from Latinas: making sense of research
4/20/23, 16:30-18:00, Salon C3-4 (LL)

ORGANIZERS
Angela Chapman, University of Texas Rio Grande Valley, Edinburg, TX, USA
Alejandro Gallard, Georgia Southern University, Statesboro, GA, USA

PANELISTS
Gianna Colson, University of Texas Rio Grande Valley, Edinburg, TX, USA
Miriam Ortiz, University of Texas Rio Grande Valley, Edinburg, TX, USA
Ruth Colyer, University of Texas Rio Grande Valley, Edinburg, TX, USA
Angela Chapman, University of Texas Rio Grande Valley, Edinburg, TX, USA

Strand 1: Science Learning: Development of student understanding SC-Organized Paper Set: Learning Progressions in Science Education Research
4/20/23, 16:30-18:00, Salon C7-8 (LL)

Development and Refinement of Learning Progressions for Fundamental Constructs of Mechanical Waves
Maria Veronica Torralba*, De La Salle University, Philippines
Frederick Talaue, De La Salle University, Philippines
Maricar Prudente, De La Salle University, Philippines

Investigation of a chemistry_specific learning progression for upper secondary school
Erika Knack*, University of Duisburg-Essen, Germany
Vanessa Fischer, University of Duisburg-Essen, Germany
Maik Walpuski, University of Duisburg-Essen, Germany

Investigating a Learning Progression for Particle Nature of Matter from Upper Elementary Through High School
Xiuhong Wang*, Northeast Normal University, China
Tingting Li*, Michigan State University, USA

Peng He, Michigan State University, USA
Joseph Krajcik, Michigan State University, USA

A Learning Progression for Water as a Limited Resource and Human Impacts within Socioecological Systems
Kristin Gunckel*, University of Arizona, USA
Malissa Hubbard, University of Arizona, USA
Sean Tan, University of California Berkeley, USA
Dan Moreno, University of Arizona, USA
Mingfeng Xu, University of California Berkeley, USA
Linda Morell, University of California Berkeley, USA
Mark Wilson, University of California Berkeley, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Student Learning and Cognition
4/20/23, 16:30-18:00, Salon C5-6 (LL)

The Role of Cognitive Engagement, Learning Enjoyment, and Epistemology Belief in Building Undergraduates' Science Learning
Hsin-Hui Wang*, National Sun Yat-sen University, Taiwan
Huann-shyang Lin, National Sun Yat-sen University, Taiwan
Zuway-R Hong, Kaohsiung Medical University, Taiwan
Ling Lee, National Sun Yat-sen University, Taiwan

Navigation of personal and disciplinary values in an undergraduate computational biology course
Sugat Dabholkar*, Tufts University, USA
Julia Gouvea, Tufts University, USA
Lawrence Uricchio, Tufts University, USA

Systematic Review on Learning in STEM Education With More Than Two Visual Representations
Eva Rexigel*, Technische Universität Kaiserslautern, Germany
Sarah Malone, Saarland University, Germany
Sebastian Becker-Genschow, University of Cologne, Germany
Jochen Kuhn, Ludwig-Maximilians-Universität, Germany

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Special Topics in Chemistry Education Research
4/20/23, 16:30-18:00, PDR 2 (L3)

Systematizing student difficulties in organic chemistry as a basis for developing adaptive support
Gyde Asmussen*, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Marc Rodemer*, University of Duisburg-Essen, Germany
Sascha Bernholt, IPN - Leibniz Institute for Science and Mathematics Education, Germany

Supporting First-Year Students in Learning MO Theory through a Digital-Collaborative Intervention
David Hauck*, TU Dortmund University, Germany
Andreas Steffen, TU Dortmund University, Germany
Insa Melle, TU Dortmund University, Germany

PS-I Instructional Approach's Effects on Transfer of Learning from an AOT perspective: A Case Study
Cheng-Wen He*, University of Georgia, USA
Paula Lemons, University of Georgia, USA
Logan Fiorella, University of Georgia, USA

Facilitation practices of learning assistants in synchronous hybrid college courses
Nicolette Maggiore*, Tufts University, USA
Jessica Karch, Tufts University, USA
Ira Caspari-Gnann, Tufts University, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Developing inquiry skills in pre-service science teacher education
4/20/23, 16:30-18:00, Salon A1 (LL)

Developing Global Science Knowledge and Global Competence Skills of Preservice Teachers in a Content Course
Shukufe Rahman*, Indiana University, USA
Conghui Liu*, Indiana University, USA
Gayle Buck, Indiana University, USA

Pre-Service Primary School Teachers' Understanding of the Distinction Between Observations and Inferences in Science
Shingo Uchinokura*, Kagoshima University, Japan
Kenya Momohara, Kagoshima University, Japan
Nana Yamanaka, Kagoshima University, Japan

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Research and Insights on Approaches About Science Teachers' Instructional Practices
4/20/23, 16:30-18:00, Waldorf (L3)

Prospective Science Teachers' Visions of Scientific Inquiry and Practices, a New Curriculum in Taiwan
Shiang-Yao Liu*, National Taiwan Normal University, Taiwan
Ping-Yi Chou, Hwa-Gang Junior High School, Taiwan

Science Teacher Educators' Collective Inquiry into Practice for Transforming Preservice Teacher Education In South Korea
Hyekeoung Lee*, Seoul National University, Korea, Republic of
Hosun Kang, University of Califonia Irvine, USA
Gyoungho Lee, Seoul National University, Korea, Republic of

Effect of practicum course on science instructional practices of pre-service science teachers
Iyad Dkeidek*, Al-Quds University, Palestine

Preservice Science Teachers' Self-Regulated Learning Practice While Planning and Enacting Classroom Questions
Hong Tran*, University of Georgia, USA
Daniel Capps, University of Georgia, USA
Timothy Cleary, Rutgers, The State University of New Jersey, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Science Teachers' Efforts to Design and Implement Innovative Science Lessons
4/20/23, 16:30-18:00, Salon A3 (LL)

Science Teacher Lesson Planning: A Preliminary Study of Acquisition, Selection, and Modification
Joe DeLuca*, University of Georgia, USA
Julie Luft, University of Georgia, USA
Elizabeth Ayano, University of Georgia, USA

What's In A Word? Teachers' Shifting Conceptualizations of "Authentic" Teaching and Learning in PBL
Tess Bernhard*, University of Pennsylvania, USA
Amy Guillotte, University of Pennsylvania, USA
Sarah Schneider Kavanagh, University of Pennsylvania, USA
Chris Pupik Dean, University of Pennsylvania, USA

Integrated STEM Design and Implementation: a Case with In-service Teachers
Argyris Nipyrakis*, University of Crete, Greece
Dimitris Stavrou, University of Crete, Greece
Lucy Avraamidou, University of Groningen, Netherlands

Exploring Teachers' Design and Enactment of Rigorous Lessons through a Collaborative Design Experience
Ryan Coker*, Florida State University, USA
Danielle Rhemer*, Florida State University, USA
Ozlem Akcil-Okan*, Florida State University, USA
Sierra Morandi*, Florida State University, USA
Jennifer Schellinger, Florida State University, USA
Miray Tekkumru-Kisa, Florida State University, USA
Sherry Southerland, Florida State University, USA

Strand 10: Curriculum and Assessment
Symposium: Reinventing Scientific Literacy for an Age of Misinformation: NGSS 2.0
4/20/23, 16:30-18:00, Salon A5 (LL)

Reinventing Scientific Literacy for an Age of Misinformation: NGSS 2.0
Jonathan Osborne*, Stanford University, USA
Douglas Allchin, University of Minnesota, USA
Noah Feinstein*, University of Wisconsin-Madison, USA
Ayelet Baram-Tsabari*, Technion University, Israel
Daniel PImentel, Stanford University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Critical Race Theory: Interrogating Resilience, Diversification, and the Model Minority Myth across STEM Education
4/20/23, 16:30-18:00, Salon A2 (LL)

Promoting [Policy] Reform Over Perseverance: Interrogating the Definition of Black Resilience in STEM Education
Takeshia Pierre*, University of Florida, USA
Felicia Mensah, Columbia University, USA

Operationalizing Critical Race Theory to Diversify the Pre-Medical Undergraduate Path: A Theoretical Paper
Candice Kim*, Stanford University, USA

"Would you comment on my English if I was White?": Asian American Women Experiencing STEM
Dionne Cross Francis*, University of North Carolina, USA
Pavneet Kaur Bharaj, University of North Carolina, USA
Jasmyne Yeldell*, University of North Carolina, USA
Kerrie Wilkins-Yel, University of Massachusettes, USA

Understanding Systemic Racism in Science Teacher Educator Preparation
Felicia Mensah*, Teachers College, Columbia University, USA

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Explorations of Social Justice and Anti-racist Science Teacher Identity
4/20/23, 16:30-18:00, Salon C1-2 (LL)

White shame and white ambivalence in learning to be a well-started White anti-racist science teacher
Jonathan McCausland*, New Mexico Highlands University, USA
Scott McDonald, Pennsylvania State University, USA

Empowering Science Praxis: Lessons from a Social Justice Science Teacher Inquiry Group
Alexandra Schindel*, University at Buffalo-SUNY, USA
Sara Tolbert, University of Canterbury, New Zealand
Lauren Urban*, University at Buffalo-SUNY, USA
Kellyann Ramdath*, University at Buffalo-SUNY, USA

Enacting Social Justice Teaching Identities in Science Classrooms
Katherine Wade-Jaimes*, University of Nevada, USA
Rachel Askew, Freed-Hardeman University, USA

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set: Applications of Technology for Data Analysis
4/20/23, 16:30-18:00, Blvd A (L2)

Technology as a tool for supporting indigenous youth's sense of consequential learning around earth science
Colby Tofel-Grehl*, Utah State University, USA

Investigating Differential Effects of a Digital Ladder of Learning with Adaptive Support in Chemistry
Michelle Möhlenkamp*, University of Duisburg-Essen, Germany
Helena van Vorst, University of Duisburg-Essen, Germany
Sebastian Habig, University of Erlangen-Nuremberg, Germany
Mathias Ropohl, University of Duisburg-Essen, Germany

Data-Driven Personas for Community Science in Paleontology
Richard Bex*, University of Florida, USA
Kent Crippen, University of Florida, USA

Designing and Developing an Instrument to Assess Scale Cognition
Tyler Gampp*, North Carolina State University, USA
Cesar Delgado, North Carolina State University, USA
Matthew Peterson, North Carolina State University, USA
Karen Chen, North Carolina State University, USA

Strand 13: History, Philosophy, Sociology, and Nature of Science
Symposium: Scientific Inquiry Literacy - Vision 1.5: A new focus for achieving scientific literacy
4/20/23, 16:30-18:00, Astoria (L3)

Scientific Inquiry Literacy - Vision 1.5: A new focus for achieving scientific literacy
Renee Schwartz*, Georgia State University, USA
Judith Lederman*, Illinois Institute of Technology, USA
Valarie Akerson*, Indiana University, USA
Selina Bartels, Valparaiso University, USA
Patrick Enderle*, Georgia State University, USA
Irene Neumann, IPN -Leibniz Institute for Science and Mathematics Education, Kiel, Germany
Kerstin Kremer, Justus-Liebig-University Giessen, Germany
Frauke Voilte, Leibniz Universität Hannover, Germany

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set: Socio-scientific issues and Culturally Responsive Environmental Science Education
4/20/23, 16:30-18:00, Blvd C (L2)

Incorporating community and citizen science into schools: How children develop science identity in California forests
Jadda Miller*, University of California Davis, USA
Shulong Yan*, University of California Davis, USA
Heidi Ballard, University of California Davis, USA

Exploring Elementary Students' Socio-scientific Argumentation within an Ecosystem Related SSI-based Unit
Nannan Fan*, University of North Carolina at Chapel Hill, USA
Li Ke, University of Nevada at Reno, USA

Jamie Elsner, university of north Carolina at Chapel Hill, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA
Laura Zangori, University of Missouri., USA

"Get kids outside!": Integrating Culturally Responsive Teaching with NGSS-aligned Environmental Science
Marisa Ritchie*, California Polytechnic State University, USA
Spencer Paine*, California Polytechnic State University, USA
Sierra Martin*, California Polytechnic State University, USA
Jasmine Nation, California Polytechnic State University, USA
Kurt Holland, California Polytechnic State University, USA

Environmental Health Investigators: developing science interest with a diverse group of middle school students
Andreia Dexheimer*, Southern Illinois University Edwardsville, USA
Sharon Locke, Southern Illinois University Edwardsville, USA
Georgia Bracey, Southern Illinois University Edwardsville, USA
Ben Greenfield, University of Southern Maine, USA
Jennifer Zuercher, Southern Illinois University Edwardsville, USA
Carol Colaninno, Southern Illinois University Edwardsville, USA
Candice Johnson, Southern Illinois University Edwardsville, USA
Charlie Blake, Southern Illinois University Edwardsville, USA

Equity And Ethics Committee Social Event: Equity and Ethics Dinner
Grant Park Bistro
4/20/23, 18:10-21:00

Board of Directors
Membership and Business Meeting
4/21/23, 8:00-8:50, Salon A1 (LL)

Concurrent Session 11
4/21/23, 9:00-10:30

Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE) Sponsored Session: Twenty years of growth in science education capacity in Southern Africa - SAARMSTE Research School
4/21/23, 9:00-10:30, Salon C5-6 (LL)

ORGANIZERS
Marissa Rollnick, Wits University, South Africa

PANELISTS
Elizabeth Mavhunga, Wits University, South Africa
Peter Hewson, University of Wisconsin, USA
Julie Luft, University of Georgia, USA
Ryan Nixon, Brigham Young University, USA
Regina McCurdy, Georgia Southern University, USA

Strand 1: Science Learning: Development of student understanding
Related Paper Set: It's never too early: Insights from empirical studies concerning evolution in kindergarten and elementary school
4/21/23, 9:00-10:30, Salon A1 (LL)

Young Children's Understandings of Camouflage as an Adaptation
Lisa Borgerding*, Kent State University, USA

Elementary-school students' can develop understanding of evolution by natural selection based on a storybook-based curriculum
Deborah Kelemen*, Boston University, USA
Sarah Brown, Boston University, USA
Alden Burnham, Boston University, USA
Gillian Puttick, TERC, USA
Sally Crissman, TERC, USA
Sara Lacy, TERC, USA
Jessica Findlay, University of Surrey, United Kingdom
Aarti Bodas, Boston University, USA
Learning evolution at home: Virtual intervention for elementary school students and their parents
David Menendez*, University of Michigan, USA

Dialogues about evolution: Interviewing young children to assess their ideas about evolutionary concepts
Isabell Adler*, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Daniela Fiedler, IPN - Leibniz Institute for Science and Mathematics Education, Germany
Ute Harms, IPN - Leibniz Institute for Science and Mathematics Education, Germany

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Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Communicating Science Through Visuals and Connections
4/21/23, 9:00-10:30, Salon A2 (LL)

Impact of Choice in Lab Exercises on Students of Different Grade, Ability, and Sociocultural Background
Laura Sührig*, Goethe University Frankfurt, Germany
Katja Hartig, Goethe University Frankfurt, Germany
Albert Teichrew, Goethe University Frankfurt, Germany
Roger Erb, Goethe University Frankfurt, Germany
Jan Winkelmann, University of Education Schwäbisch Gmünd, Germany
Mark Ullrich, Goethe University Frankfurt, Germany
Holger Horz, Goethe University Frankfurt, Germany

A State-of-Affairs Review of Science-specific Disciplinary Literacies
Molly Marek*, University of Texas, USA
Misty Sailors, Colorado State University Pueblo, USA
Chris Ham, University of North Texas, USA
Mariyeni Matariro, University of the Witwatersrand, South Africa
Alana Newell, Baylor College of Medicine: Center for Educational Outreach, USA

A historical analysis of the standards for graph construction in the US
Cesar Delgado*, North Carolina State University, USA
Alonzo Alexander, North Carolina State University, USA

Strand 3: Science Teaching - Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set: Designing, Supporting, and Enacting Elementary Science Units for Teacher Phenomenon Adaptation
4/21/23, 9:00-10:30, Blvd A (L2)

A Theoretical Model for Pedagogical Design Capacity for Phenomenon Adaptation
Katahdin Cook Whitt*, Maine Mathematics and Science Alliance, USA
Lisa Kenyon, Maine Mathematics and Science Alliance, USA
Emily Harris, BSCS Science Learning, USA

Designing Storyline Units for Phenomenon Adaptation
Emily Harris*, BSCS Science Learning, USA
Lindsey Mohan, BSCS Science Learning, USA
Candice Guy-Gaytán, BSCS Science Learning, USA
Katahdin Cook Whitt, Maine Mathematics and Science Alliance, USA
Lisa Kenyon, Maine Mathematics and Science Alliance, USA
Darryl Reano, Arizona State University, USA
Cindy Soule, Portland Public Schools, USA

Supporting Teachers Pedagogical Design Capacity to Make Phenomena Adaptations
Lisa Kenyon*, Maine Mathematics and Science Alliance, USA
Katahdin Cook Whitt, Maine Mathematics and Science Alliance, USA
Adrienne Hanson, Maine Mathematics and Science Alliance, USA
Emily Harris, BSCS Science Learning, USA

F. Leonard Kenyon, Maine Mathematics and Science Alliance, USA
Rhonda Tate, Maine Mathematics and Science Alliance, USA

Teachers' Design and Enactment of Phenomena Adaptations
Adrienne Hanson*, Maine Mathematics and Science Alliance, USA
Lisa Kenyon, Maine Mathematics and Science Alliance, USA
Katahdin Cook Whitt, Maine Mathematics and Science Alliance, USA
Emily Harris, BSCS Science Learning, USA
Seth Van Doren, BSCS Science Learning, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Achievement Gaps and Cultural Considerations in STEM Instruction
4/21/23, 9:00-10:30, Salon C1-2 (LL)

Addressing Asymmetries in General Chemistry through an Asset-Based Approach
Hannah Sevian*, University of Massachusetts Boston, USA
Klaudja Caushi, University of Massachusetts Boston, USA
Jessica Karch, Tufts University, USA
Tamari Kakhoidze, University of Massachusetts Boston, USA
Vishakha Agarwal, University of Massachusetts Boston, USA
Tyson King-Meadows, University of Massachusetts Boston, USA

Narrowing achievement gaps in reformed general chemistry courses with and without in-class active learning
Ted Clark*, The Ohio State University, USA

Using Cultural Historical Activity Theory to Characterize Different Enactments of the LA Model
Jessica Karch*, Tufts University, USA
Sedrah Mashhour, Tufts University, USA
Ira Caspari-Gnann, Tufts University, USA

Strand 6: Science Learning in Informal Contexts
SC-Organized Paper Set: Understanding Participation in Citizen Science and Science Communication
4/21/23, 9:00-10:30, PDR 2 (L3)

The relevance of science education to science-informed behavior: The case of COVID-19 in Israel
Ayelet Baram-Tsabari*, Technion - Israel Institute of Technology, Israel
Yael Rozenblum, Technion - Israel Institute of Technology, Israel
Wild Boars and Humans in Haifa: Media Framing of Socio-scientific Issues
Tali Tal*, Technion, Israel Institute of Technology, Israel
Avshalom Ginosar, The Max Stern Yezreel Valley College, Israel

Mapping the Training Ground: LCA of Graduate Student Perceptions of Scicomm
Brenda Guerrero*, FIU, USA
Remy Dou, FIU, USA
Melissa McCartney, FIU, USA

Knowledge, curiosity, and relevance: Using the Elaboration Likelihood Model to help identify COVID-19 misinformation
Yael Rozenblum*, Technion – Israel Institute of Technology, Israel
Keren Dalyot, Technion – Israel Institute of Technology, Israel

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Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Using Virtual Platforms and Online Experiences in preparing future science teachers
4/21/23, 9:00-10:30, Salon C3-4 (LL)

Using Virtual Platforms as Out of School Environment: Examine the shift in student teachers' perspectives
Tugba Yuksel*, Recep Tayyip Erdogan University, Turkey

Virtual Elementary Science Teacher Preparation: Exploring Summer Science Institute Design Structures and Outcomes
Stephen Thompson*, University of South Carolina, USA

Digital or conventional? Impact measurements and expectations of STEAM-pre-service teachers in a German Outreach Lab
Michaela Maurer*, Didactic Biology, Carl von Ossietzky University Oldenburg, Germany

From Remote to In-Person Learning: Changes in Teaching Resources Used by Preservice Secondary Science Teachers
Donald McNish*, University of California, Santa Barbara, USA
Matthew Bennett, University of California, Santa Barbara, USA
Royce Olarte, University of California, Santa Barbara, USA
Valerie Valdez, University of California, Santa Barbara, USA
Cameron Dexter-Torti, University of California, Santa Barbara, USA
Liliana Garcia, University of California, Santa Barbara, USA
Sarah Roberts, University of California, Santa Barbara, USA
Julie Bianchini, University of California, Santa Barbara, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Chemistry Learning and Teaching: Contexts, Characteristics, and Interactions
4/21/23, 9:00-10:30, Blvd C (L2)

Factors influencing formative diagnostic skills of pre-service chemistry teachers
Marc Rodemer*, University of Duisburg-Essen, Germany
Stefan Rumann, University of Duisburg-Essen, Germany
Comparing Assessments of Instructional Quality by Chemistry Teacher Candidates and their Domain Specific Advisors
Benjamin Heinitz*, Leibniz University Hannover, Germany
Andreas Nehring, Leibniz University Hannover, Germany

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Science Teachers' Understanding and Implementation of the Next Generation Science Standards
4/21/23, 9:00-10:30, Salon A3 (LL)

A Content Analysis of Next Generation Science Standards Alignment Messages
Jamie Tanas*, University of Iowa, USA
Gavin Fulmer, University of Iowa, USA

The Role of Professional Learning and Enactment Experience in Teaching Storyline Curricula: Nationwide Survey Results
Benjamin Lowell*, Boston College, USA
Renee Affolter, Boston College, USA
Katherine McNeill, Boston College, USA
Caitlin Fine, Metropolitan State University of Denver, USA

"By now I haven't told them about insulin/ pancreas?": Veteran teacher grappling with NGSS teaching.
Hildah Makori*, Michigan State University, USA
Consuelo Morales*, Michigan State University, USA
Irene Bayer*, Michigan State University, USA
Tania Jarosewich*, Censeo Group, USA
Maria Salinas, Michigan State University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Administrators and Teacher Leaders Support of Science Teacher Learning
4/21/23, 9:00-10:30, Salon C7-8 (LL)

Identifying Impacts of Administrative Support on Physics Teachers' Professional Learning
James Hancock II*, Alma College, USA
Jack Poling, Alma College, USA

Differences in STEM Teacher Education Needs According to School-Level and Geographically Diverse Administrators
Doug Ball, Utah State University, USA
Kellie Yates, Utah STEM Action Center, USA
Soojeong Jeong, Utah State University, USA
Tami Goetz, Utah STEM Action Center, USA
Colby Tofel-Grehl*, Utah State University, USA

Enacting Teacher Leadership: How teacher leaders influence others and understand leadership in an online community
Preethi Titu*, Kennesaw State University, USA
Fatma Kaya, Kent State University, USA
Gregory Rushton, Middle Tennessee State University, USA
David Yaron, Carnegie Mellon University, USA
Chinmay Kulkarni, Carnegie Mellon University, USA
Wei Zhu, Stony Brook University, USA

Science Teacher Leadership: Practices leading to empowerment and equitable opportunities in and beyond the classroom.
Tammy Moriarty, Stanford University, USA
Preetha Menon, Stanford University, USA
Brandi Cannon, Stanford University, USA
Janet Carlson*, Stanford University, USA

Concurrent Session 11, 4/21/23, 9:00-10:30

Strand 11: Cultural, Social, and Gender Issues

SC-Organized Paper Set: Identity and belonging in science education across varied spaces

4/21/23, 9:00-10:30, Salon A4 (LL)

Contemporary Colonization: How Gentrification of Urban Communities Impacts Science Education in the new "Urban" Schools
Kendra Sobomehin*, Stanford University, USA
Bryan Brown*, Stanford University, USA
Tamara Sobomehin*, Stanford University, USA

Recognition as an equal or superior being? Science identity and Rousseau's theory of self-love
Wonyong Park*, University of Southampton, United Kingdom
Lucy Avraamidou, University of Groningen, Netherlands

Promoting science capital in young Arabs in Israel
Wisal Ganaiem*, Technion- Israel institute of technology, Israel
Shulamit Kapon, Technion- Israel institute of technology, Israel

In This Space, I Got You: Exploring the Coding Trajectories of Two Black Boys
Ti'Era Worsley*, The University of North Carolina at Greensboro, USA

Strand 15: Policy, Reform, and Program Evaluation

Symposium: Scaling up innovative pedagogies in science education: A national perspective

4/21/23, 9:00-10:30, Salon A5 (LL)

Scaling up innovative pedagogies in science education: A national perspective
Anat Zohar*, Seymour Fox School of Education, Hebrew University of Jerusalem, Israel
Dana Vedder-Weiss*, School of Education, Ben Gurion University of the Negev, Israel
Rotem Trachtenberg-Maslaton*, School of Education, Ben Gurion University of the Negev, Israel
Hagit Kuperstein, School of Education, Ben Gurion University of the Negev, Israel
Aliza Segal, School of Education, Ben Gurion University of the Negev, Israel
Eran Zafrani*, Weizmann Institute of Science, Israel
Anat Yarden, Weizmann Institute of Science, Israel
Yehudit Dori*, Faculty of Education in Science and Technology, Technion, Israel
Orit Herscovitz, Faculty of Education in Science and Technology, Technion, Israel
Jonathan Osborne, Stanford Graduate School of Education, Stanford University, USA

Concurrent Session 12
4/21/23, 10:45-12:15

Roundtables Session 3
4/21/23, 10:45-12:15, Salon A5 (LL)

Topic 1: Student and teacher identity

Strand 11: Cultural, Social, and Gender Issues

Social Justice and Identity in Science Teaching: Perspectives of White Men Teaching Science

Maizie Dyess*, UNLV, USA
Katie Wade-Jaimes, UNLV, USA

Strand 11: Cultural, Social, and Gender Issues

How Indigenous Islanders Identify With STEM

Jonathan Boxerman*, WestEd, USA
Sharon Nelson-Barber, WestEd, USA
Kimberly Nguyen, WestEd, USA

Strand 1: Science Learning: Development of student understanding

The Role of Children's Racial Identity and it's Impact on their Science Education

Lisa McDonald, Teachers College, Columbia University, USA
Felicia Mensah*, Teachers College, Columbia University, USA

Topic 2: NOS Goals and Strategies
4/21/23, 10:45-12:15, Salon A5 (LL)

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

The development of an interdisciplinary learning environment with a historical context for chemistry lessons

Natalie Ahne*, University of Kassel, Germany
David Di Fuccia, University of Kassel, Germany

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

American Scientists' Views about Nature of Science in the Context of Socioscientific Issues

Rola Khishfe*, American University of Beirut, Lebanon

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

High School Students' Images of Science: A Decade into NGSS

Catherine Wagner*, University of Notre Dame, USA
Matthew Kloser*, University of Notre Dame, USA
Michael Szopiak*, University of Notre Dame, USA

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

Socioscientific Literacy: An Emancipatory Goal for Science Education

Kory Bennett*, University of South Florida, USA
Dana Zeidler, University of South Florida, USA

Topic 3: Climate change awareness and conservation

Strand 14: Environmental Education and Sustainability

Examining secondary students' awareness of bee conservation in the U.S.

Rita Hagevik*, UNC-Pembroke, USA
Kathy Trundle, Utah State University University, USA
Kaitlin Campbell, UNC-P, USA
Katherine Vela, Utah State University, USA
Laura Wheeler, Utah State University, USA

Michelle Parslow*, Utah State University, USA
David Joy, Utah State University, USA

Strand 1: Science Learning: Development of student understanding
Exploring the critical reading of a climate change topic using multimodal texts
Xavier Fazio*, Brock University, Canada
Tiffany Gallagher, Brock University, Canada

Topic 4: Curriculum and Implementation Studies

Strand 8: In-service Science Teacher Education
Using a Teacher Learning Progression of Instructional Skills to Examine Geospatial Curriculum Adoption
Danielle Malone*, Washington State University Tri-Cities, USA
Kate Popejoy*, Popejoy STEM LLC, USA
Molly Weinburgh*, Texas Christian University, USA
Kristen Brown, Texas Christian University, USA
Jonah Firestone, Washington State University Tri-Cities, USA
Alec Bodzin, Lehigh University, USA
Thomas Hammond, Lehigh University, USA

Strand 7: Pre-service Science Teacher Education
Exploring the use of a math modeling-based activity to introduce the idea of energy
Cynthia Lima*, University of Texas at San Antonio, USA

Strand 15: Policy, Reform, and Program Evaluation
Investigating the Effect of Classroom Facilities and Technology on Teachers' NGSS Aligned Instruction
Tess Bernhard*, University of Pennsylvania, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
SC-Organized Paper Set: Students Ways of Thinking
4/21/23, 10:45-12:15, Salon C5-6 (LL)

Relationship between middle school students' talks, gestures, and group outcomes in collaborative science problem-solving activities
Arif Rachmatullah*, SRI International, USA
Nonye Alozie, SRI International, USA
Hui Yang, SRI International, USA

Investigating secondary school students' knowledge about and acceptance of evolution, personal religious faith, and denomination
Roxanne Gutowski*, Institute for Biology Education, Faculty of Mathematics and Natural Sciences, University of Cologne, Germany
Helena Aptyka, Institute for Biology Education, Faculty of Mathematics and Natural Sciences, University of Cologne, Germany
Jörg Großschedl, Institute for Biology Education, Faculty of Mathematics and Natural Sciences, University of Cologne, Germany

Middle Schools Students' challenges performing the Control-of-Variables Strategy: Recognizing errors in third-party experiments is easier.
Linda Hämmerle*, University of Vienna, Austria
Alexander Bergmann, University of Leipzig, Germany
Andrea Möller, University of Vienna, Austria

Three types of FIRST mentors: interpersonal skills and STEM career choice
Shahaf Rocker Yoel*, Technion – Israel Institute of Technology, Israel
Yehudit Dori, Technion – Israel Institute of Technology, Israel

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Strand 4: Science Teaching - Middle and High School (Grades 5-12): Characteristics and Strategies
SC-Organized Paper Set: Cultural and Cognitive Approaches to Student Learning
4/21/23, 10:45-12:15, PDR 2 (L3)

Liberating Students from Anxiety and Underachievement in Flowchart and Algorithm: CTCA a Stitch in Time
Deborah Agbanimu*, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Peter Okebukola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Franklin Onowugbeda, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Juma Shabani, Université du Burundi, Burundi
Esther Peter, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Olasunkanmi Gbeleyi, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Adekunle Oladejo, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Ibukunolu Ademola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Yinka Ogunlade, Ekiti State University, Nigeria
Eunice Ikpah, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Bugoma Suwadu, Université du Burundi, Burundi
Fred Awaah, University of Professor Studies, Ghana

Students' knowledge retention in biology through the action of CTCA
Franklin Onowugbeda*, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Peter Okebukola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Deborah Agbanimu, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Esther Peter, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Olasunkanmi Gbeleyi, Africa Centre of Excellence for Innovative and

Transformative STEM Education, Lagos State University, Nigeria
Fred Awaah, University of Professional Studies, Ghana
Juma Shabani, University of Burundi, Burundi
Ibukunolu Ademola, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
Umar Adam, Lagos State University, Nigeria
Adekunle Oladejo, Africa Centre of Excellence for Innovative and Transformative STEM Education, Lagos State University, Nigeria
David Byamungu, University of Burundi, Burundi

Investigating Student Systems Thinking While Building and Revising Models
Jonathan Bowers*, Michigan State University, USA
Emanuel Eidin, Michigan State University, USA
Linsey Brennan, Michigan State University, USA

A Literature Review: Analyzing Barriers Hindering the Implementation of Self-Regulated Learning in the Classroom
Jayme Del Mario*, Texas Christian University, USA
Hong Tran*, University of Georgia, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Teaching Difficult STEM Content
4/21/23, 10:45-12:15, Salon C1-2 (LL)

Fossils, DNA, and Nothing: Evidence of Evolutionary Biology University Students Find Compelling
Sam Skrob-Martin*, Florida State University, USA
Joseph Travis, Florida State University, USA
Sherry Southerland, Florida State University, USA

Does evolution coursework mitigate, maintain, or exacerbate educational debt? Equity implications in the evolutionary sciences
Gena Sbeglia*, San Diego State University, USA
Ross Nehm, Stony Brook University, USA

Understanding the Connection Between Students' Acceptance of Socioscientific Issues and Information Sources
Brock Couch*, University of New Hampshire, USA
Grant Gardner, Middle Tennessee State University, USA

Assessing College Students' Uncertainty Management in Problem-Based Learning: Development of a Questionnaire Instrument
Jongchan Park*, Arizona State University, USA
Yuli Deng, Arizona State University, USA
Garima Agrawal, Arizona State University, USA
Ying-Chih Chen, Arizona State University, USA
Huan Liu, Arizona State University, USA

Strand 7: Pre-service Science Teacher Education
Symposium: Internationalization of Rural Science Teacher Preparation in the United States
4/21/23, 10:45-12:15, Salon C3-4 (LL)

Internationalization of Rural Science Teacher Preparation in the United States
Gayle Buck*, Indiana University, United Kingdom
Sumreen Asim, Indiana University Southeast, USA
Selina Bartels, Valparaiso University, USA
Khadija Fouad, Appalachian State University, USA
Allison Freed, University of Central Arkansas, USA
Robbie Higdon, James Madison University, USA
Lacey Huffling, Georgia Southern University, USA
Jessica Stephenson Reaves, Kennesaw State University, USA
Heather Scott, Georgian Southern University, USA
Ryan Summers, University of North Dakota, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Science Teachers' Views and Enactment of Culturally and Linguistically Responsive Instruction
4/21/23, 10:45-12:15, Salon A2 (LL)

Examining the Impact of Professional Learning Experiences on Understanding around Diversity, Equity, and Inclusion Principles
Cindy Kern*, Quinnipiac University, USA
Anna Brady*, Quinnipiac University, USA
Carrie DePetris Duell, Lincoln Middle School, USA
Jennifer DePetris Duell, Francis T Maloney High School, USA

Evaluation of Teacher Designed Integrated STEM Unit For Multilingual Learners after Receiving Professional Development
Stephanie Erickson*, University of Minnesota, USA
Gillian Roehrig, University of Minnesota, USA

Designing and Validating an Observation Protocol for Responsive Science Instruction
Niki Koukoulidis*, University of Florida, USA
Julie Brown, University of Florida, USA
Mark Pacheco, University of Florida, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Teacher Learning at the Intersections of Science and Technology
4/21/23, 10:45-12:15, Salon A3 (LL)

Teachers Create and Implement Augmented Reality Experiments for Physics Lessons
Mareike Freese*, Goethe University, Germany
Albert Teichrew, Goethe University, Germany
Jan Winkelmann, University of Education, Germany
Roger Erb, Goethe University, Germany
Michael Tremmel, Goethe University, Germany
Mark Ullrich, Goethe University, Germany

Building Lessons that Bridge Instructional Practices and Science Innovations

Kimberly Ideus*, NC State University, USA
M. Gail Jones, NC State University, USA
Julianna Nieuwsma, NC State University, USA
Emma Refvem, NC State University, USA
Kathleen Bordewieck, NC State University, USA
Soonhye Park, NC State University, USA

Research Practice Partnership: Culturally Responsive Computational Thinking Professional Development
Eleanor Richard*, University of Massachusetts Dartmouth, USA
Shakhnoza Kayumova, University of Massachusetts Dartmouth, USA
Mia Dubosarsky, Worcester Polytechnic Institute, USA
Gillian Smith, Worcester Polytechnic Institute, USA
Tiffany Davis, Ashburnham Westminster Regional Schools Public Schools, USA

Advancing design-based pedagogy using theme of 'presence' for STEM teachers using robotics
Adam Devitt*, California State University, USA
Moyu Zhang, New York University, USA

Strand 10: Curriculum and Assessment
SC-Organized Paper Set: Evidence based Instructional strategies to improve student learning
4/21/23, 10:45-12:15, Salon A1 (LL)

Developing Three-Dimensional Instructional Strategies Based on Students' Performance on Classroom Assessments
Peng He*, Michigan State University, USA
Namsoo Shin, Michigan State University, USA
Katy Nilsen, WestEd, USA
Holly Amerman, University of Georgia, USA
Joseph Krajcik*, Michigan State University, USA

Enacting curriculum that are coherent from the student perspective: Exploring the teacher-storyline relationship
Kevin Cherbow*, BSCS, USA
Katherine McNeill, Boston College, USA
Benjamin Lowell, Boston College, USA

Analyzing Educative Features in NGSS-aligned Science Curricular Materials
Tania Jarosewich*, Censeo Group, USA
Kevin Hall*, University of Illinois, USA
Barbara Hug*, University of Illinois, USA

Systematic Validation in Science Learning Progression Research
Hui Jin*, Georgia Southern University, USA
Hyo Joeng Shin, Sogang University, Korea, Republic of

Strand 11: Cultural, Social, and Gender Issues
Related Paper Set: Leveraging the Arts to Center Equity, Justice, and People of Color in Science Education
4/21/23, 10:45-12:15, Blvd C (L2)

Broadening Under-Represented Students' Interest and Participation in Science Through Drama
Maria Kolovou*, University of Miami, USA

The Arts in a Social-Justice-Centered Middle School Science Class
Stephanie Spezza*, University of Illinois Chicago, USA

Children's Identity Work Within an Embodied Arts-Based Approach to Science Education
Rebecca Kotler*, University of Illinois Chicago, USA
Ronan Rock, University of Illinois Chicago, USA
Maria Varelas, University of Illinois Chicago, USA
Amanda Diaz, University of Illinois Chicago, USA
Hannah Natividad, University of Illinois Chicago, USA
Phillip Bowen, Chicago Public Schools, USA
Rachelle Tsachor, University of Illinois Chicago, USA
Nathan Phillips, University of Illinois Chicago, USA
Rebecca Woodard, University of Illinois Chicago, USA
Jaegen Ellison, University of Illinois Chicago, USA

Embodying Physics: Exploring the power of dance as a resource for physics learning and engagement
Folashade Solomon*, TERC, USA
Dionne Champion, University of Florida, USA

Ethnodances of Black Students' Science Identity Authoring as Windows into their Science Experiencing
Mindy Chappell*, Portland State University, USA

Strand 12: Technology for Teaching, Learning, and Research
SC-Organized Paper Set: Artificial Intelligence and Machine Learning in Science Education
4/21/23, 10:45-12:15, Salon C7-8 (LL)

Using Machine Learning for a qualitative evaluation of Concept Maps: New opportunities for formative assessment?
Tom Bleckmann*, Leibniz University Hannover – Institute for Didactics of Mathematics and Physics, Germany
Gunnar Friege, Leibniz University Hannover – Institute for Didactics of Mathematics and Physics, Germany
Wolfgang Gritz, L3S Research Center, Leibniz University Hannover, Germany

Rethinking Science Education through Applications of Artificial Intelligence: Unpacking Ethical and Societal Aspects
Selin Akgun*, Michigan State University, USA
Joseph Krajcik, Michigan State University, USA

Teacher Acceptance of Artificial Intelligence Technologies for Teaching and Learning: A Systematic Review
Holly Amermanm*, University of Georgia, USA
Xiaoming Zhai, University of Georgia, USA

Computational Model of Teacher Adaptive Expertise in the Development of Epistemic Tools
Richard Lamb*, East Carolina University, USA
Brian Hand, University of Iowa, USA
Jee Kyung Suh, University of Alabama, USA

Gavin Fulmer, University of Iowa, USA

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set: Promoting students' interest in sustainability
4/21/23, 10:45-12:15, Salon A4 (LL)

Promoting Public Concern Towards Unpopular Endangered Species: Studying the Impact of In-Situ Mediated Shark Observation
Nurit Carmi*, Tel-Hai Academic College, Israel

A Moral Framework for Using Animals in Education: Making Difficult Socioscientific Decisions More Systematic
Bryan Nichols*, Florida Atlantic University, USA

Measuring Rural High School Students' Beliefs about the Bioeconomy and Career Interests
Katherine McCance*, North Carolina State University, USA
Karen Collier, North Carolina State University, USA
Margaret Blanchard, North Carolina State University, USA
Richard Venditti, North Carolina State University, USA

Building Students' Understanding of Natural Hazards and Confidence to Engage in Community Resilience Efforts
Megan Littrell*, CIRES Education & Outreach, USA
Kathryn Boyd, CIRES Education & Outreach, USA
Katya Schloesser, CIRES Education & Outreach, USA
Alica Christensen, CIRES Education & Outreach, USA
Anne Gold, CIRES Education & Outreach, USA
Irfanul Alam, CIRES Education & Outreach, USA
Casey Marsh, CIRES Education & Outreach, USA

Strand 15: Policy, Reform, and Program Evaluation
SC-Organized Paper Set: Equity and Community
4/21/23, 10:45-12:15, Blvd A (L2)

What is "Community Level" Scientific Literacy? A Systematic Literature Review and Delphi Method Study
K.C. Busch*, North Carolina State University, USA
Aparajita Rajwade*, North Carolina State University, USA

Why did it work? Using the Most Significant Change Method to Understand a Science Partnership
Maia Elkana*, Washington University in St. Louis, USA
Rachel Ruggirello*, Washington University in St. Louis, USA
Alison Brockhouse, Washington University in St. Louis, USA

Equity-Focused Computer Science Education: An Analysis of State Policy Infrastructures Designed to Achieve Equity
Stefanie Marshall*, University of Minnesota, USA
Ain Grooms*, University of Wisconsin, USA
Joshua Childs, University of Texas- Austin, USA

Concurrent Session 12, 4/21/23, 10:45-12:15

Perspectives on heterogeneity in the context of vocational education and training

Simone Rueckert*, University of Duisburg-Essen, Germany
Helena van Vorst, University of Duisburg-Essen, Germany

Concurrent Session 13
4/21/23, 13:45-15:15

Strand 1: Science Learning: Development of student understanding
SC-Organized Paper Set: Ontology and Epistemology in Science Classrooms
4/21/23, 13:45-15:15, Salon C7-8 (LL)

"Complex is useful": the epistemology of physics of complex systems as scaffolding for identity development
Francesco De Zuani Cassina*, University of Bologna, Italy
Olivia Levrini, University of Bologna, Italy

Gesture Complements Language as a Window onto Novices and Experts' Ontological Categorization of Scientific Concepts
Mariam Yamout*, University of Calgary, Canada
Tamer Amin, American University of Beirut, Lebanon

Epistemic Dispositions in Socioscientific Issues-Based Systems Modeling
Jamie Elsner*, University of North Carolina at Chapel Hill, USA
Eric Kirk, University of North Carolina at Chapel Hill, USA
Li Ke, University of Nevada Reno, USA
Troy Sadler, University of North Carolina at Chapel Hill, USA

Strand 2: Science Learning: Contexts, Characteristics and Interactions
Symposium: 10 years on: Rethinking NGSS's Underlying Principles from Ethical and Posthuman Perspectives
4/21/23, 13:45-15:15, Salon A5 (LL)

10 years on: Rethinking NGSS's Underlying Principles from Ethical and Posthuman Perspectives
Catherine Milne*, New York University, USA
Kathryn Scantlebury*, University of Delaware, USA
John Lupinacci, Washington State University, USA
Marc Higgins, University of Alberta, Canada
Anna Skorupa*, New York University, USA
Shakhnoza Kayumova, University of Massachusetts, USA
Jesse Bazzul, University of Regina, Canada
Sophia Jeong*, Ohio State University, USA
Elena Silverman, Indiana University, USA
Nickie Coomer, Colorado College, USA
Rouhollah Aghasaleh, California State Polytechnic University, USA
Jenny Tilsen, University of Minnesota, USA
Matthew Weinstein, University of Washington, USA

Strand 3: Science Teaching - Primary School (Grades preK-6): Characteristics and Strategies
SC-Organized Paper Set: Language and Elementary Science Teaching
4/21/23, 13:45-15:15, Blvd A (L2)

Examining Elementary Teachers' Reflections on Their Ability to Facilitate Argumentation-Focused Discussions in a Simulated Classroom
Jamie Mikeska*, ETS, USA
Pamela Lottero-Perdue, Towson University, USA
Devon Kinsey, ETS, USA

Science Discourse Patterns Compared with Instructional Practices During a Maker Activity in an Elementary Classroom
Tyler Hansen*, Utah State University, USA
Colby Tofel-Grehl, Utah State University, USA

Integrating Science and Language for Multilingual Learners: Results of a Two-Year Professional Development Collaboration
David Crowther*, University of Nevada, Reno, USA

Supporting Language in Science through Encouraging Teacher Criticality
Emily Reigh*, University of California, Berkeley, USA
Emily Miller, University of Georgia, USA
Maria Simani*, University of California, Riverside, USA
Ayça Fackler*, University of Georga, USA

Strand 5: College Science Teaching and Learning (Grades 13-20)
SC-Organized Paper Set: Special Topics in Physics Education Research
4/21/23, 13:45-15:15, PDR 2 (L3)

Building Pathways to Undergraduate STEM Success: Supporting Science Identity, Research, and Community for Minoritzed Students
Brit Toven-Lindsey*, University of California Los Angeles, USA
London Williams, University of California Los Angeles, USA
Casey Shapiro*, University of California Los Angeles, USA
Denise Ortiz, University of California Los Angeles, USA
Marc Levis-Fitzgerald*, University of California Los Angeles, USA
Tracy Johnson, University of California Los Angeles, USA

Teaching novices expert strategies – Evaluation of a physics course concept
Katja Plicht*, Ruhr West University of Applied Sciences, Germany
Hendrik Härtig, University of Duisburg-Essen, Germany
Alexandra Dorschu, Ruhr West University of Applied Sciences, Germany

Modeling and Measuring Visual Attention and Learning in an Online Instructional Module in Physics
Razan Hamed*, Purdue University, USA
Yifeng Huang, Stony Brook University, USA
Lester Loschky, Kansas State University, USA
Minh Nguyen, Stony Brook University, USA
N. Sanjay Rebello, Purdue University, USA

Characterizing student thinking and evidence-based reasoning during an engineering design activity in introductory physics
Ravishankar Chatta Subramaniam*, Purdue University, USA
Amir Bralin, Purdue University, USA
Jason Morphew, Purdue University, USA
Carina Rebello, Toronto Metropolitan University, Canada

N. Sanjay Rebello, Purdue University, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Types of talk: insights into the role of Discourse and Talk in science teacher preparation
4/21/23, 13:45-15:15, Salon A2 (LL)

Identifying the characteristics hybrid discourse in undergraduate courses for pre-service science teachers
Hadeel Edrees Dabbah*, Ben Gurion university, Israel
Orit Ben Zvi Assaraf, Ben Gurion university, Israel

Analyzing Discourse Moves Utilized by Preservice Teachers During Enactments of Discussions for Different Epistemic Purposes
Ron Gray*, Northern Arizona University, USA

Using the ORID Method to Facilitate Critical Discussions in Science TeacherEducation
Rachel Garcia*, Ohio University, USA
Danielle Dani, Ohio University, USA

Strand 7: Pre-service Science Teacher Education
SC-Organized Paper Set: Research investigating self-efficacy in preparing STEM teachers
4/21/23, 13:45-15:15, Salon A3 (LL)

Exploring Elementary Pre-service Teachers' Science and Engineering Teaching Efficacy Beliefs
Christine Pavlovich*, Montana State University, USA
Rebekah Hammack*, Montana State University, USA
Ibrahim Yeter, Nanyang Technical University, Singapore

Investigating Preservice Elementary Teachers Integrated STEM Teaching Self-efficacy
Deepika Menon*, University of Nebraska-Lincoln, USA
Deef Al Shorman*, University of Nebraska-Lincoln, USA

Effects of Virtual Lab Activities on Elementary Pre-Service Teachers' Self-Efficacy in Teaching Science
Soon Lee*, Kennesaw State University, USA

Strand 8: In-service Science Teacher Education
SC-Organized Paper Set: Supporting Teachers To Support Student Talk: Multidimensional Examination of Collaborative and Participatory Professional Learning Contexts
4/21/23, 13:45-15:15, Salon C1-2 (LL)

Exploring the Personal Domain: Noticing Task as New Method and Descriptive Analyses of Change
Jennifer Schellinger*, Florida State University, USA
Asli Kaya, Florida State University, USA
Ryan Coker, Florida State University, USA
Sherry Southerland, Florida State University, USA

Exploring the Domain of Practice: Documenting Outcomes of PDs by Examining Teachers' Instructional Practices
Patrick Enderle*, Georgia State University, USA
Ozlem Okan, Florida State University, USA
Ryan Coker, Florida State University, USA
Sierra Morandi, Florida State University, USA
Jennifer Schellinger, Florida State University, USA
Miray Tekkumru-Kisa, RAND, USA
Sherry Southerland, Florida State University, USA

Exploring the Domain of Consequence: Examining Changes in Students' Scientific Reasoning and Affect
Kari Roberts*, Florida State Univerity, USA
Jennifer Schellinger*, Florida State University, USA
Patrick Enderle*, Georgia State University, USA
Sierra Morandi*, Florida State University, USA
Harini Krishnan, Florida State University, USA
Sherry Southerland*, Florida State University, USA

Exploring the External Domain: Describing the Role of Collaboration on Teacher Learning
Sherry Southerland*, Florida State University, USA
Allison Metcalf*, Florida State University, USA
Jennifer Schellinger, Florida State University, USA
Harini Krishnan, University of Utah, USA

Exploring the Personal/External Domains: Investigating Changes in Epistemic Orientations During Sustained Collaborative Professional Learning
Sierra Morandi*, Florida State University, USA
Jennifer Schellinger*, Florida State University, USA
Kari Roberts*, Florida State University, USA
Patrick Enderle*, Georgia State University, USA
Ellen Granger, Florida State University, USA
Sherry Southerland, Florida State University, USA

Strand 8: In-service Science Teacher Education
Symposium: Symposium on Science Teacher Leadership from Research and Practice Perspectives
4/21/23, 13:45-15:15, Salon C3-4 (LL)

Symposium on Science Teacher Leadership from Research and Practice Perspectives
Sara Heredia*, University of North Carolina at Greensboro, USA
Michelle Phillips, Exploratorium, USA
Tammy Cook-Endres, Exploratorium, USA
Corene Duarte, Oxnard Union High School District, USA
Brooke Whitworth, Clemson University, USA
Meredith Schwendemann, Clemson, USA
Amanda Gonczi, Michigan Technological University, USA
Laura Ruelas, Kalamazoo Public Schools, USA
Todd Campbell, University of Connecticut, USA

Strand 10: Curriculum and Assessment Related Paper Set: Unpacking "Relevance" as a Design Aim for Instructional Materials: In What Ways? For Whom?
4/21/23, 13:45-15:15, Salon A4 (LL)

Relevance in Teachers' Customization: Data from a Pilot Survey on PCK for Equitable Sensemaking
Jason Buell*, Northwestern University, USA
Yang Zhang, Northwestern University, USA
Brian Reiser, Northwestern University, USA
Kelsey Edwards, Northwestern University, USA

From Superficial to Foundational: Integrating Cultural Relevance with Computer Science Content and Pedagogy
Amanda Nolte, University of Delaware, USA
Diane Codding*, Northwestern University, USA
Rosalie Rolon-Dow, University of Delaware, USA
Chrystalla Mouza, University of Illinois Urbana-Champaign, USA
Lori Pollock, University of Delaware, USA

Agentic Teaching: Strategic Science Curriculum Adaptation for Relevance
Nicholas Leonardi*, University of Illinois at Urbana-Champaign, USA
Barbara Hug*, University of Illinois at Urbana-Champaign, USA
Christina Krist, University of Illinois at Urbana-Champaign, USA

Co-Designing for Relevance in NGSS-Aligned Performance Assessments
Jennifer Richards*, Northwestern University, USA
Kevin Cherbow*, BSCS, USA
Miray Tekkumru-Kisa, Florida State University, USA
J. Richey, University of Pittsburgh, USA

Attending to Student Interest and Identity in Instructional Phenomenon
Kate Henson*, University of Colorado, USA
William Penuel, University of Colorado, USA

Exploring the 'What' and 'Why' in Student Co-Created Computer Science Curricula
Bradley Davey*, Northwestern University, USA
Sepehr Vakil, Northwestern University, USA

Determining Relevance in A Nation-Wide Curriculum Co-Design Process
Katarzyna Pomian Bogdanov*, Northwestern University, USA

Strand 11: Cultural, Social, and Gender Issues
Symposium: Creating reflexive and critical spaces: International perspectives on working with teachers towards equitable science education
4/21/23, 13:45-15:15, Salon C5-6 (LL)

Creating reflexive and critical spaces: International perspectives on working with teachers towards equitable science education
Christina Siry*, University of Luxembourg, Luxembourg
Sara Wilmes*, University of Luxembourg, Luxembourg

Carla Zembal-Saul, The Pennsylvania State University, USA
David Segura, Beloit College, USA
Maria Varelas, University of Illinois, USA
Nina Hike, University of Illinois, USA
Darrin Collins, University of Illinois, USA
Daniel Morales-Doyle, University of Illinois, USA
Jennifer Adams, University of Calgary, Canada
Sarah El Halwany, University of Calgary, Canada
Sophia Marlow, University of Calgary, Canada
Kristal Turner, University of Calgary, Canada

Strand 11: Cultural, Social, and Gender Issues
SC-Organized Paper Set: Science Identity for k-12 Learners: Where we've been, where we're going
4/21/23, 13:45-15:15, Salon A1 (LL)

A Brief Review of Secondary Physics Identity Research in the United States
Kate Miller*, Michigan State University, USA
Terrance Burgess*, Michigan State University, USA

How do Students' Science, Mathematics, and Nature Identities Impact Students' Interest in STEAM Careers?
Michelle Parslow*, Utah State University, USA
Katherine Vela*, Utah State University, USA
Kathy Trundle, Utah State University, USA
Rita Hagevik, University of North Carolina, USA
Laura Wheeler, Utah State University, USA
David Joy, Wahlquist Junior High School, USA

Who Can be a Scientist?: Youth perceptions of STEM pathways
Alexandria Muller*, University of California, Santa Barbara, USA
Natalie Churchley, University of California, Santa Barbara, USA
Tiffany Yun, University of California, Santa Barbara, USA
Liliana Garcia, University of California, Santa Barbara, USA
Considering Possibilities for Identity Expansion: A Grounded Theory of Youths' STEM Identity Play
Alison Mercier*, University of Wyoming, USA
Heidi Carlone, Vanderbilt University, USA

Strand 14: Environmental Education and Sustainability
SC-Organized Paper Set: Community environmental issues
4/21/23, 13:45-15:15, Blvd C (L2)

Epistemological Plurality for Globally Situated Science Discourse
Mary Short*, George Washington University, USA

Co-creating the Discourse of Environmental Consciousness toward Justice in Science Classrooms
Won Jung Kim*, Santa Clara University, USA
Lisa Archuleta, Santa Clara University, USA

Centering Social Justice in K-12 Place-Based Education

Meena Balgopal, Colorado State University, USA
Elizabeth Diaz-Clark*, Colorado State University, USA
Laura Sample McMeeking, Colorado State University, USA
Andrea Weinberg, Arizona State University, USA

Community science literacy as a sociomaterial practice rooted in place

Christopher Jadallah*, University of California, Davis, USA
Heidi Ballard, University of California, Davis, USA

Closing Session

4/21/23, 15:15-16:15, Salon A1 (LL)

Looking ahead to the 2024 Conference

Gillian Roehrig, outgoing NARST President: Showing appreciation for Board and Committee leadership
Jomo Mutegi, incoming NARST President: NARST Goals and Inspiration

Virtual Conference Day
Opening Session
7:00-7:30, Zoom A

The all-virtual conference day will open with remarks by outgoing President Gillian Roehrig, and incoming President Jomo Mutegi

Concurrent Session 1

4/28/23, 7:45-8:45

Multi-Strand Paper Set
Representations of Science
4/28/23, 7:45-8:45, Zoom A

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

The representation of nature of science in grade 6 French, American and CountryL science textbooks

Marie-Noel Salem*, American University of Beirut, Lebanon

Saouma BouJaoude, American University of Beirut, Lebanon

Strand 1: Science Learning: Development of student understanding

Investigating Science Process Skills of Middle School Students

Fatma Uçar*, Hasan Kalyoncu University, Turkey

Semra Sungur, Middle East Technical University, Turkey

Multi-Strand Paper Set
Exploring Ideas in STEM
4/28/23, 7:45-8:45, Zoom B

Strand 7: Pre-service Science Teacher Education

Adaptive Expertise in Math and Science Teaching: Differential Impact on Preservice Teachers' iSTEM Teaching Attitudes

Mounir Saleh*, UOB, Bahrain

Bashirah Ibrahim, UOB, Bahrain

Strand 12: Technology for Teaching, Learning, and Research

Technology-Enhanced Differentiated Instruction in STEM Education: Teacher Candidates' Development of Digital Educative Curriculum Materials

Mohammed Estaiteyeh*, Western University, Canada

Isha DeCoito, Western University, Canada

Strand 10: Curriculum and Assessment

Design, Enactment, and Redesign of a STEM Curricular Unit

Tasneem Anwar*, Institute for Educational Development, Aga Khan University, Pakistan

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

Reasoning About the Technological Aspects of Societal Issues: Insights from Technology Studies

Jacob Pleasants*, University of Oklahoma, USA

Breakout Room Discussions
8:45-9:15
Zoom A and Zoom B

Multiple breakout rooms will be available for open discussion.

Concurrent Session 2

4/28/23, 9:30-10:30

Multi-Strand Paper Set
Science Education Research Innovations
4/28/23, 9:30-10:30, Zoom A

Strand 12: Technology for Teaching, Learning, and Research

Augmented Culturo-Techno-Contextual Approach (CTCA) for Teaching and Learning a Concept in Computer Study

Michael Adewusi*, Lagos State University (LASU), Ojo ACEITSE, Nigeria
Ola Tokunbo Odekeye, Lagos State University (LASU), Ojo ACEITSE, Nigeria
Olugbenga Akindoju, Lagos State University (LASU), Ojo, Nigeria
Silas Egbowon, Lagos State University (LASU), Ojo, Nigeria
Mukaila Rahman, Lagos State University (LASU), Ojo, Nigeria
Michael Ahove, Lagos State University (LASU), Ojo ACEITSE, Nigeria

Strand 14: Environmental Education and Sustainability

Using Place-Based SSI Instruction that Utilizes Role-Playing to Promote Preservice Teachers' Socioscientific Accountability and NOS

Banu Avsar Erumit*, Recep Tayyip Erdogan University, Turkey
Bahadir Namdar, Ege University, Turkey
Aysegul Oguz Namdar, Recep Tayyip Erdogan University, Turkey

Strand 12: Technology for Teaching, Learning, and Research

Quality Assessment of Written Reflections by Computer-Based Structural Analysis

Lukas Mientus*, University of Potsdam, Germany
Peter Wulff, Heidelberg University of Education, Germany
Anna Nowak, University of Potsdam, Germany
Andreas Borowski, University of Potsdam, Germany

Strand 11: Cultural, Social, and Gender Issues

ITPOP: Development of an instrument for observing inclusive teaching practices in undergraduate science classrooms

Hai Nguyen*, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, University of Missouri-Columbia, USA
Marcelle Siegel, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, and Department of Biochemistry, University of Missouri-Columbia, USA
Natalia Franca, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, University of Missouri-Columbia, USA
Saaedah Albishi, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, University of Missouri-Columbia, USA
Ritesh Sharma, Department of Learning, Teaching, and Curriculum, College of Education and Human Development, University of Missouri-Columbia, USA
Yejun Bae, Moore School of Education, Carolina University, USA

Multi-Strand Paper Set
Seeing Science Education Differently
4/28/23, 9:30-10:30, Zoom B

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

Sequential Synthesis Problem-Solving: Do Correct and Incorrect Problem Solvers' Gaze Patterns Differ?

Bashirah Ibrahim*, Bahrain Teachers College, University of Bahrain, Bahrain
Lin Ding, The Ohio State University, USA

Strand 7: Pre-service Science Teacher Education

A model of Two-Eyed Seeing in science education developed with teacher students through action research

Albert Zeyer*, University of Teacher Education Lucerne, Switzerland

Strand 7: Pre-service Science Teacher Education

Pre-service Primary teachers' training through Model-Based Inquiry: What do they perceive to feel and learn?

Manuela González-Herrera*, Universidad de Almería, Spain
María Martínez-Chico, Universidad de Almería, Spain
Francisco José Castillo-Hernández, Universidad de Almería, Spain

Strand 2: Science Learning: Contexts, Characteristics and Interactions

Using digital platforms to assist with teaching and learning during COVID-19 lockdown in South Africa

Magdeline Stephen*, University of the Wiwatersrand, South Africa
Nomfundo Radebe, University of the Wiwatersrand, South Africa

Concurrent Session 3

4/28/23, 10:45-12:00

Multistrand Related Paper Set
Beyond Absolutes: Expanding Conceptions of Science and Teaching with Preservice Science Teachers
4/28/23, 10:45-12:00, Zoom A

Strand 7: Pre-service Science Teacher Education

Examining Opportunities for Expansiveness in a PST Science Modeling Course

Jessica Watkins*, Vanderbilt University, USA
Natalie De Lucca, Vanderbilt University, USA
Serena Pao, Metro Nashville Public Schools, USA

Strand 7: Pre-service Science Teacher Education

Expanding Pre-service Teachers' Conceptions of Science, Learning, and Teaching

Allison Metcalf*, Florida State University, USA
Lama Jaber, Florida State University, USA
Shannon Davidson, University of Alabama, USA

Strand 7: Pre-service Science Teacher Education

Examining Opportunities for Expansiveness in a PST Science Modeling Course

Déana Scipio*, IslandWood, USA
Priya Pugh, IslandWood, USA

Strand 10: Curriculum and Assessment

Chemistry Teachers' Knowledge of Assessment in a Collaborative and Dynamic Learning Environment

Abir Saleh*, Technion, Israel
Shirly Avargil, Technion, Israel

Multi-Strand Paper Set
STEM and Identity
4/28/23, 10:45-11:45, Zoom B

Strand 11: Cultural, Social, and Gender Issues

Taking Up a Theoretical Framework to Support Student/Teacher STEM Identities

Rachel Askew*, Freed Hardeman University, USA
Katie Wade-Jaimes, University of Nevada - Las Vegas, USA
Heidi Carlone, Vanderbilt University, USA

Strand 7: Pre-service Science Teacher Education

The middle of the STEM sandwich: Investigating, modeling, analyzing, arguing, and explaining

Christine Schnittka*, Auburn University, USA
Mark Brenneman, Auburn University, USA

Virtual Poster Session 4/28/23, 12:15-13:00, Zoom A

Strand 7: Pre-service Science Teacher Education
Physics Experiences of Elementary Teacher Candidates for Empowerment: A Case Study Survey Design
E.J. Bahng*, Iowa State University, USA
John Hauptman, Iowa State University, USA

Strand 11: Cultural, Social, and Gender Issues
Discourse around Creationism in an evolution textbook: A critical discourse analysis
Andrea Phillips*, Indiana University, USA

Strand 4: Science Teaching — Middle and High School (Grades 5-12): Characteristics and Strategies
The Impact of STEM Curriculum on Students' Abilities of Engineering Design and Attitudes Toward STEM
Meng-Fei Cheng*, National Changhua University of Education, Taiwan
Yu-Heng Lo, National Changhua University of Education, Taiwan

Strand 5: College Science Teaching and Learning (Grades 13-20)
Analysis of Graduate Physics and Astronomy Programs
Andria Schwortz*, Quinsigamond Community College, USA
Andrea Burrows, University of Central Florida, USA
Adam Myers, University of Wyoming, USA
Daniel Dale, University of Wyoming, USA

Strand 15: Policy, Reform, and Program Evaluation
Why NOT Become a Teacher? Perspectives from Undergraduate Students
Jacob Pleasants*, University of Oklahoma, USA

Strand 10: Curriculum and Assessment
The alchemy of university-school relations through an experience of Brazil's initial Biology teacher training
Beatriz Pereira, Universidade Federal de Santa Catarina, Brazil
Gabriel Pedro*, Universidade Federal do Rio de Janeiro, Brazil
Marcia Ferreira, Universidade Federal do Rio de Janeiro, Brazil

Strand 5: College Science Teaching and Learning (Grades 13-20)
Exploring Epistemic Performance in Different Task Contexts
Alp Köksal*, Bo_aziçi University, Turkey
Fatih Mercan, Bo_aziçi University, Turkey

Strand 6: Science Learning in Informal Contexts
STEM interest patterns during adolescence: A latent profile analysis
Nancy Staus*, Oregon State University, USA
Lynn Dierking, Institute for Learning Innovation, USA
John Falk, Institute for Learning Innovation, USA

Concurrent Session 4

4/28/23, 14:00-15:00

Multi-Strand Paper Set
Creating Connections in Science Teaching and Learning
4/28/23, 14:00-15:00, Zoom A

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

Epistemic belief and science career expectancy in China: Using PISA data to understand gender differences

Xuerong Lin*, East China Normal University, China

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

Retaining Students from Minoritized Groups in STEM Majors: The Role of Counterspaces and Distributed Mentoring

Stacy Olitsky*, Saint Joseph's University, USA

Strand 7: Pre-service Science Teacher Education

Looking for science: Preservice science teachers journaling about science in daily life

Danielle Hudson*, Auburn University, USA
Christine Schnittka, Auburn University, USA

Strand 11: Cultural, Social, and Gender Issues

Bridging Science and Language: Responsive Curricula for Refugee Multilingual Learners

Rena Al Debs*, University of Balamand, Lebanon
Sara Salloum, University of Balamand, Lebanon

Multi-Strand Paper Set
Integrating Engineering and Science
4/28/23, 14:00-15:00, Zoom B

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

Assessing Elementary Teachers' Nature of Engineering Views via Open-Ended Views of Nature of Engineering Instrument

Erdogan Kaya*, George Mason University, USA
Ezgi Yesilyurt, Weber State University, USA
Hasan Deniz*, University of Nevada Las Vegas, USA

Strand 8: In-service Science Teacher Education

A Systematic Review of Engineering Design for Authentic Integrated Science and Engineering Instruction: 1997-2021

Sandra Richy John*, Southern Illinois University Carbondale, USA
Senetta Bancroft, Southern Illinois University Carbondale, USA
Cody Maze, Southern Illinois University Carbondale, USA

Strand 7: Pre-service Science Teacher Education

Middle and High School Pre-service Science Teachers' Engineering Design Self-Efficacy

John Ojeogwu*, University of Virginia, USA
Frackson Mumba, University of Virginia, USA

Strand 7: Pre-service Science Teacher Education

Linear Growth Model Analysis of Pre-service Science Teachers' Self-Efficacy.

Frackson Mumba, University of Virginia, USA
John Ojeogwu*, University of Virginia, USA

Concurrent Session 5

4/28/23, 15:15-16:15

Multi-Strand Paper Set
Pedagogical Innovations in Science Education
4/28/23, 15:15-16:15, Zoom A

Strand 7: Pre-service Science Teacher Education

Preparing preservice science teachers to enact scientific modeling-based instruction: A literature review on existing interventions

Kennedy Chan*, The University of Hong Kong, Hong Kong
David Lau*, The University of Hong Kong, Hong Kong

Strand 7: Pre-service Science Teacher Education

The Science Practice of Asking Questions About Phenomena: Shifting Towards Generating Explanatory Questions

Jaclyn Murray*, Augusta University, USA

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

Development and Initial Validation of the Quantitative Modeling Observation Protocol (QMOP) for Undergraduate Biology Courses

Lyrica Lucas*, University of Nebraska-Lincoln, USA
Anum Khushal*, University of Nebraska-Lincoln, USA
Joseph Dauer, University of Nebraska-Lincoln, USA
Brian Couch, University of Nebraska-Lincoln, USA
Robert Mayes, Georgia Southern University, USA

Multi-Strand Paper Set
The Power of Relationships in Science
4/28/23, 15:15-16:15, Zoom B

Strand 6: Science Learning in Informal Contexts

Relationships with pets as a context for science learning

Priyanka Parekh*, University of Colorado Boulder, USA
Joseph Polman, University of Colorado Boulder, USA
Shaun Kane, University of Colorado Boulder, USA
Ben Shapiro, University of Colorado Boulder, USA

Strand 6: Science Learning in Informal Contexts

Networks and Ecosystems: Plant/Gardening Enthusiasts' Use of Community Spaces to Support their Learning

Elysa Corin*, Institute for Learning Innovation, USA
Eric Jones, University of Texas Health Science Center at Houston (UTHealth) School of Public Health, USA
David Meier, Institute for Learning Innovation, USA

Strand 11: Cultural, Social, and Gender Issues

Equity in rural physics education: Voices of a student, a teacher, and an immigrant parent

Izzah Mardhiya Mohammad Isa*, Universiti Teknologi Malaysia, Malaysia
Muhammad Abd Hadi Bunyamin, Universiti Teknologi Malaysia, Malaysia
Fatin Aliah Phang, Universiti Teknologi Malaysia, Malaysia

Strand 14: Environmental Education and Sustainability

Navigating Relational Perspectives through Collaboration to Expand Students' Experiences of/with/in Places and Cultures

Beth Covitt*, University of Montana, USA
Nicollette Frank, University of Montana, USA
Noelani Puniwai, University of Hawai'i, USA
Ho'oulul_hui Perry, University of Hawai`i, USA
Bruce Watson, University of Hawai`i, USA
Sarah Haavind, Concord Consortium, USA
Dale Cope, Independent Education Consultant, USA
Carolyn Staudt, Concord Consortium, USA

Breakout Room Discussions
16:15-8:45-16:40
Zoom A and Zoom B

Multiple breakout rooms will be available for open discussion.

Closing Session

Join the closing session for remarks by outgoing President Gillian Roehrig and incoming President Jomo Mutegi

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