

Cory T. Forbes

Associate Professor of Science Education | Coordinator, Science Literacy Initiative | Director, NE Collaborative for Food, Energy, & Water Education

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**CORY T. FORBES**

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**EDUCATION**

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Ph.D	Science Education, University of Michigan School of Education Advisor and Committee Chair, Professor Elizabeth A. Davis Committee members, Professors Joe Krajcik, Jay Lemke, Michaela Zint	2009
M.S.	Natural Resources, University of Michigan School of Natural Resources & Environment Advisor and Committee Chair, Professor Michaela Zint	2009
M.S.	Science Education, University of Kansas School of Education Advisors, Professors James Ellis and Marc Mahlios	2002
Cert.	7-12 Teaching Certification in Biology, Chemistry, & General Science	2002
B.S.	Ecology & Evolutionary Biology, University of Kansas Advisor, Professor Val Smith	1999

**PROFESSIONAL EXPERIENCE**

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<i>Associate Professor of Science Education (50% research, 25% teaching)</i> <i>Coordinator, IANR Science Literacy Initiative (25% administration)</i> <i>Director, NE Collaborative for Food, Energy, &amp; Water Education</i>	<ul style="list-style-type: none"> <li>• University of Nebraska-Lincoln (UNL)</li> <li>• School of Natural Resources, College of Agricultural Sciences and Natural Resources (CASNR), Institute for Agriculture and Natural Resources (IANR)</li> <li>• Department of Teaching, Learning, and Teacher Education (TLTE), College of Education and Human Sciences (CEHS)</li> <li>• Faculty Affiliate, Robert B. Daugherty Water for Food Global Institute</li> <li>• Faculty Affiliate, Nebraska Center for Research on Children, Youth, Families and Schools (CYFS)</li> </ul>	2014-Present
<i>Visiting Professor of Science Education</i>	<ul style="list-style-type: none"> <li>• University of Augsburg, Institute for Didactic Research and Teacher Education, Primary Education and Didactics</li> </ul>	Summer, 2013
<i>Assistant Professor of Science Education (40% research, 40% teaching, 20% service)</i>	<ul style="list-style-type: none"> <li>• University of Iowa College of Education, Dept. of Teaching and Learning</li> <li>• Faculty Affiliate, Center for Global and Regional Environmental Research (CGRER)</li> </ul>	2009-2013
<i>Graduate research assistant – Professor Elizabeth A. Davis</i>	<ul style="list-style-type: none"> <li>• University of Michigan School of Education</li> <li>• Doctoral Fellow, Center for Curriculum Materials in Science (CCMS; NSF CLT-0227557)</li> </ul>	2004-2009

*Secondary Science Teacher* (9<sup>th</sup>-grade biology and physical science) 2002-2004

- Chisholm Trail Junior High School
- Olathe School District, Olathe, Kansas

*Graduate research assistant* - Professor Joseph Heppert 2000-2002

- University of Kansas Center for Science Education
- Kansas Collaborative for Excellence in Teacher Preparation (KCETP; NSF DUE-9876676)

## **ADMINISTRATIVE LEADERSHIP**

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*Coordinator, Science Literacy Initiative, IANR, UNL* 2014-Present

*Director, NE Collaborative for Food, Energy, & Water Education*

Provide leadership for the development of nationally and internationally recognized research, extension, and teaching programs fostering science literacy through development of innovative programs in food, fuel, water, landscapes, people, and the integrated stewardship of agriculture and natural resources

- Founding Director, [Nebraska Collaborative for Food, Energy, and Water Education](#). Supporting STEM teaching and learning about sustainable food, energy, and water systems through the development of K-16 STEM curriculum, education research and program evaluation, and nationwide engagement and capacity-building.
- Administrative development team for the new, interdisciplinary, 15-hour undergraduate Food, Energy, and Water in Society minor that offers UNL undergraduate students the opportunity to develop the knowledge and skills to analyze and make informed decisions about current and emerging real-world, STEM-based food, energy, and water issues. Established a new course identifier (SCIL) for Science Literacy program-affiliated courses.
- Secured \$300,000 in charitable donations from external stakeholders in support of the Science Literacy Initiative and established the Science Literacy Excellence Fund with the NU Foundation.
- Organizer, annual *STEMming into the Future* STEM outreach event at the Nebraska State Fair, involving 35+ organizations and reaching over 350,000 fairgoers.
- Supervisor and mentor for three pre-tenure STEM education faculty members and one full-time staff member
- Co-Coordinator, CASNR Masters of Applied Science program, Science for Educators specialization. Led efforts to reconstitute the program committee, redesign core curriculum, academic requirements, and faculty advising structure, and serve on college-wide MAS program committee.
- Project Director, UNL ORED Big Ideas Seed Grant to build capacity for long-term science literacy efforts. Lead a project team comprised of 10 UNL faculty representing 7 departments across 5 colleges (CASNR, CEHS, Engineering, Law, Arts and Sciences) and multiple interdisciplinary centers.
- Organizer, Science Literacy Seminar Series, which has brought 7 visiting scholars from the U.S. and Germany to UNL for invited presentations and engagement with UNL faculty.
- Lead development of external funding proposals for program-level capacity-building, evaluation, and education research efforts.
- Significant, ongoing engagement with UNL administration, faculty and graduate students from STEM, STEM education, social sciences, and humanities units, and external stakeholders.
- Provide budgetary oversight and fiscal accountability at the program level.

- Participant, 2016 *Academic Leadership Academy*, Pennsylvania State Center for the Study of Higher Education and the Higher Education Program. <http://sites.psu.edu/cshe/education/academic-leadership-academy/>

*Elementary Science Coordinator, University of Iowa College of Education* 2009-2013

- Coordinator for 7 sections/year of the 07E:162 – Elementary Science Teaching Methods course, including supervision of faculty and graduate student instructors, curriculum planning, facilities management, and both program-, department-, and college-level reporting.
- Science education representative on the Elementary Teacher Education program committee.
- Provided leadership for 2-year effort to redesign of the Elementary Teacher Education program, including the development of three new integrated science/pedagogy courses for undergraduate students preparing to become K-8 teachers.

## EXTERNAL FUNDING

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### *Current Grant-Funded Projects*

Principal Investigator, HIGH SCHOOL STUDENTS' CLIMATE LITERACY THROUGH EPISTEMOLOGY OF SCIENTIFIC MODELING (CliMES; NSF DRK-12, DRL [1720838](#) & [1719872](#)), \$1.7M, 9/1/2017-8/31/2021, awarded May, 2017). A 4-year, mixed-methods, design-based research project to investigate teaching and learning through a high school climate education module designed around EzGCM (Easy Global Climate Modeling), a web-based climate modeling suite designed to provide non-scientists experiences with climate modeling. We will develop and implement a 6-week climate science module for secondary science classrooms designed around EzGCM. Each year, we will collect and analyze evidence of students' model-based reasoning about the Earth's climate. The project will impact an anticipated 55 secondary teachers and 3000 secondary students over four years.

Director, NATIONAL COLLABORATIVE FOR FOOD, ENERGY, & WATER EDUCATION, Coordinator, IANR Science Literacy Initiative (January, 2014-Present). Institutional and national community of educators and education researchers focused on education in the Food-Energy-Water-Nexus. It advances efforts toward sustained, systemic, and interdisciplinary education and outreach efforts focused on FEW issues in a wide array of contexts, including K-12 classrooms, university settings, informal and non-formal learning environments, and in public spaces.

- \$180,000 in charitable gifts from external stakeholders
- \$79,200 USDA-NIFA subcontract
- \$49,300 UNL CASNR and Extension
- \$30,000 from USDA-NIFA Higher Education Challenge Grant (HEC)
- \$12,000 Multistate Research/UNL ARD
- \$10,500 from National STEM Education Centers (NSEC) network/APLU
- \$10,000 Big Ideas Seed Grant, UNL Office of Research and Economic Development
- \$10,000 ARD Strategic Initiatives Fund

Principal Investigator, FOSTERING UNDERGRADUATE STUDENTS' DISCIPLINARY LEARNING AND WATER LITERACY (WELL; NSF DUE-1609598), 8/1/2016-7/31/2019 (awarded June, 2016). A 3-year IUUSE *Engaged Student Learning: Exploration* project focused on the iterative design, implementation, and study of a new, interdisciplinary course for non-majors – SCIL/AECN/NRES 109: *Water in Society* – at the University of Nebraska-Lincoln (UNL).

- \$299,018 from the National Science Foundation, Improving Undergraduate STEM Education (IUUSE)
- \$34,000 from the Robert B. Daugherty Water for Food Global Institute at the University of Nebraska

Principal Investigator, WATER EDUCATION LEADERS for SECONDARY SCIENCE (WELS<sup>2</sup>), 12/1/2016-9/30/2018 (awarded August, 2016). The WELS<sup>2</sup> project at the University of Nebraska-Lincoln (UNL) supports the development, implementation, and evaluation of a 15-month sustained professional development program for secondary STEM teachers in the state of Nebraska focused on teaching and learning about water resources. This integrated project is grounded in a partnership involving the Science Literacy Initiative, Robert B. Daugherty Water for Food Institute, UNL water scientists, the Groundwater Foundation, and four Nebraska school districts. The project will help catalyze a **self-sustaining** and **non-exhaustive** professional development model that leverages, builds upon, and enhances existing UNL programs, including on online master's degree for K-12 STEM educators, the Nebraska Collaborative for Food, Energy, & Water Education, and other grant-funded projects at UNL focused on K-16 teaching and learning about water.

- \$144,150 from the USDA-NIFA, Food, Agriculture, Natural Resources and Human Sciences Education and Literacy Initiative (ELI), PD-STEP track
- \$62,038 from Nebraska Title IIA Improving Teacher Quality State Grant (Nebraska Coordinating Commission for Postsecondary Education)

Principal Investigator, EXCELLENCE IN EDUCATION FOR FOOD, ENERGY, AND WATER (E<sup>2</sup>FEW; 2/1/2017-1/31/2020, awarded January, 2017). The 3-year E<sup>2</sup>FEW project at UNL supports the development, implementation, and evaluation of a 24-month sustained professional development program for postsecondary STEM science faculty. The program will complement and synergistically enhance the impact of the recently-established Food, Energy, and Water in Society (FEWS) undergraduate minor in the UNL College of Agricultural Sciences and Natural Resources, which will serve undergraduate students from across the university and provide integrated, multidisciplinary, learner-centered instruction in STEM with an emphasis on FEW issues. The faculty development program is designed around core tenets of effective undergraduate STEM instruction, including active learning, scientific teaching strategies, and the use of Undergraduate Learning Assistants. The goals of the program, which will be rigorously evaluated as part of the project, are to a) increase implementation of innovative curricular and instructional components into existing FEWS minor courses and, through changes to these courses, b) positively impact students' learning. The project will catalyze a self-sustaining community of practice for instructional innovation around the FEWS minor and lay the foundation for future efforts to scale and evaluate the minor's impact.

- \$138,000 from USDA-NIFA Higher Education Challenge Grant (HEC)
- \$10,000 from UNL UCARE undergraduate research program

Principal Investigator, UNDERSTANDING INHERITANCE IN CORN (UnICORN; June 1, 2014-Sept 30, 2019, awarded June, 2014). The 4-year UnICORN project involves a collaborative effort between UNL, USDA-NIFA, the national Agriculture in the Classroom (AITC) program, and school districts that emphasizes the science, technology, engineering, and mathematics (STEM) foundations of agricultural and natural resource systems. Project activities involve developing, implementing, and studying the impact of an 8-week, 3rd-grade science unit focused on a particular production system – corn – to promote student learning about core life sciences concepts emphasized in the Nebraska State Science Standards and Next Generation Science Standards (NGSS).

- \$386,600 from Hatch Multistate (regional) Research Project funds
- \$30,000 from the Nebraska Corn Board

Senior Personnel, NEBRASKA STEM: NOYCE ELEMENTARY STEM MASTER TEACHING FELLOWS PROGRAM FOR RURAL NEBRASKA, \$1.5M, 03/01/2018 - 02/28/2023, awarded March, 2018). NebraskaSTEM is a Track 3 MTF proposal among the University of Nebraska-Lincoln, Nebraska Educational Technology Association, North Bend Central Public Schools, Longfellow Elementary School, and Harvard Public Schools. NebraskaSTEM aims to enhance the capacity of Nebraska teachers to facilitate high-quality, science, technology, engineering, and mathematics learning opportunities for K- 6 students attending rural Nebraska schools. Fifteen highly qualified, certified elementary teachers who currently teach or intend to teach in high needs, rural Nebraska schools will be selected to become NebraskaSTEM NSF Master Teaching Fellows (MTFs). During the first year of the five-year fellowship, at least twelve teachers will complete a master's degree in elementary education, with specialization in STEM, with up to three teachers who already possess master's degrees completing STEM and leadership graduate coursework. Ongoing mentorship and professional development during years two through five will provide MTFs with opportunities to apply and share their knowledge and skills as they implement high-quality STEM instruction in their classrooms and serve as STEM leaders in their local schools and communities. The overall goal of NebraskaSTEM is to enhance STEM learning for K-6 students in rural Nebraska schools.

#### *Prior Grant-Funded Projects*

Principal Investigator, MODELING HYDROLOGIC SYSTEMS IN ELEMENTARY SCIENCE (MoHSES; NSF DRL-1443223) and WATER FOR ELEMENTARY TEACHERS OF SCIENCE IN NEBRASKA (NE WETS), September 1, 2012 – August 31, 2017 (awarded August 2012). Five years of research and development to investigate elementary students' model-based reasoning about the water cycle and how elementary teachers scaffold students' model-based reasoning. The project leverages a partnership involving the University of Nebraska-Lincoln (UNL) and Michigan State University (MSU) science education programs, the Iowa Van Allen Science Teaching (VAST) Center and Grant Wood Area Education Agency (GWAEA), UNL's National Drought Mitigation Center (NDMC), the UI Center for Global and Regional Environmental Research (CGRER), and six school districts in Iowa and Nebraska.

- \$448,546 from the National Science Foundation (Discovery Research K-12)
- \$71,734 Nebraska Title IIA Improving Teacher Quality State Grant (Nebraska Coordinating Commission for Postsecondary Education)
- \$29,945 from UI Center for Global and Regional Environmental Research
- \$23,394 from the Iowa Measurement Research Foundation
- \$10,000 from UNL

Principal Investigator, REFLECTIVE ASSESSMENT FOR ELEMENTARY SCIENCE (RAES), March 2012 – June 2015 (awarded January 2012). Three years of research and development to investigate 3rd-6th-grade teachers' use of Reflective Assessment, a formative assessment strategy for science. It is grounded in a partnership between UNL, the UI Colleges of Education and Engineering, VAST and GWAEA, four school districts, and CGRER.

- \$477,812 from the Title IIA Improving Teacher Quality State Grant, State of Iowa Board of Regents
- \$39,932 from the Spencer Foundation (Small Grants Program)
- \$25,721 from University of Iowa College of Education

Principal Investigator, PROMOTING INQUIRY-BASED ELEMENTARY SCIENCE THROUGH COLLABORATIVE CURRICULUM CONSTRUCTION (PIESC3), August 2010 – July 2013 (May 2010). This project involves the development, implementation, and evaluation of a 2-year science professional development program for elementary teachers (K-5) in the Davenport Community School District (DCS) and research and

development associated with reliability and validity testing of an inquiry observation protocol and scoring rubric for elementary science.

- \$134,978 from the Carver Charitable Trust
- \$73,168 from the UI CoE and VP for Research
- \$73,168 from Iowa Measurement Research Foundation and Iowa Math and Science Education Partnership

*Submitted Grant Proposals (Declined/Unfunded)*

- IES, U.S. Dept. of Education, EDUCATION RESEARCH AND DEVELOPMENT CENTER PROGRAM, \$5M, R&D Center on Science Teaching in Elementary School Classrooms, Co-PI and Associate Director (2018)
- USDA-NIFA AFRI-ELI Grants Program, \$300,000, Building Skills of Digitally Agile Educators to Teach Food, Agriculture, Natural Resources and Human Sciences through Technology, co-PI (2017)
- NSF IUUSE Grants Program, \$300,000, Instructional Innovation for Food, Energy, and Water (I2FEW), PI, (2017)
- NSF INCLUDES Grants Program, \$300,000, Building and Strengthening a National Network of Local Partnerships to Serve Diverse High School and College Students in the Environmental Sciences, co-PI (2016, 2017)
- NSF Improving Undergraduate STEM Education (IUUSE), \$300,000, *Improving Undergraduate Students' Reasoning about Socioscientific Issues and Science Literacy*, Co-PI (2015)
- NSF, DRK-12, \$3,000,000, *Efficacy of Science Coaching in Teacher Professional Development*, Co-PI (2015)
- North Central Region Water Network (University of Wisconsin), \$30,000, *Youth Water Education: Building informed and Empowered Youth*, Co-PI (2015)
- USDA NIFA, \$2,995,000, *Engaging young scholars in shaping new methods for genomic selection: integrating quantitative and molecular genetics using sheep as a model*, Co-PI (2015)
- Nebraska Environmental Trust, \$25,000, *Soils Education*, Co-PI (2015)
- USDA NIFA, \$500,000, *Building Resilient Organic Agroecosystems through Cover Crops and Science Literacy*, Co-PI (2014)
- NSF, Research Experience for Undergraduates (REU), \$180,000, *Immersion into the Science, Technology, Engineering, and Mathematics (STEM) Education Research Community*, Co-Investigator, (2014)
- USDA NIFA Higher Education Challenge Grant (HEC), \$30,000, *Fostering Science Literacy through Collaborative Partnerships in Nebraska: A Conference*, PI (2014)
- Title IIA Improving Teacher Quality State Grant (Nebraska Coordinating Commission for Postsecondary Education), \$76,000, *Agroecosystems as Tools for Teaching*, PI (2014)
- NSF, Integrative Graduate Education and Research Traineeship Program (IGERT), \$1,600,000, (2013), Co-Investigator
- NSF, DRK-12, \$2,800,000, *Reflective Assessment for Elementary Science*, (2012), PI
- IES, Education Research Grants, Goal II, \$2,700,000, *Professional Development for Reflective Assessment* (2011), PI
- NIH, STEM Challenge Grants, \$720,000, *Pipeline to a Healthy Iowa: Comprehensive Career Education Diverse Students* (2011), Co-Investigator
- NSF CAREER, DRK-12, \$780,000, *Integrative Inquiry Modeling (I<sup>2</sup>M) for Middle-School Atmospheric Science* (2010, 2011), PI

- Title IIA Improving Teacher Quality State Grant, State of Iowa Board of Regents, \$448,000, *Promoting Inquiry-based Elementary Science through Collaborative Curriculum Co-construction* (2010), PI
- Iowa Math and Science Education Partnership, \$40,000, *Preparation of Elementary Science Teachers in Iowa: Developing a CORE-Based Content Knowledge Assessment for Preservice Elementary Teachers* (2010), PI

## PEER-REVIEWED PUBLICATIONS

\*co-author was current or former student

\*\*co-author was former graduate advisor

Sole or shared first authorship indicated in bold

### Refereed Journal Articles

- Sutter, A.M.\* , Dauer, J.M., Kreuziger, T., Schubert, J., Forbes, C.T. (accepted pending revisions). Sixth-grade students' problematization of and decision-making about a wind energy socio-scientific issue. In *International Research in Geographical and Environmental Education*.
- Baumfalk, B.\* , Bhattacharya, D., Vo, T.\* , Forbes, C.T., Zangori, L.\* , & Schwarz, C. (in press). Impact of model-based curriculum and instruction on 3rd-grade students' scientific explanations for the hydrosphere. *Journal of Research in Science Teaching*.
- Lally, D.\* , Forbes, C.T., McNeal, K., & Soltis, N. (in press). National Geoscience Faculty Survey 2016: Prevalence of systems thinking and scientific modeling learning opportunities. *Journal of Geoscience Education*.
- Petitt, D.N.\* & Forbes, C.T. (in press). Values use of undergraduate students in socio-hydrological reasoning: A comparative study. *Natural Sciences Education*.
- Sutter, A.M.\* , Dauer, J.M., & Forbes, C.T. (2018). [Construal level and value-belief norm theories: Implications for undergraduate decision-making on a prairie dog socio-scientific issue](#). In *International Journal of Science Education*, 40(9), 1058-1075.
- Brandt, M.\* , Forbes, C.T., & Keshwani, J. (2017). [Exploring elementary students' scientific knowledge of agriculture using Evidence-Centered Design](#). *Journal of Agricultural Education*, 58(3), 134-149.
- Nelson, K.\* , Sabel, J.\* , Forbes, C.T., Grandgenett, N., Tapprich, W., & Cutucache, C.E. (2017). [How do undergraduate STEM mentors reflect upon their mentoring experiences in an outreach program engaging K-8 youth?](#) *International Journal of STEM Education*, 4(3), 1-13.
- Sabel, J.\* , Dauer, J., & Forbes, C.T. (2017). [Introductory biology students' use of enhanced answer keys and reflection questions to engage in metacognition and enhance understanding](#). *CBE--Life Sciences Education*, 16(3), 2-12.
- Sabel, J.\* , Vo, T.\* , Alred, A., Dauer, J. & Forbes, C.T. (2017). Undergraduate students' scientifically-informed decision-making about socio-hydrological issues. *Journal of College Science Teaching*, 46(6), 64-72.
- Zangori, L.\* , Vo, T.\* , Forbes, C.T., & Schwarz, C. (2017). [Supporting 3rd-grade students' model-based explanations about groundwater: A quasi-experimental study of a curricular intervention](#). In *International Journal of Science Education*, 39(11), 1421-1442.
- Dauer, J. & Forbes, C. T. (2016). [Making decisions about complex socioscientific issues: A multidisciplinary science course](#). *Science Education & Civic Engagement: An International Journal*, 8(2), 5-12.
- Sabel, J.\* , Forbes, C. T., & Flynn, M.L. (2016). [Elementary teachers' use of content knowledge to evaluate students' thinking in the life sciences](#). *International Journal of Science Education*, 38(7), 1077-1099.

- Zangori, L.\* & Forbes, C. T. (2016). [Development of an empirically-based learning performances framework for 3rd-grade students' model-based explanations about plant processes](#). *Science Education*, 100(6), 961–982.
- Forbes, C.T.**, Sabel, J.\*, & Biggers, M.\* (2015). [Elementary teachers' use of formative assessment to support students' learning about interactions between the hydrosphere and geosphere](#). *Journal of Geoscience Education*, 63(3), 210-221.
- Forbes, C.T.**, Sabel, J.\*, & Zangori, L.\* (2015). [Integrating life science content and instructional methods in elementary teacher education](#). *American Biology Teacher*, 77(9), 5-11.
- Forbes, C.T.**, Zangori, L.\*, Schwarz, C.V. (2015). [Empirical validation of integrated learning performances for hydrologic phenomena: 3rd-grade students' model-driven explanation-construction](#). *Journal of Research in Science Teaching*, 52(7), 895-921.
- Sabel, J.\*, Forbes, C.T., & Zangori, L.\* (2015). [Promoting prospective elementary teachers' learning to use formative assessment for life science instruction](#). *Journal of Science Teacher Education*, 26(4), 419-445.
- Vo, T.\*, Forbes, C.T., Zangori, L.\*, & Schwarz, C. (2015). [Fostering 3rd-grade students' use of scientific models with the water cycle: Elementary teachers' conceptions and practices](#). *International Journal of Science Education*, 37(15), 2411-2432.
- Zangori, L.\* & Forbes, C. T. (2015). [Exploring 3rd-grade students' model-based explanations about plant relationships within an ecosystem](#). *International Journal of Science Education*, 37(18), 2942-2964.
- Zangori, L.\*, Forbes, C.T., & Schwarz, C.V. (2015). [Exploring the effect of embedded scaffolding within curricular tasks on 3rd-grade students' model-based explanations about hydrologic cycling](#). *Science & Education*, 24(7-8), 957-981.
- Forbes, C.T.**, Lange, K., Möller, K., Biggers, M.\*, Laux, M., & Zangori, L.\* (2014). [Explanation-construction in 4th-grade classrooms in Germany and the United States: A cross-national comparative video study](#). *International Journal of Science Education*, 36(14), 2367-2390.
- Zangori, L.\* & Forbes, C.T. (2014). [Scientific practices in elementary classrooms: 3rd-grade students' scientific explanations for seed structure and function](#). *Science Education*, 98(4), 614-639.
- Biggers, M.\*, **Forbes, C.T.**, & Zangori, L.\* (2013). [Elementary teachers' curriculum design and pedagogical reasoning for supporting students' comparison and evaluation of evidence-based explanations](#). *The Elementary School Journal*, (114)1, 48-72.
- Forbes, C.T.** (2013). [Curriculum-dependent and curriculum-independent factors in preservice elementary teachers' adaptation of science curriculum materials for inquiry-based science](#). *Journal of Science Teacher Education*, (24)1, 179-197.
- Forbes, C.T.**, Biggers, M.\*, & Zangori, L.\* (2013). [Investigating essential characteristics of scientific practices in elementary science learning environments: The Practices of Science Observation Protocol \(P-SOP\)](#). *School Science and Mathematics*, (113)4, 180-190.
- Zangori, L.\* & Forbes, C.T. (2013). [Preservice elementary teachers and explanation construction: Knowledge-for-practice and knowledge-in-practice](#). *Science Education*, 97(2), 310-330.
- Zangori, L.\*, **Forbes, C.T.**, & Biggers, M.\* (2013). [Fostering student sense-making in elementary science learning environments: Elementary teachers' use of science curriculum materials to promote explanation-construction](#). *Journal of Research in Science Teaching*, (50)8, 887-1017.
- Biggers, M.\* & Forbes, C.T. (2012). [Balancing teacher and student roles in elementary classrooms: Preservice elementary teachers' ideas about the inquiry continuum](#). *International Journal of Science Education*, 34(14), 2205-2229.



- Forbes, C.T.** & Davis, E.A.\*\* (2012). [Operationalizing identity in action: A comparative study of direct versus probabilistic measures of curricular role identity for inquiry-based science teaching](#). *International Journal of Science and Mathematics Education*, 10(2), 267-292.
- Davis, E.A.\*\* , Beyer, C., Forbes, C.T., & Stevens, S. (2011). [Understanding pedagogical design capacity through teachers' narratives](#). *Teaching and Teacher Education*, 27(4), 797-810.
- Forbes, C.T.** (2011). [Preservice elementary teachers' adaptation of science curriculum materials for inquiry-based elementary science](#). *Science Education*, 95, 1–29.
- Forbes, C.T.** & Zint, M.\*\* (2011). [Elementary teachers' beliefs about, perceived competencies for, and reported use of scientific inquiry to promote student learning about and for the environment](#). *Journal of Environmental Education*, 42(1), 30-42.
- Forbes, C.T.** & Davis, E.A.\*\* (2010). [Curriculum design for inquiry: Preservice elementary teachers' mobilization and adaptation of science curriculum materials](#). *Journal of Research in Science Teaching*, 47(7), 365-387.
- Forbes, C.T.** & Davis, E.A.\*\* (2010). [Beginning elementary teachers' beliefs about the use of anchoring questions in science: A longitudinal study](#). *Science Education*, 94(2), 365-387.
- Forbes, C.T.** & Davis, E.A.\*\* (2008). [The development of preservice elementary teachers' curricular role identity for science teaching](#). *Science Education*, 92(5), 909-940.
- Forbes, C.T.** & Davis, E.A.\*\* (2008). [Exploring preservice elementary teachers' critique and adaptation of curriculum materials in respect to socioscientific issues](#). *Science & Education*, 17(8-9), 829-854.
- Forbes, C.T.** (2004). [The value of peer mentoring in the development of beginning secondary science teachers: 3 case studies](#). *Mentoring & Tutoring Journal*, 12(2), 219-239.

#### *Refereed Conference Proceedings*

- Forbes, C.T.**, Chandler, M.C., Bhattacharya, D., Vo, T.\*, & Griffin, J. (2018). Secondary students' model-based reasoning about Earth systems: Practice, epistemology, and conceptual understanding. *Rethinking learning in the digital age: making the Learning Sciences count: Proceedings of the 13th International Conference of the Learning Sciences (ICLS 2018)*. London: International Society of the Learning Sciences.
- McKenney, S., van Aalst, J., & Forbes, C.T. (2016). Realizing research-practice connections: Three cases from the learning sciences. In Looi, C-K, Polman, J., Cress, U., and Reimann, P. (Eds.), *Transforming learning, empowering learners: Proceedings of the 12th International Conference of the Learning Sciences (ICLS 2016), Volume 1*, (pp. 639-646). Singapore: International Society of the Learning Sciences.
- Forbes, C.T.**, Schwarz, C., & Zangori, L.\* (2014). Development of an empirically-based learning performances framework for 3rd-grade students' model-based explanations about hydrologic cycling. In Polman, J. L., Kyza, E. A., O'Neill, D. K., Tabak, I., Penuel, W. R., Jurow, A. S., O'Connor, K., Lee, T., and D'Amico, L. (Eds.), *Learning and becoming in practice: The International Conference of the Learning Sciences (ICLS) 2014, Volume 1*, (pp. 46-53). Boulder, CO: International Society of the Learning Sciences.
- Zangori, L.\*, Forbes, C.T., & Schwarz, C. (2014). Investigating the effect of curricular scaffolds on 3rd-grade students' model-based explanations for hydrologic cycling. In Polman, J. L., Kyza, E. A., O'Neill, D. K., Tabak, I., Penuel, W. R., Jurow, A. S., O'Connor, K., Lee, T., and D'Amico, L. (Eds.), *Learning and becoming in practice: The International Conference of the Learning Sciences (ICLS) 2014, Volume 2*, (pp. 942-946). Boulder, CO: International Society of the Learning Sciences.
- Forbes, C.T.**, Madeira, C.A., & Slotta, J.D. (2010). Activity-theoretical research on science teachers' expertise and learning. In Gomez, K., Lyons, L., & Radinsky, J. (Eds.), *Learning in the Disciplines:*

*Proceedings of the 9th International Conference of the Learning Sciences (ICLS 2010), Volume 1*, (pp. 651-658). Chicago, IL: International Society of the Learning Sciences.

#### *Refereed Practitioner Articles*

- Cisterna, D., Ingram, E., Bhattacharya, D., Roy, R., & Forbes, C.T. (in press). Decoding the corn field: Building students' ideas about plant inheritance and variation. *Science and Children*.
- Bhattacharya, D., Carroll-Steward, K.\*, Sutter, A.\*, Chandler, M., & Forbes, C.T. (2018). [Climate literacy: Insights from research on K-16 climate education](#). *Green Schools Catalyst Quarterly*, V(4), 26-35.
- Forbes, C.T.**, Brozovic, N., Franz, T., Lally, D.\*, & Petitt, D.\* (2018). Water in Society: An interdisciplinary course to support undergraduate students' water literacy. *Journal of College Science Teaching*, 48(1), 36-42.
- Forbes, C.T.**, Vo, T.\*, Zangori, L.\*, & Schwarz, C. (2015). Supporting students' scientific modeling when learning about the water cycle, *Science and Children*, 53(2), 42-49.
- Lange, K., Forbes, C.T., Helm, K., & Hartinger, A. (2014). Forschen heißt auch Modellieren! Wie kann das im naturwissenschaftlichen Sachunterricht der Grundschule aussehen? [Inquiry includes modelling - how can this look in elementary classrooms?]. *Grundschulunterricht*, 4, 17-22.
- Zangori, L.\*, Forbes, C.T., & Biggers, M.\* (2012). This is inquiry...right? Strategies for effectively adapting elementary science lessons. *Science and Children*, 50(1), 48-53.

#### *Book Chapters*

- Forbes, C.T.** (forthcoming). Conclusion. In E.A. Davis, C. Zembal-Saul, & S. Kademian (Eds.), *Sensemaking in Elementary Science: Supporting Teacher Learning*. Routledge; New York.
- Forbes, C.T.**, Chandler, M., Blake, J., Bhattacharya, D., Carroll-Steward, K.\*, Johnson, V., DeGrand, T., Mason, W., and Murrow, B. (forthcoming). Fostering climate literacy with global climate models in secondary science classrooms: Insights from a collaborative partnership. In J. Henderson & A. Drewes (Eds.), *Teaching Climate Change in the United States*. Routledge; New York.
- Forbes, C.T.**, Lange-Schubert, K., Böschl, F., & Vo, T.\* (forthcoming) Supporting primary students' developing modeling competency for water systems. In A. Upmeyer zu Belzen, D. Krüger, & J. van Driel (Eds.), *Towards a Competence-based View on Models and Modeling in Science Education*.
- Lange-Schubert, K.; Böschl, F.; Vo, T.\* & Forbes, C.T. (forthcoming). Modellieren in der Grundschule – Mehr als matchbox autos [Models and modeling in primary science education – More than Matchbox cars]. In M. Emden, M. Ropohl, & K. Sommer, (Eds.) *Modellieren im Chemieunterricht* [Modeling in Chemistry Classrooms]. Friedrich Verlag.
- Teasdale, R., Scherer, H., Holder, L., Boger, R., & Forbes, C.T. (2018). [Research on teaching about Earth in the context of societal problems](#). In K. St. John (Ed.), *Community Framework for Geoscience Education Research* (pgs. 49-60). National Association of Geoscience Teachers. Retrieved from [https://doi.org/10.25885/ger\\_framework/5](https://doi.org/10.25885/ger_framework/5).
- Lange-Schubert, K., Schubert, J., Böschl, F., & Forbes, C.T. (2016). Wasser – Boden – Interaktionen: Durch wissenschaftliches Beobachten, Untersuchen und Modellieren über den Was-serkreislauf lernen [Water – soil interactions: Learning through scientific monitoring, investigating, and modeling on the water cycle]. In M. Adamina, M. Hemmer, & J.C. Schubert, (Eds.), *Die Geographische Perspektive Konkret – Begleitband 3 zum Perspektivrahmen Sachunterricht* (pp. 29-42). Bad Heilbrunn: Klinkhardt.
- Forbes, C.T.** & Biggers, M.\* (2015). What kind of science teacher will I be? Teachers' curricular role identity for elementary science. In L. Avraamidou (Ed.), *Studying Teacher Identity: Theoretical Perspectives and Methodological Approaches*, (pgs. 129-152). Sense Publishers; Rotterdam.

**Forbes, C.T.** & Davis, E.A. (2010). Beginning elementary teachers' curriculum design and development of pedagogical design capacity for science teaching: A longitudinal study. In L.E. Kattington (Ed.), *Handbook of Curriculum Development* (pgs. 209-232). Nova Science Publishers; New York.

#### *Other Papers*

- Aguirre-Mendez, C.P., Promyod, N., & Forbes, C.T. (in preparation). Characteristics of scientifically-oriented questions and the nature of inquiry in elementary classrooms: A multiple-case study.
- Bhattacharya, D., Carroll-Steward, K.\*, & Forbes, C.T. (in preparation). Climate education research in K-16 science education: A systemic review.
- Bhattacharya, D., Carroll-Steward, K.\*, & Forbes, C.T. (in preparation). Promoting secondary students' model-based reasoning about Earth's climate: Two teachers' implementation of a curriculum module.
- Böschl, F., Lange-Schubert, K., & Forbes, C.T. (in preparation). Scientific modeling in elementary science learning environments: A comparative study of the United States and Germany.
- Biggers, M.\* & Forbes, C.T. (in preparation). Inquiry in elementary science learning environments: Investigating fidelity of implementation of science curriculum materials.
- Cisterna, D., Roy, R., Bhattacharya, D., & Forbes, C.T. (in preparation). Model-based teaching and learning about heredity: Elementary students' ideas about traits, inheritance, and life cycles.
- Cisterna, D., Roy, R., Bhattacharya, D., & Forbes, C.T. (in preparation). Modeling elementary students' ideas about heredity: A comparison of a curricular intervention.
- Forbes, C.T.** (in preparation). From pedagogical reasoning to expansive learning: Activity-theoretical research on epistemic dimensions of expertise for teaching.
- Forbes, C.T.**, Neumann, K., & Schiepe-Tiska, A. (in preparation). PISA science 2015: Student achievement and science teaching.
- Lally, D.\* & Forbes, C.T. (in preparation). Socio-hydrological systems thinking of undergraduate students.
- Lally, D.\*, Pettit, D.\*, & Forbes, C.T. (in preparation). Undergraduate students' model-based reasoning about water systems using computer-based simulation tools.
- Laux, M.\*, Forbes, C.T., Lange-Schubert, K., & Möller, K. (in preparation). Studying the influence of teachers' inquiry practices on student outcomes in primary science classrooms in Germany.
- Pettit, D.\* & Forbes, C.T., & Lally, D. (in preparation). Undergraduate students' reasoning about socio-hydrologic challenges: Scientific literacy and informed decision-making in interdisciplinary STEM.
- Pinney, B., Suh, J., & Forbes, C.T. (in preparation). Dichotomous inquiry practice: Characterizing teaching practice based on five essential features of inquiry.
- Soltis, N., McNeal, K., Forbes, C.T. & Lally, D.\* (in preparation). The relationship between active learning, course innovation, and teaching Earth systems thinking: A structural equation modeling approach. In *Geosphere*.
- Sommers, A., Mott, B., White, H., Alred, A., Dauer, J., & Forbes, C.T. (in preparation). Instruction, socio-scientific reasoning, and systems thinking in undergraduate food, energy, and water systems (FEWS) courses.
- Vo., T.\* & Forbes, C.T. (in preparation). A mixed methods comparison of 3<sup>rd</sup> and 5<sup>th</sup>-grade students' model-based explanations for water systems.
- Vo., T.\*, Forbes, C.T., Zangori, L.\*, & Schwarz, C. (in preparation). A multiple-year longitudinal study of 3<sup>rd</sup>-grade teachers' learning to support students' model-based learning about water.

## **WORKSHOPS, SESSIONS, AND SYMPOSIA**

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Co-organizer and facilitator, 3-day morning workshop, *Advancing Transdisciplinary* 2018

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<i>Dialogue in Geoscience Education Research</i> , 2018 Earth Educators Rendezvous, University of Kansas.		
Invited participant, <i>Geoscience Education Research (GER) Grand Challenges and Strategies Workshop</i> , Earth Educators' Rendezvous (EER), Albuquerque, NM		2017
Organizer and facilitator, Structured Poster Session, <i>Food, Energy, and Water Education: Research, Development, Extension, and Outreach</i> , Water for Food Global Conference, NCDC231 Annual Meeting, University of Nebraska-Lincoln.		2017
Invited participant, <i>FEW Nexus Workshop on Integrated Science, Engineering &amp; Policy: A Multi Stakeholder Dialogue</i> , Texas A&M University, College Station, Texas.		2017
Organizer and facilitator, Structured Poster Session, <i>Supports for Elementary Teachers Implementing NGSS: Challenges and Opportunities across Science, Technology, and Engineering</i> , NSF DRK-12 PI Meeting, Washington, DC.		2016
Organizer and facilitator, Structured Poster Session, <i>Scientific Modeling across the K-12 Continuum: Alignment between Theoretical Foundations and Classroom Interventions</i> , NSF DRK-12 PI Meeting, Washington, DC.		2016
Invited participant, <i>Learning by Design Workshop</i> , Supported by award # #1347814 (WIDER: Adopting Research-Eased Instructional Strategies for Enhancing STEM Education), University of Nebraska-Lincoln		2016
Invited discussant, Related Paper Set, <i>Supporting Teachers to Facilitate Student Sensemaking in Elementary Science Classrooms</i> , NARST, Baltimore, MD.		2016
Invited participant, <i>International Workshop on Scientific Modeling</i> , University of Augsburg, Germany, German Research Foundation (DFG).		2015
Invited participant, <i>Workshop: Tightening Research-Practice Connections: Taking ISLS findings to Public Debate</i> , International Conference of the Learning Sciences, Boulder, Colorado.		2014
Invited participant, <i>Writing an Application for an IES Grant: A Workshop</i> , 2013 AERA meeting, Institute for Education Sciences.		2013
Invited participant, Doctoral Consortium, International Conference of the Learning Sciences, Utrecht, the Netherlands.		2008
Facilitator, <i>Teacher Identity &amp; Use of Curriculum Materials</i> , 2006 CCMS Knowledge Sharing Institute, Ann Arbor, MI.		2006
Facilitator, <i>Science Education Policy</i> , 2006 CCMS Knowledge Sharing Institute, Ann Arbor, MI.		2006

## PRESENTATIONS

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### *Invited Presentations*

Forbes, C.T., Scherer, H., Wang, H-H., Millenbah, K., Sintov, N., & Li, C. (invited, 2018, June). *A national collaborative for food, energy, & water education*. Poster presented at the 2018 annual meeting of the National Network of STEM Education Centers (NSEC).

Forbes, C.T., Bhattacharya, D., & Chandler, M.A. (2017). *Climate Literacy through Epistemology of Scientific Modeling (CLIMES): Promoting understanding of Earth's climate among secondary students using global climate models*. Invited session presented at the Climate Literacy and Energy Awareness Network (CLEAN). Recording retrieved from <https://cleanet.org/details/files/133713.html>

- Forbes, C.T. (invited, 2017, November). *Scientific modeling for K-16 Earth systems education: Theoretical perspectives and empirical insights*. Invited presentation at the Center for Science and Technology in Education (CSTE), University of Maryland, College Park, MD.
- Forbes, C.T. (invited, 2017, June). *A national collaborative for food, energy, & water education: Opportunities and strategic visioning*. Invited presentation at the 2017 annual meeting of the National Network of STEM Education Centers (NSEC).
- Forbes, C.T. (invited, 2016, April). *Cultivating science literacy in the nexus: Multidisciplinary STEM education across food, energy, and water*. Invited presentation at 2016 Annual Symposium of the Global Food Security Consortium, Iowa State University, Ames, IA.
- Forbes, C.T. (invited, 2016, January). *Teaching and learning about water in elementary science learning environments: A view across projects*. Invited presentation at SRI International, Menlo Park, CA.
- Forbes, C.T. (invited, 2015, December). *Fostering science literacy in the elementary grades: Educational research on third-grade students' learning about plants*. Invited presentation at the UNL Department of Agronomy and Horticulture Seminar Series.
- Forbes, C.T. (2014, September). *Discipline-based education research on teaching and learning in elementary science learning environments*. Invited presentation at the UNL School of Natural Resources Seminar Series.
- Forbes, C.T. (2014, June). *Supporting teachers' use of curriculum materials for science: Empirically-grounded perspectives on teachers' curriculum design competencies*. Invited presentation at the International Conference of New Teacher Competencies, Center for Knowledge Creation on Teacher Development and Curriculum Design and the National Institute for Curriculum Development in The Netherlands, University of Twente, Enschede, the Netherlands.
- Forbes, C.T. (2014, March). *Discipline-based research on elementary science learning environments designed to foster students' learning about water systems*. Invited presentation at the UNL Discipline-Based Educational Research (DBER) Group Seminar.
- Forbes, C.T. (2013, June). *Supporting elementary teachers' to engage in 'high-leverage' instructional practices: Theory and research on teachers' use of elementary curriculum materials*. Invited presentation at the University of Augsburg, Augsburg, Germany.
- Forbes, C.T. (2013, April). *Supporting teachers to attend to students' ideas in elementary science learning environments: The Reflective Assessment for Elementary Science in Iowa (RAES-Iowa) project*. Invited presentation at the Lawrence Hall of Science, Full Option Science System (FOSS) group.
- Forbes, C.T. (2013, March). *Multifaceted approaches to research and development on elementary students' formulation and evaluation of scientific explanations*. Invited presentation at Florida State University College of Education.
- Forbes, C.T. (2012, May). *Integrated educational research and development to foster effective teaching and learning in K-8 science learning environments*. Invited presentation at the Center for Global and Regional Environmental Research (CGRER) Advisory Board Meeting, Iowa City, IA.
- Forbes, C.T. (2012, January). *Fostering sense-making in K-8 science learning environments through curriculum and instruction: An evolving research agenda*. Invited presentation at the University of Essen (NWU-Essen), Essen, Germany. Sponsored by the German Research Foundation (DFG).
- Forbes, C.T. (2012, February). *Fostering sense-making in K-8 science learning environments through curriculum and instruction: An evolving research agenda*. Invited presentation at the University of Münster (WWU-Münster), Münster, Germany. Sponsored by the German Research Foundation (DFG).
- Forbes, C.T. (2010, December). *Investigating and promoting elementary teachers' use of science curriculum materials to teach science as inquiry*. Invited presentation at the Dean's Annual Emeriti Faculty Symposium, University of Iowa College of Education.

*Peer-Reviewed Conference Presentations*

- Bhattacharya, D., Forbes, C.T., Chandler, M., Carroll-Steward, K. (2018, December). *Student learning outcomes using model-based climate literacy in secondary geo-science classrooms*. Poster presented at the 2018 annual meeting of the American Geophysical Union (AGU), Washington, DC.
- Holder, L.N., Boger, R.A., Scherer, H.H., Forbes, C.T., & Teasdale, R. (2018, December). *Research on teaching about Earth in the context of societal problems*. Poster presented at the 2018 annual meeting of the American Geophysical Union (AGU), Washington, DC.
- Huyck Orr, C., Scherer, H.H., Forbes, C.T., & Bruckner, M.Z. (2018, December). *Teaching about food, water, and energy in the context of sustainability: Opportunities and connections with the InTeGrate STEP center*. Poster presented at the 2018 annual meeting of the American Geophysical Union (AGU), Washington, DC.
- Bhattacharya, D., Forbes, C., Chandler, M., Carroll-Steward, K. (2018, November). *Developing secondary students' understanding of the Earth's climate through computer-based global climate models*. Paper presented at the 2018 Geological Society of America annual meeting (GSA), Indianapolis, IN.
- Lally, D., Petitt, D.N., Forbes, C., Brozovic, N., Franz, T. (2018, November). *Investigating undergraduate students' reasoning about socio-hydrological issues: Results from a transdisciplinary water course*. Poster presented at the 2018 Geological Society of America annual meeting (GSA), Indianapolis, IN.
- Lally, D., Forbes, C., McNeal, K.S., Soltis, N. (2018, November). *National survey of geoscience teaching practices 2016: Current trends in geoscience instruction of scientific modeling and systems thinking*. Paper presented at the 2018 Geological Society of America annual meeting (GSA), Indianapolis, IN.
- Soltis, N.A., McNeal, K.S., Forbes, C., Lally, D. (2018, November). *The relationship between active learning course innovation and teaching earth system thinking: A structural equation modeling approach*. Paper presented at the 2018 Geological Society of America annual meeting (GSA), Indianapolis, IN.
- Teasdale, R., Scherer, H.H., Forbes, C., Boger, R.A., Holder, L.N. (2018, November). *A call for more geoscience education research on teaching about Earth in the context of societal problems*. Poster presented at the 2018 Geological Society of America annual meeting (GSA), Indianapolis, IN.
- Bhattacharya, D. Forbes, C.T., Chandler, M.A., Carroll-Steward, K., & Sutter, A.M. (2018, October). *Promoting model-based climate literacy in secondary geo-science classrooms*. Paper presented at the annual meeting of the North American Association for Environmental Education (NAAEE), Spokane, WA.
- Bhattacharya, D. Forbes, C.T., Chandler, M.A., Carroll-Steward, K., & Sutter, A.M. (2018, October). *Student learning outcomes using model-based climate literacy in secondary geoscience classrooms*. Poster presented at the annual meeting of the North American Association for Environmental Education (NAAEE), Spokane, WA.
- Forbes, C.T., Lie, C., Busch, K.C., Stevenson, K. (2018, October). *A National Collaborative for Food, Energy, and Water Education Research*. Invited panel symposium at the annual meeting of the North American Association for Environmental Education (NAAEE), Spokane, WA.
- Forbes, C.T., Scherer, H., Li, C., Millenbah, K., Sintov, N., & Wang, H-H. (2018, July). *Building a National Collaborative for Food, Energy, and Water Education (NC-FEW): Insights from a national conference*. Poster presented at the Earth Educators Rendezvous (EER), Lawrence, KS.

- Lally, D., Forbes, C.T., McNeal, K., & Soltis, N. (2018, July). *National Survey of Geoscience Teaching Practices 2016: Current trends in geoscience instruction of scientific modeling and systems thinking*. Presentation at the Earth Educators Rendezvous (EER), Lawrence, KS.
- Petitt, D., Lally, D., Forbes, C.T., Brozovic, N., & Franz, T. (2018, July). *Water in society: undergraduate learning and reasoning about socio-hydrological issues*. Paper presented at the Earth Educators Rendezvous (EER), Lawrence, KS.
- Forbes, C.T., Bhattacharya, D., Chandler, M.A., & Sutter, A. M. (2018, June). High school students' *climate literacy through epistemology of scientific modeling (CLiMES)*. Poster presented at the Discovery Research Prek-12 PI meeting, Washington, D.C.
- Bhattacharya, D., Ingram, E., Forbes, C., Cisterna, D. (2018, March). Using agriculture as a context for teaching genetics in elementary classrooms: Insights from UnICORN (Understanding Inheritance in CORN). Paper presented at the annual meeting of the National Science Teachers Association (NARST/NSTA sponsored session), Atlanta, GA.
- Petitt, D., Lally, D., Forbes, C.T., Brozovic, N., & Franz, T. (2018, March). *Undergraduate students' learning and reasoning about socio-hydrological issues*. Poster presented at the annual meeting of the National Association of Research in Science Teaching (NARST), Atlanta, GA.
- Vo, T., Bhattacharya, D., Baumfalk, B., Zangori, L., Welch, G., Forbes, C., (2018, April). *Examining the impact of a modeling enhanced water unit on 3rd grade students' scientific explanations*. Paper presented at the annual meeting of the American Educational Research Association (AERA), New York City, NY.
- Böschl, F., Vo, T., Forbes, C.T., Lange-Schubert, K., (2018, March). *Development of an empirically grounded learning performance framework for elementary students' modeling competency of water*. Paper presented at the annual meeting of the National Association of Research in Science Teaching (NARST), Atlanta, GA
- Vo, T., Forbes, C.T., (2018, March). *A mixed methods comparison of elementary students' model based explanations about water*. Paper presented at the annual meeting of the National Association of Research in Science Teaching (NARST), Atlanta, GA.
- Cisterna, D., Bhattacharya, D., Vo, T., Zangori, L., & Forbes, C.T., (2018, March). *Examining multiple programs to supporting K-12 teachers' instruction about water using scientific models*. Submitted to the National Association of Research in Science Teaching (NARST), 2018 Annual International Conference, Atlanta, GA.
- Bhattacharya, D., Forbes, C.T., Ingram, E., Hawley, L., Stevens, J. & Cisterna, D. (2018, March). *Developing 3<sup>rd</sup>-grade students' understanding of inheritance using a model-based curriculum*. Paper presented at the annual meeting of the National Association of Research in Science Teaching (NARST), Atlanta, GA.
- Bhattacharya, D., Forbes, C.T., Ingram, E., Hawley, L., Stevens, J. & Cisterna, D. (2018, March). *Supporting scientific modeling practices in elementary science instruction about inheritance*. Poster presented at annual meeting of the National Association of Research in Science Teaching (NARST), Atlanta, GA.
- Lally, D., Dauer, J.M., Forbes, C.T., (2018, March). *Helping undergraduate students' CREATE understanding of scientific and popular media articles about contemporary water issues*. Poster presented at the annual meeting of the National Association of Research in Science Teaching (NARST), Atlanta, GA.
- Lally, D., Forbes, C.T., (2018, March). *Water in society: Making water issues matter to undergraduate students*. Session presented at the annual meeting of the National Science Teachers Association (NSTA), Atlanta, GA.

- Lally, D., Forbes, C.T., McNeal, K., (2018, July). *National survey of geoscience teaching practices 2016: Current trends in geoscience instruction of scientific modeling and systems thinking*. Submitted to the 2018 Earth Educators Rendezvous (EER), Lawrence, KS.
- Vo, T. & Forbes, C. T. (2018, January). *Supporting K-12 teachers' instruction about water using scientific modeling: Looking across multiple projects*. Paper presented at the annual meeting of the Association for Science Teacher Education (ASTE), Baltimore, MD.
- Bhattacharya, D., Forbes, C.T., Chandler, M. & Roehrig, G. (2017, December). *Promoting climate literacy among in-service secondary science teachers requires epistemological knowledge and understanding*. Paper presented at the 2017 annual meeting of the American Geophysical Union (AGU), New Orleans, LA.
- Bhattacharya, D., Derowitsch A., Forbes, C.T., Ingram, E., & Kegley, M. (2017, September). Using corn as a model organism to foster elementary students' understanding of core concepts about plant life cycle, inheritance and genetic variation. Presentation at the annual meeting of the Nebraska Association of Teachers of Science (NATS), Kearney, NE.
- Baumfalk, B., Forbes, C.T., Bhattacharya, D., Vo, T., & Welch, G. (2017, November). *Applying a systematic approach to measuring intervention fidelity*. Paper presented at the 2017 annual meeting of the American Evaluation Association (AEA), Washington, D.C.
- Bhattacharya, D., Forbes, C.T., Ingram, E. (2017, January). *Using corn as a model organism to foster 3rd-grade students' learning of inheritance*. Experiential session presented at the 2017 annual meeting of the Association of Science Teacher Education (ASTE), Des Moines, IA.
- Bhattacharya, D., Ingram, E., Forbes, C.T., Wolken, T., & Kegley, M. (2017, April). *Using corn to foster elementary students' understanding of plant life cycle, inheritance and genetic variation*. Paper presented at the 2017 annual meeting of the National Association of Research in Science Teaching (NARST), San Antonio, TX.
- Bhattacharya, D., Vo, T., Baumfalk, B., Zangori, L., Welch, G., Forbes, C., (2017, August) *Impact of a model-based curricular intervention on elementary students' explanations for the hydrosphere*. Paper presented at the 2017 annual meeting of the European Science Educational Research Association (ESERA) 2017 conference, Dublin, Ireland.
- Chandler, M, Bhattacharya, D., Forbes, C., Sohl, L., Zhou, J. & Bush, D. (2017, June). *Using Global Climate Models in the classroom*. Workshop presented at the 2016 Climate Generation Summer Institute, Climate Generation: A Will Steger Legacy, Minneapolis, MN.
- Forbes, C., Bhattacharya, D., Vo, T., Baumfalk, B., Zangori, L., Welch, G., (2017, April). *Impact of model-based science instruction on 3rd grade students' scientific explanations for hydrologic cycling*. Paper presented at the 2017 annual meeting of the National Association of Research in Science Teaching (NARST), San Antonio, TX.
- Forbes, C.T., Brozović, N., Franz, T., Lally, D., & Petitt, D. (2017, June). *Transdisciplinary undergraduate water education: Pedagogical reflections*. Paper presented at the 2017 meeting of the North American Colleges and Teachers of Agriculture Conference (NACTA), Purdue University, West Lafayette, IN.
- Forbes, C.T., Brozović, N., Franz, T., Lally, D., & Petitt, D. (2017, April). *Fostering undergraduate students' disciplinary learning and science literacy*. Poster presented at the 2017 meeting of the Water for Food Global Conference, Lincoln, NE.
- Forbes, C.T., Foster, D., Millenbah, K., Scherer, H., & Wang, H-H. (2017, June). *A national collaborative for food, energy, and water education*. Poster presented at the 2017 annual meeting of the North American Colleges and Teachers of Agriculture (NACTA), West Lafayette, IN.
- Forbes, C.T., Lange-Schubert, K., Vo, T., Gogolin, S., Böschl, F. (2017, August). *Model-based learning in primary science: A collaborative approach to exploring strategies for assessing scientific*



- modelling*. Paper presented at the 2017 annual meeting of the European Science Education Research Association (ESERA), Dublin, Ireland.
- Forbes, C.T. & Li, C. (accepted). *A national collaborative for food, energy, and water education*. Symposium to be presented at the 2017 annual meeting of the North American Association of Environmental Education, San Juan, PR. **CONFERENCE CANCELLED**
- Forbes, C.T. & Scherer, H. (2017, July). *Education in the Food-Energy-Water-Nexus: A transdisciplinary community*. Paper presented at the 2017 Earth Educators' Rendezvous, Albuquerque, NM.
- Lally, D., Pettitt, D., Forbes, C.T., Brozović, N., & Franz, T. (2017, July). *Water in Society: Interdisciplinary Undergraduate Teaching and Learning about Water*. Paper presented to the 2017 Earth Educators' Rendezvous, Albuquerque, NM.
- Lally, D. Sabel, J., Forbes, C., Dauer, J. (2017, April). *Undergraduate students' use and understanding of scientific and popular media articles*. Poster presented at the 2017 annual meeting of the National Association of Research in Science Teaching (NARST), San Antonio, TX.
- Peterson, A.M., Dauer, J.M., Kreuziger, T., Schubert, J., & Forbes, C.T. (accepted). *Student problematization and decision-making on a wind energy socio-scientific issue*. Poster to be presented at the 2017 annual meeting of the North American Association of Environmental Education, San Juan, Puerto Rico. **CONFERENCE CANCELLED**
- Peterson, A.M., Forbes, C.T., Schubert, J., & Kreuziger, T. (2017). *Student conceptualization of and decisions about a wind energy socio-scientific issue*. Poster presented at the 2017 annual meeting of the European Science Education Research Association (ESERA), Dublin, Ireland.
- Peterson, A.M. & Forbes, C.T. (2017). *Using construal theory to characterize middle-school students' decision-making about wind energy*. Paper presented at the 2017 annual meeting of the National Association for Research in Science Teaching (NARST), San Antonio, TX.
- Peterson, A.M., Dauer, J.M., & Forbes, C.T. (2017). *Using construal theory to understand students' problematization of a prairie dog socio-scientific issue*. Poster presented at the *Midwest Fish and Wildlife Conference*, Lincoln, NE.
- Pettitt, D., Lally, D., Forbes, C.T., Brozovic, N., & Franz, T. (2017, October). *Transdisciplinary students' learning & reasoning about socio-hydrological issues in an undergraduate water course*. Poster presented at the 2017 annual meeting of the Geological Society of America (GSA), Seattle, WA.
- Sabel, J., Dauer, J., & Forbes, C. (2017, April). *Introductory biology students' use of rubrics and reflection questions to engage in metacognition and enhance understanding*. Paper presented at the 2017 annual meeting of the National Association of Research in Science Teaching (NARST), San Antonio, TX.
- Vo, T., Forbes, C.T, Zangori, L., Schwarz, C. (2017, August) *A case study investigating elementary teachers' learning to engage in model-based instruction*. Paper presented at the 2017 annual meeting of the European Science Education Research Association (ESERA) 2017 conference, Dublin, Ireland.
- Vo, T. & Forbes, C. T., (2017, July). *Supporting K-12 teachers' instruction about water using scientific modeling: A view across programs*. Poster presented at 2017 Earth Educators' Rendezvous, Albuquerque, New Mexico.
- Vo, T., Forbes, C. T., Zangori, L., Schwarz, C.V (2017, April). *Exploring elementary teachers' conceptualizations and practices around model-based instruction of the water cycle: A three-year longitudinal multi-case study*. Paper presented at the 2017 annual meeting of the American Educational Research Association (AERA), San Antonio, TX.
- Vo, T., Forbes, C.T, Zangori, L., Schwarz, C. (2017, April). *A 3-year longitudinal multi-case study exploring three elementary teachers' model-based science instruction about water*. Paper presented at the

- 2017 annual meeting of the National Association of Research in Science Teaching (NARST), San Antonio, TX.
- Vo, T., Forbes, C.T., Zangori, L., Schwarz, C. (2017, April). *Comparing 3rd and 5th grade students' model-based explanations about water*. Poster presented at the 2017 annual meeting of the National Association of Research in Science Teaching (NARST), San Antonio, TX.
- Bhattacharya, D., Forbes, C.T., & Ingram, E. (2016, October). *Teaching lifecycles using modeling. Results from UNICORN-Using corn as a model organism to foster 3rd-grade students' learning of genetics and inheritance*. Experiential session presented at the regional conference for National Science Teacher Education (NSTA), Minneapolis, MN.
- Brandt, M., Forbes, C., & Keshwani, J. (2016, April). *Operationalizing science in applied contexts: Developing measures for elementary students' understanding of STEM dimensions of food systems*. Paper presented at the 2016 annual meeting of the National Association of Research in Science Teaching (NARST), Baltimore, MD.
- Chandler, M, Bhattacharya, D., Forbes, C., Sohl, L., Zhou, J. & Bush, D. (2016, June). *Using Global Climate Models in the classrooms*. Workshop presentation at the Climate Generation Summer Institute 2016, Climate Generation: A Will Steger Legacy, Minneapolis, MN.
- Forbes, C.T. (2016, July). *Science literacy for the 21st Century: An institutional initiative to science-informed decision-making about food, energy, and water*. Presentation at the 2016 Summer Institute, Science Education for New Civic Engagements and Responsibilities, Chicago, IL.
- Forbes, C.T., Brozovic, N., Franz, T., Lally, D., & Pettit, D. (2016, October). *Fostering undergraduate students' disciplinary learning and science literacy*. Poster to be presented at the 2016 meeting of the Geological Society of America (GSA), Denver, CO.
- Forbes, C.T., Dauer, J., Dauer, J., & Keshwani, J. (2016, January). *Grow, eat, learn: Fostering science literacy through food, energy, and water in Nebraska and beyond*. Poster presented at the 16<sup>th</sup> National Conference and Global Forum on Science, Policy, and the Environment: The Food-Energy-Water Nexus, Washington, DC.
- Forbes, C., Keshwani, J., Brandt, M., & Wolken, T. (2016, June). *Translating Applied STEM Research into Secondary Science (TASRs)*. Presentation at the 2016 annual meeting of the National Agriculture in the Classroom Organization (NAITC), Litchfield Park, AZ.
- Forbes, C.T., Vo, T., Zangori, L., & Schwarz, C.V. (2016, June). *Modeling Hydrologic Systems in Elementary Science (MoHSES) project*. Poster presented at the 2016 NSF DR K-12 PI Conference, Washington, DC.
- Ingram, E., Morrow, M., Forbes, C., & Brandt, M. (2016, June). *Pollinators in the High School Biology Classroom*. Presentation at the 2016 annual meeting of the National Agriculture in the Classroom Organization (NAITC), Litchfield Park, AZ.
- Peterson, A.M., Dauer, J.M., & Forbes, C. T. (2016, October). *Using construal theory to understand student problematization of two socio-scientific issues*. Poster presented at the UNL STEM Education Retreat, Lincoln, NE.
- Sabel, J., Vo, T., Alred, A., Dauer, J., & Forbes, C. (2016, April). *Undergraduate students' scientifically-informed decision-making about water-based socioscientific issues*. Poster presented at the 2016 annual meeting of the National Association of Research in Science Teaching (NARST), Baltimore, MD.
- Sabel, J., Forbes, C., & Zangori, L. (2016, April). *Use of structured formative assessment assignments to engage preservice teachers with life science concepts*. Paper presented at the 2016 annual meeting of the National Association of Research in Science Teaching (NARST), Baltimore, MD.
- Vo, T., Forbes, C. T. (2016, April). *Learning to support students' model-based learning about the water cycle: A three-year longitudinal case study of two 3rd-grade teachers*. Paper presented at the

- 2016 annual meeting of the National Association of Research in Science Teaching (NARST), Baltimore, MD.
- Zangori, L. & Forbes, C. T. (2016, April). *Development of an empirically-based learning performances framework for 3rd-grade students' model-based explanations about plant processes*. Poster presented at the 2016 annual meeting of the National Association of Research in Science Teaching (NARST), Baltimore, MD.
- Zangori, L., Vo, T., Forbes, C.T., Schwarz, C.V. (2016, April). *Exploring links between 3rd-grade students' model-based explanations and teachers' model-based science instruction about groundwater*. Paper presented at the 2016 annual meeting of the National Association of Research in Science Teaching (NARST), Baltimore, MD.
- Biggers, M. & Forbes, C. T. (2015, April). *Curriculum planning and enactment in elementary science: Beyond fidelity of implementation*. Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST), Chicago, IL.
- Brandt, M., Keshwani, J., Forbes, C., & Luck, J. (2015, June). *Increasing production with precision agriculture*. Paper presented at the annual meeting of the National Agriculture in the Classroom (NAITC), Louisville, KY.
- Dauer, J. & Forbes, C.T. (2015, July). *A socioscientific framework for teaching a general science literacy course*. Poster presented at the annual meeting of the Society for the Advancement of Biology Education Research (SABER), Minneapolis, MN.
- Forbes, C. T., Schwarz, C. V., Zangori, L., & Vo, T. (2015, March). *Using models to support elementary students' learning about water*. Paper presented at the annual meeting of the National Science Teachers Association (NSTA), Chicago, IL.
- Forbes, C.T., Vo, T., & Bernadt, T. (2015, Sept). *Supporting students' learning about water: Model-based scientific inquiry*. Presentation at the annual meeting of the Nebraska Association of Teachers of Science (NATS), Fremont, NE.
- Forbes, C. T., Vo, T., Schwarz, C. V., & Zangori, L. (2015, April). *Exploring elementary teachers' knowledge and practices for model-based science instruction about the water cycle*. Paper presented at the annual meeting of the American Educational Research Association (AERA), Chicago, IL.
- Forbes, C. T., Zangori, L., Vo, T. & Schwarz, C. V. (2015, April). *Studying the impact of a design intervention on 3rd-grade students' model-based explanations for water systems*. Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST), Chicago, IL.
- Sabel, J., Forbes, C. T. (2015, April). *Elementary teachers' use of life science content knowledge to inform formative assessment instructional decisions*. Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST), Chicago, IL.
- Sabel, J., Forbes, C., & Dauer, J. (2015, November). *Using rubrics in undergraduate biology courses to advance understanding of complex biological concepts*. Paper presented at the annual meeting of the National Association of Biology Teachers (NABT), Providence, RI.
- Sabel, J., Forbes, C., & Dauer, J. (2015, July). *Using rubrics in undergraduate biology courses to advance understanding*. Poster presented at the annual meeting of the Society for the Advancement of Biology Education Research (SABER), Minneapolis, MN.
- Sabel, J., Forbes, C., & Zangori, L. (2015, November). *Preservice teachers' engagement with life science concepts within structured formative assessment assignments*. Paper presented at the Biology Education Research Symposium at the annual meeting of the National Association of Biology Teachers (NABT), Providence, RI.

- Sabel, J., Forbes, C. T., & Zangori, L. (2015, April). *Preservice teachers' use of content knowledge and formative assessment in a life science methods course*. Paper presented at the annual meeting of the American Educational Research Association (AERA), Chicago, IL.
- Sabel, J., Forbes, C.T., & Zangori, L. (2015, April). *Content knowledge and formative assessment integration in a life sciences methods course for preservice teachers*. Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST), Chicago, IL.
- Vo, T., Forbes, C. T., Zangori, L., & Schwarz, S. (2015, April). *Engaging students in scientific practices: The role of teachers in providing opportunities for student learning*. Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST), Chicago, IL.
- Zangori, L. & Forbes, C. T. (2015, November). *Exploring third-grade students' model-based explanations about plant processes*. Paper presented at the 2015 annual meeting of the National Association of Biology Teachers (NABT), Providence, RI
- Zangori, L. & Forbes, C. T. (2015, April). *Exploring 3rd-grade students' model-based explanations about the interactions between plant processes and the hydrosphere*. Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST), Chicago, IL.
- Zangori, L. & Forbes, C. T. (2015, April). *Exploring 3rd-grade students' model-based explanations about the interactions between plant processes and the hydrosphere*. Paper presented at the annual meeting of the American Educational Research Association (AERA), Chicago, IL.
- Zangori, L. Forbes, C., Schwarz, C. V., & Vo, T. (2015, April). *Supporting 3rd-grade students' model-based explanations about the water cycle: A quasi-experimental study of a curricular intervention*. Paper presented at the annual meeting of the American Educational Research Association (AERA), Chicago, IL.
- Sabel, J., Forbes, C. T., & Zangori, L. (2014, November). *Preservice teachers' use of content knowledge to inform formative assessment strategies in an integrated life sciences methods course*. Paper presented at the annual meeting of the National Association of Biology Teachers (NABT), Cleveland, OH.
- Vo, T., Forbes, C.T., Schwarz, C. (2014, October). *Fostering 3rd-grade students' use of scientific models with the water cycle: Teachers' conceptions and practices*. Paper presented at the annual meeting of the Geological Society of America (GSA), Vancouver, BC.
- Forbes, C.T., Schwarz, C., Zangori, L., & Vo., T. (2014, August). *Modeling Hydrologic Systems in Elementary Science (MoHSES) project*. Poster presented at the 2014 NSF DR K-12 PI Conference, Washington, DC.
- Forbes, C.T., Zangori, L., & Schwarz, C. (2014, April). *Mapping concepts to systems: Fostering 3<sup>rd</sup>-grade students' use of models to explain hydrologic phenomena*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Pittsburgh, PA.
- Forbes, C. T., Schwarz, C., & Zangori, L. (2014, April). *Development of an empirically grounded learning performances framework for 3rd-grade students' model-based explanations about water*. Paper presented at the annual meeting of the American Educational Research Association, Philadelphia, PA.
- Sabel, J., Forbes, C.T., & Biggers, M. (2014, April). *Elementary teachers' implementation of formative assessment strategies: Supporting students' learning about water and Earth materials*. Poster presented at the annual meeting of the National Association for Research in Science Teaching, Pittsburgh, PA.
- Vo, T., Forbes, C.T., Zangori, L., & Schwarz, C. (2014, April). *Elementary teachers conceptions and practices: Fostering students' use of scientific models of the water cycle*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Pittsburgh, PA.

- Zangori, L., Forbes, C. T., & Schwarz, C. (2014, March). *Elementary students' model-based explanations for botanical components of the water cycle*. Poster presented at the annual meeting of the National Association of Research Teaching, Pittsburgh, PA.
- Zangori, L., Forbes, C.T., & Schwarz, C. (2014, April). *Investigating the effect of curricular scaffolds on 3rd-grade students' model-based reasoning about the water cycle*. Poster presented at the annual meeting of the American Educational Research Association, Philadelphia, PA.
- Sabel, J., Forbes, C. T., & Zangori, L. (2013, November). *Design of an integrated teaching and learning biological sciences course for prospective elementary teachers*. Poster presented at the annual meeting of the National Association of Biology Teachers, Atlanta, GA.
- Zangori, L., Forbes, C.T., & Schwarz, C. (2013, November). *Elementary students' model-based explanations about the water cycle*. Paper presented at the annual meeting of School Science and Mathematics, San Antonio, TX.
- Forbes, C.T., Biggers, M., & Zangori, L. (2013, August). *Teachers' reasoning about students' sensemaking in elementary science learning environments*. Paper presented at the bi-annual meeting of the European Association for Research on Learning and Instruction, Munich, Germany.
- Biggers, M., Forbes, C.T., & Zangori, L. (2013, April). *Elementary teachers' ideas about, planning for, and implementation of learner-guided and teacher-guided inquiry*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Rio Grande, Puerto Rico.
- Biggers, M., Forbes, C.T., & Zangori, L. (2013, April). *Investigating variations of inquiry in elementary science classrooms: Establishing validity/reliability of a modified observation protocol*. Poster presented at the annual meeting of the National Association for Research in Science Teaching, Rio Grande, Puerto Rico.
- Forbes, C.T., Lange, K., Möller, K., Biggers, M., Laux, M., & Zangori, L. (2013, April). *A comparative study of early learners' engagement in scientific practices in the U.S. and Germany*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Rio Grande, Puerto Rico.
- Forbes, C.T., Long, K.J., Kennedy, C.A., Bancroft, J., Soldat, C., Biggers, M., & Sabel, J. (2013, April). *Supporting elementary teachers' learning to use formative assessment for science: The RAES- Iowa professional development model*. Poster presented at the annual meeting of the National Association for Research in Science Teaching, Rio Grande, Puerto Rico.
- Yarker, M.B., Stanier, C.O., Forbes, C. & Park, S. (2013, January). *Challenges teachers encounter when using models to teach weather and climate in middle school classrooms*. Paper presented at the American Meteorological Society annual meeting, Austin, TX.
- Zangori, L., Forbes, C.T., & Biggers, M. (2013, April). *Elementary students' explanation construction of seed structure and function: A concurrent mixed methods study*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Rio Grande, Puerto Rico.
- Zangori, L., Forbes, C.T., & Biggers, M. (2013, April). *Elementary teachers' use of science curriculum materials to foster explanation construction*. Poster presented at the annual meeting of the National Association for Research in Science Teaching, Rio Grande, Puerto Rico.
- Zangori, L., Forbes, C.T., & Biggers, M. (2013, April). *Elementary teachers' use of science curriculum materials to promote students' sense making: An embedded mixed methods study*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.
- Yarker, M.B., Stanier, C.O., Forbes, C.T. & Park, S. (2012, December). *Strategies for effective implementation of science models into 6-9 grade classrooms on climate, weather, and energy*

- topics*. Poster presented at the fall meeting of the American Geophysical Union, San Francisco, CA.
- Biggers, M., Forbes, C.T., & Zangori, L. (2012, April). *Elementary teachers' curriculum design and pedagogical reasoning for supporting students' comparison and evaluation of evidence-based explanations*. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, BC.
- Forbes, C.T., Biggers, M., & Zangori, L. (2012, April). *Investigating essential characteristics of scientific practices in elementary science learning environments: The Practices of Science Observation Protocol (P-SOP)*. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, BC.
- Forbes, C.T., Biggers, M., & Zangori, L. (2012, April). *Toward an empirically-based learning progression: Defining progress variables and measurable levels of elementary teachers' pedagogical content knowledge for science*. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, BC.
- Aguirre-Mendez, C., Promyod, N., Forbes, C.T., Biggers, M., & Zangori, L. (2012, March). *Characteristics of scientifically-oriented questions and the nature of inquiry in elementary classrooms: A multiple-case study*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Indianapolis, IN.
- Biggers, M. & Forbes, C.T. (2012, March). *Elementary teachers' ideas about, planning for, and implementation of learner-guided and teacher-guided inquiry*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Indianapolis, IN.
- Biggers, M., Zangori, L., & Forbes, C.T., (2012, March). *Exploring scientific explanations: Promoting students' Sense-making in elementary classrooms*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Indianapolis, IN.
- Forbes, C.T., Biggers, M., & Zangori, L. (2012, March). *Elementary teachers' enactment of science curriculum materials: Investigating early learners' engagement in scientific practices*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Indianapolis, IN.
- Pinney, B., Suh, J-K., Tseng, C-M., Forbes, C.T., Biggers, M., & Zangori, L. (2012, March). *Dichotomous inquiry practices: Characterizing teaching practice based on essential features of inquiry*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Indianapolis, IN.
- Yarker, M.B., Stanier, C.O., Forbes, C.T. & Park, S. (2012, March). *Mapping model to argument-based inquiry as an approach to support middle school teachers in teaching climate, weather, and energy topics*. Paper presented at the annual meeting of National Association for Research in Science Teaching, Indianapolis, IN.
- Zangori, L., Biggers, M., & Forbes, C.T. (2012, March). *This is inquiry...right? Five essential features to modify a science lesson*. Paper presented at the annual meeting of the National Science Teachers Association, Indianapolis, IN.
- Zangori, L. & Forbes, C.T., (2012, March). *Learning to support elementary students' scientific reasoning: Preservice elementary teachers and the evidence-explanation continuum*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Indianapolis, IN.
- Yarker, M.B., Stanier, C.O., Forbes, C.T. & Park, S. (2012, January). *Preparing middle school teachers to effectively use science models to support learning about climate, weather, and energy topics*. Poster presented at the annual meeting of the American Meteorological Society, New Orleans, LA.

- Yarker, M.B., Stanier, C.O., Forbes, C.T. & Park, S. (2011, December). *Utilizing an approach to model-based inquiry for a professional development on climate weather and energy topics for Iowa middle school teachers*. Poster presented at the annual conference of the Iowa Educational Research & Evaluation Association, Ames, IA.
- Forbes, C.T. (2011, September). *Elementary teachers' curriculum design and pedagogical design capacity for reform-based science: Research across the teacher professional continuum*. Paper presented at the bi-annual meeting of the European Science Education Research Association, Lyon, France.
- Forbes, C.T., Biggers, M., & Zangori, L. (2011, September). *Promoting and investigating elementary teachers' PCK for inquiry-based science*. Paper presented at the bi-annual meeting of the European Science Education Research Association, Lyon, France.
- Forbes, C.T. (2011, April). *The influence of curriculum-independent factors on preservice elementary teachers' adaptation of science curriculum materials*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Orlando, FL.
- Biggers, M. & Forbes, C.T. (2011, April). *Preservice elementary teachers' learning about the five essential features of classroom inquiry*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Orlando, FL.
- Forbes, C.T., Biggers, M., & Zangori, L. (2011, April). *Supporting elementary teachers' evaluation and adaptation of science curriculum materials: The PIESC3 professional development model*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Orlando, FL.
- Yarker, M. & Forbes, C.T. (2011, January). *Rethinking model-based inquiry in terms of weather and climate computer models*. Paper presented at the annual meeting of the American Meteorological Society, Seattle, WA.
- Biggers, M. & Forbes, C.T. (2011, January). *Preservice elementary teachers' learning about essential features of inquiry-based teaching and learning*. Paper presented at the annual meeting of the Association for Science Teacher Education, Minneapolis, MN.
- Forbes, C.T., Biggers, M., & Zangori, L. (2011, January). *Promoting inquiry-based elementary science through collaborative curriculum co-construction: The PIESC3 Project*. Paper presented at the annual meeting of the Association for Science Teacher Education, Minneapolis, MN.
- Forbes, C.T., Gasaway, K., Biggers, M., & Zangori, L. (2010, August). *Promoting inquiry-based elementary science through collaborative curriculum co-construction*. Poster presented at the 2nd annual Iowa Science and Mathematics Teacher Educators Summit, Grinnell, IA.
- Forbes, C.T. (2010, March). *Preservice elementary teachers' adaptation of science curriculum materials for inquiry*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Philadelphia, PA.
- Forbes, C.T., Madeira, C.A., Davis, E.A., & Slotta, J.D. (2009, April). *Activity-theoretical research on science teachers' learning: Challenges and opportunities*. Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.
- Forbes, C.T. & Davis, E.A. (2009, April). *Preservice elementary teachers' curriculum design and development of pedagogical design capacity for inquiry: An activity-theoretical perspective*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Garden Grove, CA.
- Forbes, C.T. & Zint, M. (2009, April). *Elementary teachers' beliefs about, perceived capacities for, and reported use of scientific inquiry to promote student learning about and for the environment*. Poster presented at the annual meeting of the National Association for Research in Science Teaching, Garden Grove, CA.

- Forbes, C.T. & Davis, E.A. (2009 January). *Preservice elementary teachers' use of science curriculum materials: Initial attempts at curriculum design for inquiry-oriented science teaching*. Paper presented at the annual meeting of the Association for Science Teacher Education, Hartford, CT.
- Forbes, C.T. & Davis, E.A. (2008, March). *Beginning elementary teachers' learning to use questions and questioning in inquiry-oriented science teaching: A longitudinal study*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Baltimore, MD.
- Forbes, C.T. & Davis, E.A. (2008, January). *Preservice elementary teachers' curricular role identity for science teaching: A multi-year study*. Poster presented at the annual meeting of the Association for Science Teacher Education, St. Louis, MO.
- Forbes, C.T. & Davis, E.A. (2007, April). *Beginning elementary teachers' learning through the use of science curriculum materials: A longitudinal study*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, New Orleans, LA.
- Davis, E.A., Beyer, C., Forbes, C.T., Stevens, S. (2007, April). *Promoting pedagogical design capacity through teachers' narratives*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, New Orleans, LA.
- Forbes, C.T. & Davis, E.A. (2007, January). *Exploring preservice elementary teachers' role identity development in respect to the use of science curriculum materials*. Paper presented at the annual meeting of the Association for Science Teacher Education, Clearwater Beach, FL.
- Forbes, C. T. & Davis, E.A. (2006, June). *Mapping the teacher professional continuum through the use of science curriculum materials: Novice elementary teachers' curriculum-specific learning and role identity development*. Poster presented at the 4th Annual CCMS Knowledge Sharing Institute, Ann Arbor, MI.
- Forbes, C.T. & Davis, E.A. (2006, January). *Exploring preservice elementary teachers' critique and adaptation of science curriculum materials in respect to socioscientific issues*. Paper presented at the annual meeting of the Association for Science Teacher Education, Portland, OR.
- Forbes, C.T. (2004, March). *Peer mentoring: Shared experiences help new teachers succeed*. Paper presented at the STEMTEC Teacher Preparation PI Conference, Washington, DC.
- Forbes, C.T., Heppert, J.A., & Webber, G.K. (2002, March). *Informal learning environments as resources for supporting early career teachers in inquiry-based instruction*. Paper presented at the STEMTEC Pathways to Change Conference, Washington, DC.

## POST-SECONDARY TEACHING EXPERIENCE

SCIL 800 Experiential Learning in Food, Energy, & Water Systems II (Grad, UNL)	Summer, 2018
SCIL/AECN/ENVR/GEOG/NRES 109 Water in Society (Undergrad, UNL)	Spring, 2017, 2018
NRES 898 Teaching and Learning about Water Systems (Grad, UNL)	Summer, 2015, 2017
SCIL 101 Science and Decision-Making for a Complex World (Undergrad, UNL)	Fall, 2014, 2016
07E:158 Teaching and Learning in the Biological Sciences (Undergrad, U. of Iowa)	Fall, 2013
07S:273 Introductory Mixed Methods Data Analysis with Atlas.Ti	Fall, 2013 (proposed)
SU/WP Inquiry Learning and Teaching in Elementary Science Classrooms in the United States (Undergrad, U. of Augsburg, Germany)	Summer, 2013
MoHSES Teacher Professional Development Workshop (Grad, U. of Iowa)	Summer, 2013
07E:340 Advanced Topics in Teaching and Learning (RAES-Iowa Teacher Professional Development Workshop, Grad, U. of Iowa)	2012-2014
07S:355/356 Research Apprenticeship in Science Education (Grad, U. of Iowa)	Spring, 2011, 2013
07S:255 Inquiry in Science Learning Environments (Grad, U. of Iowa)	Fall, 2010, 2012



## Cory T. Forbes

Associate Professor of Science Education | Coordinator, Science Literacy Initiative | Director, NE Collaborative for Food, Energy, & Water Education

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07S:254 Theory and Research on Curriculum Materials for Science (Grad, U. of Iowa)	Spring, 2012
PIESC <sup>3</sup> Teacher Professional Development Workshop (Grad, U. of Iowa)	Summer, 2011-2012
07E:162 Methods: Elementary School Science (Undergrad, U. of Iowa)	2010-2014
07E/S:350 Seminar Science Education (Grad, U. of Iowa)	Spring, 2010
07S:151 Science Teaching & Practicum with Early Learners (Undergrad, U. of Iowa)	Fall 2009, 2011
EDUC 421, Teaching of Science in Elementary School (Undergrad, U. Michigan)	2004-2007
KCETP Microbiology Teacher Professional Development Workshops (Grad, U. Kansas)	2001, 2002
Physics 116 Laboratory (Undergrad, U. Kansas)	Fall, 2001
Biology 102 Laboratory (Undergrad, U. Kansas)	1998-1999

## HONORS, AWARDS, AND RECOGNITION

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Fulbright Core Fulbright U.S. Scholar	2018-2019
SENCER Leadership Fellow, National Center for Science & Civic Engagement	2017
NARST Early Career Research Award	2014
Nominee, NABT Four-Year College and University Section Research in Biology Education Award	2016
Nominee, 2015 AERA Div. C Early Career Award	2014
NARST/NSTA "Research worth Reading" recognition for paper entitled 'Fostering student sense-making in elementary science learning environments: Elementary teachers' use of science curriculum materials to promote explanation-construction (Zangori, Forbes, & Biggers, 2013)	2014
Nominee, NARST Outstanding Paper Award	2013
Summer Research Fellowship, University of Iowa International Programs	2012
Old Gold Summer Fellowship, University of Iowa	2010
Nominee, Dimond Outstanding Dissertation Award University of Michigan School of Education	2010
Rackham Predoctoral Fellowship Awardee University-wide fellowship that provides one year of support to advanced doctoral candidates currently working on dissertation research. Students are nominated by their departments and approximately 72 fellowships are awarded out of 250 nominees each year.	2008-2009

## ADVISEES AND GRADUATE STUDENT COMMITTEES

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### *Postdoctoral Researchers*

1. Devarati Bhattacharya – Ph.D., Science Education, University of Minnesota (2015)
2. Dante Cisterna – Ph.D., Science Education, Michigan State University (2015)
3. Ranu Roy – Ph.D., Science Education, Indiana University (2018)

### *Current and Past Graduate Advisees*

1. Diane Lally – Ph.D., School of Natural Resources, University of Nebraska-Lincoln
2. Tyler Wolken – M.A.S., University of Nebraska-Lincoln
3. Amie Sommers - Ph.D., School of Natural Resources, University of Nebraska-Lincoln
4. Kim Carroll-Steward – Ph.D., School of Natural Resources, University of Nebraska-Lincoln

5. Tina Vo – Ph.D., Teaching, Learning, and Teacher Education – 2018 – Assistant Professor of Science Education, University of Nevada-Las Vegas \*participant, 2017 Sandra K. Abell Institute for Doctoral Students
6. Kari Nelson – Ph.D., Teaching, Learning, and Teacher Education – 2018 - University of Nebraska Medical Center
7. Destini Petitt – M.S., School of Natural Resources – 2018
8. Ashley (McKinzie) Peterson – M.S., Natural Resource Sciences (Science Literacy) – 2017
9. Jaime Sabel, Ph.D., Science Education – 2016 – Assistant Professor of Biology Education, University of Memphis
10. Molly Brandt, M.A.S. - 2016 – Undergraduate Advisor, College of Agricultural Sciences and Natural Resources (CASNR), University of Nebraska-Lincoln
11. John Brummer, M.A.S. – 2016 – Secondary science teacher, NE
12. Laura Zangori, Ph.D. Science Education - 2015 – Assistant Professor of Science Education, University of Missouri-Columbia \*participant, 2013 Sandra K. Abell Institute for Doctoral Students
13. Mandy Biggers, Ph.D. Science Education- 2013 – Assistant Professor of Science Education, Texas Women’s University \*participant, 2011 Sandra K. Abell Institute for Doctoral Students
14. Dave Pierson, M.S. Science Education – 2013 – Secondary science teacher, Mediapolis School District, Iowa

#### *Doctoral Committees*

1. Diane Lally (current, Chair) - UNL Science Education Ph.D. Student
2. Amie Sommers (current, Co-Chair) - UNL Science Education Ph.D. Student
3. Kim Carroll-Steward (current, Chair) – UNL Science Education Ph.D. Student
4. Theresa Haack (current, member) – UNL Ed.D. Student
5. Jennifer Davis (current, member) – UNL Ed.D. Student
6. Tina Vo (2018, Chair). *Using Scientific Models to Support Elementary Science Teaching & Learning about Water.*
7. Kari Nelson (2018, Co-Chair). *The Impact of Mentoring on Undergraduate STEM Mentors.*
8. Jaime Sabel, Ph.D. (2016, Chair). *Use of Scaffolds to Support Undergraduate Students in Learning and Understanding Biological Concepts.*
9. Zangori, Laura, Ph.D. (2015, Chair). *Exploring 3rd-Grade Students’ Model-Based Reasoning about Plant Growth and Development*
10. ChingMei Tseng, Ph.D. (2014, Member). *The Effect of the Science Writing Heuristic Approach Reflected in Students’ Critical Thinking Skills*
11. Mandy Biggers, Ph.D. (2013, Chair). *Elementary Teachers’ Ideas about, Planning for, and Implementation of Learner-directed and Teacher-directed Inquiry*
12. Morgan Yarker, Ph.D. (2013, Co-Chair). *Mapping Argument-Based Inquiry to Model-Based Inquiry Approaches: Teachers’ Use of Science Models in Middle-School Classrooms about Climate, Weather, and Energy Concepts*
13. Nattida Promyod, Ph.D. (2013, Member). *Investigating the Shifts in Thai Teachers’ Views of Learning and Pedagogical Practices while Adopting an Argument-based Inquiry Approach*
14. Saeyeol Yoon, Ph.D. (2012, Member). *Dual Processing and Discourse Space: Exploring Fifth Grade Students’ Language, Reasoning, and Understanding through Writing*
15. Matt Benus, Ph.D. (2011, Member). *The Teacher’s Role in the Establishment and Refinement of Dialogue Over Time in Classrooms using Science Argumentation*

16. Juan Diaz, Jr., Ph.D. (2011, Member). *Examining Student-generated Questions in an Elementary Science Classroom*
17. Ying-Chih Chen, Ph.D. (2011, Member). *Examining the Integration of Talk and Writing for Student Knowledge Construction through Argumentation*
18. William Bennet, Ph.D. (2011, Member). *Multimodel Representation Contributes to the Complex Development of Science Literacy in a College Biology Class*
19. Jeong Yoon Jang, Ph.D. (2011, Member). *The Effect of Using a Structured Reading Framework on Middle School Students' Conceptual Understanding Within The Science Writing Heuristic Approach*

#### *Masters Thesis Committees*

1. Tyler Wolken, M.A.S. (current, Co-Chair) - UNL Masters of Applied Science
2. Megan Cramer, M.A.S. (current, Member) - UNL Masters of Applied Science
3. Destini Petitt, M.S. Natural Resource Sciences (2018, Chair). *A Comparative Study of the Role of Value in Reasoning about Socio-Hydrological Issues in Undergraduate Students from Developed and Developing Countries.*
4. Ashley (McKinzie) Peterson, M.S. Natural Resource Sciences (2017, Co-Chair). *Problematizing Socio-Scientific Issues: An Approach to Understanding Student Decision-Making Using Construal Level Theory*
5. Ashley Alred, M.S. Natural Resource Sciences (2016, Member). *Undergraduates' Learning and Reasoning about Agricultural and Natural Resources Socioscientific Issues*
6. Molly Brandt, M.A.S. (2016, Chair). *Elementary Students' Knowledge about STEM Dimensions of Agriculture*
7. David Pierson, M.S. Science Education (2013, Chair). *Elementary Teachers' Assessment Actions and Elementary Science Education: Formative Assessment Enactment in Elementary Science*

#### *Visiting Students*

1. Florian Böschl (Ph.D. student, University of Leipzig, Germany; Summer, 2018)
2. Mira Laux (Ph.D. student, University of Münster, Germany; Summer 2012)

## **SERVICE AND PROFESSIONAL ACTIVITIES**

### *Program, Department, College, and University*

Graduate Committee, CASNR Master of Applied Science Program	2015-Present
Organizing Committee, UNL STEM Education Research Retreat	2015-Present
CIRTL@Nebraska Steering Committee (Center for the Integration of Research, Teaching, and Learning) <a href="http://www.cirtl.net/">http://www.cirtl.net/</a>	2016-Present
UNL Research Council/Grant Proposal Reviewer (ORED)	2015-2018
<ul style="list-style-type: none"> <li>• Interdisciplinary Research Grants</li> <li>• Hatch Multistate Funding Program</li> <li>• UNL STEM Education Seed Grants</li> </ul>	
Vice Chair & committee member, Graduate Committee, School of Natural Resources	2015-2018
Undergraduate Committee, School of Natural Resources	2015-2016
Chair, K-12 Curriculum Development Specialist Search Committee	2015
Co-Chair, STEM Education Professor of Practice Search Committee	2016
Organizer and Facilitator, <i>Grading Homework, Exams, Lab Reports or Problem Sets</i> workshop, UNL Campus-wide Workshops for Graduate Teaching Assistants	2014-2017
Panelist, UNL Research Development Fellows Program (RDFFP), Office of Research	2017

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and Economic Development	
Session organizer/facilitator, Preparing Future Faculty (PFF) Program	2017
Science and Ag Literacy Extension Educator Search Committee, UNL Extension	2014
Prairie Corridor on Haines Branch Committee	2014-2015
Organizer, Graduate Student Research Symposium (UI College of Education)	2010-2013
UI COE Elementary Science Coordinator – Elementary Teacher Education Program Committee	2009-2013
UI COE Faculty Search Committee, Tenure-track Assistant Professor Position, Science Education	2010-2011
UI COE Faculty Search Committee, Department of Psychological and Quantitative Foundations	2011
UI COE Ad-Hoc Committee to develop online Elementary Education M.A. program	2009
UI Review Committee, 2013 UI International Programs Summer Research Fellowship	2012
Organizer and Facilitator, RefWorks workshop, UI COE faculty and graduate students	2010, May
Organizer and Facilitator, Atlas.Ti workshop, UI COE faculty and graduate students	2010, May
<i>State, National, and International</i>	
Grant Proposal Reviewer, National Science Foundation	2010-present
<ul style="list-style-type: none"> <li>• Division of Research on Learning (DRL) - Discovery-Research K-12, Math-Science Partnership/STEM + Computing Partnerships, CAREER, REESE, EHR Core Research</li> <li>• Division of Undergraduate Education (DUE) - Improving Undergraduate STEM Education: Pathways into Geoscience (IUSE: GEOPATHS)</li> </ul>	
Grant Proposal Reviewer, USDA-NIFA, Professional Development Delivery Model for Department of Defense Education Activity Leadership Department of Defense Schools	2016
Grant Proposal Reviewer, Nebraska Coordinating Commission for Postsecondary Education (CCPE), Title IIA Teacher Quality grants program	2015
Editorial Board member, <i>Journal of Research in Science Teaching</i> (JRST)	2012-2015
Co-Chair, National Association for Research in Science Teaching Outstanding Doctoral Research Award Selection Committee	2015-2018
National Association for Research in Science Teaching JRST Award Committee	2012-2013
Association for Science Teacher Education Oversight Committee	2008
Reviewer, ESERA Summer School	2017, 2018
Senior Reviewer, International Conference of the Learning Sciences	2014
Reviewer, International Conference of the National Association for Research in Science Teaching (NARST)	2007-present
Reviewer, International Conference of the Association for Science Teacher Education	2009
Ad-hoc Journal Reviewer	2008-present
<i>American Biology Teacher, Curriculum Inquiry, Educational Researcher, Elementary School Journal, International Journal of Science Education, Journal of Educational Psychology, Journal of Environmental Education, Journal of Teacher Education, Science Education, Teaching and Teacher Education</i>	
NARST Conference New Member Mentor	2015-2017
Reviewer, Intel Science Talent Search (Intel STS), Society for Science & the Public	2014
Reviewer, ESERA Summer School for Doctoral Students	2017
Invited Participant, STEM Strategy Meeting, Nebraska Dept. of Education	2015

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Earth Educators Rendezvous (EER) 2018 Conference Planning Committee 2017-2018

*State and Community Outreach*

STEM Nova/Supernova award mentor, Scouts BSA 2015-present

Participant, *STEMming into the Future* K-12 outreach event 2015-2016

Volunteer, UNL School of Natural Resources annual *NaturePalooza* outreach event 2014, 2015

Professional Development, NE Educational Service Units, Science Cadre meetings 2014-present

*Consulting*

External evaluator, Nutrients for Life K-12 STEM curriculum 2015-2016

Curriculum materials reviewer, Learning Design Group, Lawrence Hall of Science 2015

Science4Us, advisory board member and curriculum materials reviewer 2011-2014

P-SOP Training, NSF MSP evaluation team, Auburn University 2012, Nov

P-SOP Training, Workgroup Möller, PLUS Project, University of Münster, Germany 2012, January

Teacher mentor and supervisor, Real World Externships for STEM Teachers 2011-2012

program, Iowa Math and Science Education Partnership

Curriculum materials reviewer, Biological Science Curriculum Study (BSCS) 2011, 2008

Implementation team for field trials of ISIOP observation protocol 2010

Education Development Center (EDC)

Book Reviewer, NSTA 2015-2016

*Memberships*

American Educational Research Association (AERA)

European Science Education Research Association (ESERA)

International Society of the Learning Sciences (ISLS)

National Association of Biology Teachers (NABT)

National Association of Geoscience Teachers (NAGT)

National Association for Research in Science Teaching (NARST)

National Science Teachers Association (NSTA)

Nebraska Association of Teachers of Science (NATS)