

# Catherine E. Cullicott

Mary Lou Fulton Teachers College  
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(970) 946-2951  
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## ACADEMIC DEGREES

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- Ph.D., Learning, Literacies and Technologies Expected Summer 2024  
*Arizona State University, Tempe, Arizona*  
Dissertation: Elementary and Middle School Teachers' Pedagogical Content Knowledge for Teaching Natural Hazards Using a Place-Based Approach  
Dissertation Committee: Dr. James Middleton – Chair; Dr. Michelene Chi, Dr. Steven Semken, Dr. Amanda Jansen (External Committee Member, University of Delaware)
- M.S., Geological Sciences 1996  
*University of Washington, Seattle, Washington*  
Thesis: Petrology and Stratigraphy of the Upper Banded Series, Stillwater Complex, Montana  
Advisors: Dr. Ian S. McCallum, Dr. George W. Bergantz
- A.B., *Cum Laude*, Geological and Geophysical Sciences 1989  
*Princeton University, Princeton, New Jersey*  
Thesis: Origins of Organic Matter in Devonian Guilmette Limestone, Nye County, Nevada  
Advisors: Dr. Kenneth S. Deffeyes, Dr. Robert B. Hargraves, Dr. William E. Bonini

## ADDITIONAL EDUCATION

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- Teaching Licensure Coursework and Continuing Education 2000-2014  
*Adams State University, Alamosa, Colorado; Colorado School of Mines, Golden, Colorado; Fort Lewis College, Durango, Colorado; University of Phoenix, Phoenix, Arizona*  
Licensed teacher in Arizona, Colorado, New Mexico, 2002-2020. Endorsed in Science (6-12), Mathematics (6-12), and English as a Second Language (Arizona, K-12)/ Linguistically Diverse Education (Colorado K-12)/ TESOL (New Mexico, 7-12). Coursework included: Spanish Immersion and ESL coursework in Sonora, Mexico; Cultural and Scientific Bioregional Studies; Literacy Design Collaborative; Common Core State Standards; Individual Instruction in a Pluralistic Society.

## PROFESSIONAL EXPERIENCE

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- Research Assistant**, Mary Lou Fulton Teachers College, Arizona State University, Tempe, AZ 2017-Present
- *Arizona Community Educator Initiative*, Supervisor Dr. Steven Zuiker
  - *SMiLES Project*, Supervisor Dr. James Middleton
  - *ICAP Project* and *PAIR-C Project*, Supervisor Dr. Michelene Chi
  - *Physics Teacher Pedagogical Content Knowledge Project* and *Uncertainty Management Project*, Supervisor Dr. Ying-Chih Chen
- Faculty Associate / Instructor of Record**, Mary Lou Fulton Teachers College, Arizona State University, Tempe, AZ 2020-2023
- *Science Teaching Methods for Elementary School* (EED 529), Developed “refreshed” curriculum in coordination with graduate program strategists and instructional designer. Summer-Fall 2023
  - *Science in Elementary Schools* (EED 411), Taught Fall 2021

- *Investigating Space: Geometry, Measurement, and Visualization* (MTE 281), Taught Summer 2021 and Fall 2021
  - *Investigating Change: Patterns, Functions, and Modeling* (MTE 301), Taught Fall 2020
- Science Teacher**, McClintock High School, Tempe, AZ 2016-2017
- Science and Mathematics High School Teacher/Tutor**, Southern Ute Indian Tribe Education Department, Ignacio, CO 2015-2016
- Distance Education Coordinator for Higher Education**, Southern Ute Indian Tribe Education Department, Ignacio, CO 2015
- Science and Mathematics Teacher**, Rite of Passage/Robert E. DeNier Youth Services Center [Secure Juvenile Correctional Facility], Durango, CO 2014
- Mathematics Teacher**, 7<sup>th</sup> and 8<sup>th</sup> Grades, Dolores Middle School, Dolores, CO 2013-2014
- Science and Mathematics Teacher**, Career Prep High School, Shiprock, NM, in the Navajo Nation 2012-2013
- Science Teacher**, Dulce High School, Dulce, NM, in the Jicarilla Apache Nation 2010-2012
- Science and Mathematics Teacher**, Animas High School, Durango, CO 2009-2010
- Science, Mathematics, and Outdoor Education Teacher**, Sandia Preparatory School, Albuquerque, NM 2007-2009
- Geologist and Researcher**, Ecos Consulting, Durango, CO 1999-2007
- Geologist**, Energy Metals Corporation, Durango, CO 2006-2007
- Science Teacher**, Upward Bound Summer Academy, Fort Lewis College, Durango, CO 2006
- Science and Electives Teacher**, Mancos Middle School, Mancos, CO 2002-2006
- Science and Mathematics Student Teacher**, Partnership Program, Teacher Education Department, Fort Lewis College, Durango, CO 2001-2002
- Geologist/Hydrogeologist**, Envirotech, Inc., Farmington, NM 2000-2001
- Environmental Geologist**, Plateau Environmental Services, Durango, CO 1998-1999
- Associate Faculty**, Geology and Mathematics, Coconino Community College, Flagstaff, AZ 1995-1998
- *Physical Geology* (4-credit lab science course, taught four semesters)
  - *Geology of the Grand Canyon* (Self-developed, 2-credit elective course, taught three semesters)
  - *Geology of Northern Arizona* (Self-developed 2-credit elective course, taught three semesters)
  - *Intermediate Algebra* (taught one semester)
  - *Beginning Algebra* (taught one semester)
- Program Coordinator**, Institute for Tribal Environmental Professionals, Northern Arizona University, Flagstaff, AZ 1998
- Instructional Specialist**, Educational Systems Programming, Northern Arizona University, Flagstaff, AZ 1996-1997
- Public Education Program Staff**, Lowell Observatory, Flagstaff, AZ 1996

<b>Associate Faculty</b> , <i>Physical Geology</i> , Edmonds Community College, Lynnwood, WA (5-credit lab science course, taught six quarters)	1993-1995
<b>Graduate Teaching Assistant</b> , upper and lower division laboratory sections, Department of Geological Sciences, University of Washington, Seattle, WA	1991-1995
<ul style="list-style-type: none"> <li>• <i>Physical Geology</i> (100 level)</li> <li>• <i>Petrology</i> (300 level)</li> <li>• <i>Geochemistry</i> (400 level)</li> </ul>	
<b>Exploration Geologist</b> , Aurtex, Inc., Ketchum, ID, Dillon, MT, Ely, NV, Beaver, UT	1988-1994

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## SCHOLARSHIP

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### Publications

- Jansen, A., Curtis, K, Mirzaei, A. M., **Cullicott, C. E.**, Smith, E. P., & Middleton, J. A. (2023). Secondary mathematics teachers' descriptions of student engagement. *Educational Studies in Mathematics*, 113(3), 425–442.
- Riske, A. K., **Cullicott, C. E.**, Mirzaei, A. M., Jansen, A., & Middleton, J. (2021). Student engagement with the “Into Math Graph” tool. *Mathematics Teacher: Learning and Teaching PK-12*, 114(9), 677–684.
- Headrick, L., Wiesel, A., Tarr, G., Zhang, X., **Cullicott, C.**, Middleton, J. A., & Jansen, A. (2020). Engagement and affect patterns in high school mathematics classrooms that exhibit spontaneous problem posing: An exploratory framework and study. *Educational Studies in Mathematics*, 105(3), 435-456.
- Cullicott, C. E.** (2008). Quick and dirty rock identification – Colorado Plateau rocks. *Lessons from the Bioregion, Newsletter of the Bioregional Outdoor Education Project*. Insert, 6p.
- Cullicott, C. E.** (2006). Edible landfill at Mancos Middle School. *Lessons from the Bioregion, Newsletter of the Bioregional Outdoor Education Project* (7)3, explanation p. 11, lesson plan on insert.
- Gonzales, D., Stahr, D., Frechette, J., Dorin, F., Costello, K., **Cullicott, C.**, Kolody, R., Remley, K., & Graham, K. (2004). *Geologic map of Electra Lake 7.5-Minute Quadrangle, La Plata County, Colorado*. Colorado Geological Survey Publication #OF03-21.
- Cullicott, C. E.** (2002). Overview of CBM issues in the San Juan Basin. In *Coalbed Methane Development in the Intermountain West*, Natural Resources Law Center, University of Colorado School of Law, p. 217-219.
- Cullicott, C. E.**, Dunmire, C., Brown, J., & Calwell, C. J. (2002). Case study: Coalbed methane in the San Juan Basin of Colorado and New Mexico. In *Coalbed Methane Development in the Intermountain West*, Natural Resources Law Center, University of Colorado School of Law, p. 51-85.
- Cullicott, C. E.**, Dunmire, C., & Calwell, C. J. (2002). *The HD Mountains of southwest Colorado: Impacts of proposed coal-bed methane development and promising alternatives*. Durango, Colorado: Ecos Consulting report for The Center for the Wild West, Boulder, CO.
- Koomey, J., Calwell, C. J., Laitner, S., Thorson, J., Brown, R. E., Eto, J., Webber, C., & **Cullicott, C.** (2002). Sorry, wrong number: The use and misuse of numerical facts in analysis and media reporting of energy issues. *Annual Review of Energy and the Environment* (27), 119-158.
- Calwell, C. J., & **Cullicott, C.** (2001). *Oil from the Arctic National Wildlife Refuge: Too little, too late*. Natural Resources Defense Council publication, 8p.

**Cullicott, C. E., & Tarrant, C. A.** (1997). Something to celebrate: Women in geoscience make progress. *Geotimes*, (44)12, 3.

**Cullicott, C. E.** (1996). *Petrology and Stratigraphy of the Upper Banded Series, Stillwater Complex, Montana*. Unpublished Master's Thesis, University of Washington, Seattle, Washington. 176p.

Hargraves, R. B., **Cullicott, C. E.**, Deffeyes, K. S., Hougén, S., Christiansen, P. P., & Fiske, P. S. (1990). Shattercones and shocked rocks in Southwestern Montana: The Beaverhead Impact Structure. *Geology* (18), 832 - 834.

### Conference Proceedings

**Cullicott, C.**, Semken, S., Chi, M. T. H., & Boucher, N. (2021). Enhancing active learning in a place-based geoscience course using the ICAP Theory of Cognitive Engagement. *Geological Society of America Abstracts with Programs* 53(6).

**Cullicott, C.**, Semken, S., Chi, M., & Boucher, N. (2020). "Compel them to engage with the content:" Upgrading an undergraduate geology course using ICAP. In Gresalfi, M. & Horn, I. S. (Eds.), *The Interdisciplinarity of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020, Volume 4* (pp. 2361-2362). Nashville, Tennessee: International Society of the Learning Sciences.

Ha, J., Su, M., Chi, M., & **Cullicott, C.** (2020). Misunderstandings of teachers applying ICAP Theory into practice. In Gresalfi, M. & Horn, I. S. (Eds.), *The Interdisciplinarity of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020, Volume 4* (pp. 2407–2408). International Society of the Learning Sciences.

Jansen, A., Curtis, K., Mohammad Mirzaei, A., **Cullicott, C.**, Smith, S., & Middleton, J. (2020). High school mathematics teachers' orientations toward engagement. In: Sacristán, A.I., Cortés-Zavala, J.C. & Ruiz-Arias, P.M. (Eds.). (2020). *Mathematics Education Across Cultures: Proceedings of the 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1984-1992). Mexico. Cinvestav/AMIUTEM/PME-NA.

Jansen, A., Middleton, J., Wiezel, A., **Cullicott, C.**, Zhang, X., Tarr, G., & Curtis, K. (2019). Secondary mathematics teachers' efforts to engage students through academic and social support. In Otten, S., Candela, A. G., de Araujo, Z., Haines, C., & Munter, C. (Eds.). *Proceedings of the Forty-First Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1434-1443). St Louis, MO: University of Missouri.

**Cullicott, C. E.**, & Chen, Y.-C. (2018). Uncertainty management in science argumentation. In J. Kay & R. Luckin (Eds.), *Rethinking Learning in the Digital Age: Making the Learning Sciences Count: 13th International Conference of the Learning Sciences (ICLS) 2018, Volume 3*, (pp. 1479-1480). London, United Kingdom: International Society of the Learning Sciences.

**Cullicott, C. E.** (1996). Magma chamber dimensions during crystallization of Gabbro-norite Zone III, Upper Banded Series, Stillwater Complex, Montana. *Geological Society of America Abstracts with Programs* (28)7, p. A-289.

### Invited Presentations

**Cullicott, C.**, Semken, S., Chi, M. T. H., & Boucher, N. (2022, February 25). *Enhancing active learning in a place-based geoscience course using the ICAP Theory of Cognitive Engagement* [Poster presentation]. Teachers College Doctoral Council 8<sup>th</sup> Annual Education Research Conference, Tempe, AZ, United States.

Middleton, J., Riske, A., **Cullicott, C.**, Headrick, L., Smith, E., Mohammad Mirzaei, A., & Jansen, M. (2021, April 28-May 1). *Supporting students' engagement with mathematics: Strategies for improving motivation* [Paper presentation]. National Council for Teachers of Mathematics, 2021 Annual Meeting.

**Cullicott, C. E.** (2011, March). *Quick and dirty rock identification – Colorado Plateau rocks* [Paper presentation]. Bioregional Outdoor Education Project (Now PLATEAU) Annual conference, Monticello, UT, United States.

### **Presentations**

**Cullicott, C.**, Semken, S., Chi, M. T. H., & Boucher, N. (2023, February 17). *Enhancing active learning in a place-based geoscience course using the ICAP Theory of Cognitive Engagement* [Paper presentation]. Current Student Research Presentations, Mary Lou Fulton Teachers College prospective student campus visits, Tempe, AZ, United States.

**Cullicott, C.** (2022, April 15). *Using the ICAP Theory of Cognitive Engagement to plan/enhance active learning* [Paper presentation]. Graduate Educators Symposium, Arizona State University, Tempe, AZ, United States.

**Cullicott, C.**, Semken, S., Chi, M. T. H., & Boucher, N. (2022, February 18). *Enhancing active learning in a place-based geoscience course using the ICAP Theory of Cognitive Engagement* [Paper presentation]. Current Student Research Presentations, Mary Lou Fulton Teachers College prospective student campus visits, Tempe, AZ, United States.

**Cullicott, C. E.**, Semken, S., Chi, M., & Boucher, N. (2020, December 1-17). *Aligning place-based geoscience teaching with the ICAP framework of cognitive engagement for enhanced active learning* [Paper presentation]. American Geophysical Union Fall Meeting, San Francisco, CA, United States.

**Cullicott, C.**, & Semken, S. (2020, July 13-17). *Applying the ICAP theory of cognitive engagement to active geoscience learning* [Workshop]. Earth Educators Rendezvous, Stanford, CA, United States.

Jansen, A., Curtis, K., Mohammad Mirzaei, A., **Cullicott, C.**, Smith, E., & Middleton, J. (2020, April). *High school mathematics teachers' orientations toward engagement*. Research conference for the National Council of Teachers of Mathematics. (Conference canceled).

**Cullicott, C. E.** (2020, March 15-19). *"We do it through direct instruction:" Science teachers reflect on learning inquiry teaching* [Poster presentation]. 2020 NARST Graduate Student Research Symposium, National Association for Research in Science Teaching Annual International Conference, Portland, OR, United States. (Conference canceled).

**Cullicott, C. E.** (2020, February 28). *"We do it through direct instruction:" Science teachers reflect on learning inquiry teaching* [Poster presentation]. Teachers College Doctoral Council 6<sup>th</sup> Annual Education Research Conference, Tempe, AZ, United States.

**Cullicott, C.**, Semken, S., Chi, M., & Boucher, N. (2020, February 28). *"Compel them to engage with the content:" Upgrading an undergraduate geology course using ICAP* [Poster presentation]. Teachers College Doctoral Council 6<sup>th</sup> Annual Education Research Conference, Tempe, AZ, United States.

**Cullicott, C. E.**, Curtis, K. C., Rodriguez, E. A., Jansen, A., James A. Middleton, J. A., & Koshy, J. (2019, April 5-9). *"They have a lot of potential": High school mathematics teachers' perspectives on difficult students* [Paper presentation]. American Education Research Association Annual Conference, Session # 18.033, Toronto, Canada.

**Cullicott, C. E.**, & Chen, Y-C. (2019, March 31-April 3). *"I don't understand:" Uncertainty management during whole-class argumentation in a 5th grade science classroom* [Poster presentation]. 2019 NARST Graduate Student Research Symposium, National Association for Research in Science Teaching Annual International Conference, Baltimore, MD.

**Cullicott, C.** (2019, March 26), *PAIC: A framework for helping students understand patterns and processes*, [Paper presentation]. InSciEd Out (interdisciplinary science education research group), Arizona State University, Tempe, AZ, United States.

**Cullicott, C.**, (2019, February 1) *High school math teachers' thinking about difficult students* [Paper presentation]. Teachers College Doctoral Council 5<sup>th</sup> Annual Education Research Conference, Tempe, AZ, United States.

Chen, Y-C., **Cullicott, C.**, Techawitthaychinda, R., & Terada, T. (2019, February 1) *Productive management of uncertainty: Supporting science teachers to raise, maintain, and reduce uncertainty toward student conceptual development in argumentation*. [Poster presentation]. Faculty Poster Session at Teachers College Doctoral Council 5<sup>th</sup> Annual Education Research Conference, Tempe, AZ, United States.

**Cullicott, C. E.**, & Chen, Y-C. (2018, June 24-27). "*Darkness does not give off cold*" - A longitudinal study of uncertainty management during 5<sup>th</sup> grade whole-class argumentation [Poster presentation]. International Conference for the Learning Sciences, London, England.

Jansen, A., Curtis, K., Edusei, K., Zhang, X., Middleton, J. A., **Cullicott, C.**, Rodriguez, E. A., Tarr, G., & Wiesel, A. (2018, April). *Operationalizing an engaging high school mathematics classroom climate* [Paper presentation]. Research conference for the National Council of Teachers of Mathematics, Washington, D.C., United States.

**Cullicott, C. E.**, & Chen, Y-C. (2018, March 10-13). *Managing uncertainty in argumentation: A longitudinal case study in a fifth-grade classroom* [Poster presentation]. 2018 NARST Graduate Student Research Symposium, National Association for Research in Science Teaching Annual International Conference, Atlanta, GA, United States.

**Cullicott, C. E.** (2005, March). *Quick and dirty rock identification – Colorado Plateau rocks* [Paper presentation]. Bioregional Outdoor Education Project (Now PLATEAU) Annual conference, Monticello, UT, United States.

Calwell, C. J., Dunmire, C., & **Cullicott, C. E.** (2002, December). *The HD Mountains: Impacts of proposed coal-bed methane development and promising alternatives* [Paper presentation]. Community meeting on oil and gas development, Fort Lewis College, Durango, CO, United States.

**Cullicott, C. E.** (2002, April). *Overview of coalbed methane issues in the San Juan Basin*. [Paper presentation] Coalbed Methane Development in the Intermountain West Conference, University of Colorado Boulder Natural Resources Law Center, Denver, CO, United States.

## GRANTS & SCHOLARSHIPS

ASU Graduate and Professional Student Association (GPSA) GPSA Research Grant Program, Jumpstart Research Grant, \$375 Participant incentives	2023-Present
Arizona Community Educator Initiative Elementary and Secondary School Emergency Relief (ESSER III) Fund, \$7,400,000 <i>PI:</i> Dr. Carole Basile, Dean, Mary Lou Fulton Teachers College <i>Role:</i> Research Assistant	2022-Present
ASU Daisy M Jones Scholarship <i>Amount:</i> \$13,008, tuition coverage, health benefits coverage	Fall 2021-Spring 2022
ASU Mary Lou Fulton Teachers College Travel Grants (\$750 each) Geological Society of American (GSA) Annual Meeting, Portland, OR National Association of Research in Science Teaching (NARST) Annual Meeting, Baltimore, MD International Conference of the Learning Sciences (ICLS) Annual Meeting, London, England, National Association of Research in Science Teaching (NARST) Annual Meeting, Atlanta, GA	2018, 2019, 2021
ASU Graduate and Professional Student Association (GPSA) Travel Grant (\$950) Grant to attend the International Conference of the Learning Sciences (ICLS), London, England	2018

<i>SMiLES: Secondary Mathematics, in-the-moment Longitudinal Engagement Study</i> , National Science Foundation, \$1,498,213. <i>PI</i> : Dr. James Middleton and Dr. Amanda Jansen <i>Role</i> : Research Assistant	2017-2021
<i>Developing and Revising Instructional Activities to Optimize Cognitive Engagement</i> Institute of Education Sciences, \$1,456,185. <i>PI</i> : Dr. Michelene Chi <i>Role</i> : Research Assistant	2019-2021
<i>Teaching the Crosscutting Concept of Emergent Cause-and-Effect to Overcome Misconceptions</i> , Institute of Education Sciences, \$1,456,431. <i>PI</i> : Dr. Michelene Chi <i>Role</i> : Research Assistant	2018-2019
ASU Mary Lou Fulton Teachers College Educational Leadership and Innovation Fellowship (\$15,000)	2017

## RESEARCH EXPERIENCE

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### Education Research

Supervisor Dr. Steve Zuiker, ASU Mary Lou Fulton Teachers College 2022-Present  
*Role*: Support all research aspects and some implementation components of ESSER-funded project -  
 The Arizona Community Educator Initiative

- Research team consists of one doctoral student and two master's students in addition to Dr. Zuiker. Implementation team consists of three full-time ASU staff members.
- Supervision of master's students as directed by Dr. Zuiker.
- Lead instrument developer for two-stage research program (current system and intervention): Pre-post and checkin surveys for students, teachers, and community educators. Focus group interview protocols for teachers and community educators.
- Institutional Review Board: Initial development of protocol document and submission of supporting materials, revision of documents in response to feedback, development and submission of modifications to approved study.
- Communities and Classrooms Survey: Lead in survey development, validation, programming, analysis, qualitative and quantitative analysis, and manuscript authorship for statewide survey of educators from schools and community education organizations.
- Other project events: Coordinate data collection with implementation team, data logging, reduction, and analysis across research team, conduct qualitative data analysis of multiple data types.

Supervisor Dr. James Middleton, ASU School for Engineering of 2017-2021  
 Matter, Transport & Energy

*Role*: Supported all aspects of NSF-funded project - SMiLES: Secondary Mathematics, in-the-moment  
 Longitudinal Engagement Study

- Research team consisted of ten doctoral students across two universities, a master's student, and an undergraduate, in addition to the two PIs.
- Classroom Observation Team Chair, 2 years, Team Member four years. As Chair, held regular one-on-one meetings with co-PI, coordinated and ran all observation team meetings, coordinated analysis process (documenting and tracking all observations, assignment of analyses to different team members, member check meetings), wrote summary for Advisory Board meetings. Collaboratively developed Classroom Observation Protocol and analysis, conducted classroom observations across all Arizona school sites, including contacting teachers regarding their rationales and goals for observed lessons. Analyzed videos of classroom observations (qualitative coding of selected teaching episodes), wrote analytical memos, and co-authored presentations and publications for research and practitioner audiences.

- Lead point of contact between research team and teachers at one participating Arizona school.
- Teacher Interview Team Member: Collaboratively developed and analyzed Teacher Baseline Survey and Teacher Interview Protocol, wrote analytical memos, and co-authored presentations and publications for research and practitioner audiences.
- Field researcher, all Arizona school sites: Explained research to high school students during assenting / consenting process, administered long-term surveys to students at beginning and end of school year, administered short-term/ESM surveys to students during or after classroom observations, conducted face-to-face student focus group interviews and face-to-face semi-structured teacher interviews.

Supervisor Dr. Michelene Chi, ASU Mary Lou Fulton Teachers College

2018-2021

- Developing and Revising Instructional Activities to Optimize Cognitive Engagement [ICAP - Interactive, Constructive, Active, Passive - Framework for characterizing student engagement with instruction and instructional materials]
  - Research team consisted of two post-doctoral scholars and two undergraduate assistants in addition to doctoral students and PI
  - Lead researcher, case study of a geology professor's use of the ICAP Theory of Cognitive Engagement to increase active learning in an upper division geology course. Presented research at multiple conferences and workshops. Wrote manuscript on study which was included in a larger grant proposal.
  - Collaborative initial development of ICAP-based self-evaluation rubric for faculty in the School of Earth and Space Exploration, for use in face-to-face and online teaching.
  - Collaborative adaptation of ICAP teacher professional development from face-to-face to online platforms.
- Teaching the Crosscutting Concept of Emergent Cause-and-Effect to Overcome Misconceptions [PAIR-C - Pattern, Agent, Interactions, Relations, Causality - Framework to help distinguish between sequential and emergent processes]
  - Research team consisted of a local high school biology teacher, a post-doctoral scholar, a staff member, and an undergraduate assistant in addition to doctoral students and PI
  - Worked with teacher and post-doctoral scholar to develop coding scheme and code student papers from laboratory exercises, computer simulations, and exams covering high school biology content. Used results of analysis to help teacher plan next phases of instruction and assessment. Helped develop exams used in experimental and control conditions.
  - Applied PAIR-C framework to geological processes and wrote memos illustrating these examples.
  - Developed presentation for teaching PAIR-C framework to teachers and researchers and presented to campus-wide interdisciplinary science education research group. Developed a step-by-step worksheet for characterizing patterns as resulting from sequential or emergent processes.

Supervisor Dr. Ying-Chih Chen, ASU Mary Lou Fulton Teachers College

2017-2019

- Uncertainty Management Project: Developed coding scheme and coded multiple transcripts of elementary student whole-class argumentation for different aspects of uncertainty management. Co-authored several presentation abstracts and presented posters at international conferences.
- Physics Teacher Pedagogical Content Knowledge Project: Conducted (approximately) weekly onsite classroom observations of a high school physics teacher, including videoing the class, taking detailed field notes, getting copies of all classwork and homework papers, and interviewing teacher after class. Developed and implemented data organization scheme for observation videos, field notes, interviews, and papers.



**Geology Research**

- Geological field work: field notes and sketches; mapping; sample collection in igneous, sedimentary, and metamorphic rocks, sediment, soils, and surface and groundwater; measuring stratigraphic sections; logging drill core, percussion drill cuttings, auger drill sediment. Worked in Colorado, Idaho, Montana, Nevada, New Mexico, Utah.
- Sample preparation: thin section preparation for light microscope and electron microprobe; crushing and sieving samples for chemical analysis.
- Analysis: qualitative - field notes and sketches. Qualitative and quantitative using petrographic microscope and JEOL Electron Beam Microprobe.
- Computer modeling of hypothetical magma compositions (based on microprobe analyses), and of groundwater patterns and flows (based on well survey data).
- Writing: Master's thesis, Senior (undergraduate) thesis, abstracts for conference proposals, reports for diverse stakeholders and clients.
- Legal research into Federal, Tribal, state, and local-level environmental, archaeological, and hazard mitigation regulations governing a range of processes, including new construction, drilling, lighting, paint booths, land ownership changes, and asbestos abatement.

**SERVICE****Institutional**

<i>Current Issues in Education</i> , Manuscript reviewer. Mary Lou Fulton Teachers College, Arizona State University, Tempe, AZ	2020-Present
<i>Prospective PhD Student Visits and Recruiting Sessions</i> , LLT student representative (virtual and in-person). Mary Lou Fulton Teachers College, Arizona State University, Tempe, AZ	2017-Present
<i>Teachers College Doctoral Council (TCDC)</i> buddy/mentor for new PhD students	2018-2022
<i>Mary Lou Fulton Teachers College Doctoral Executive Committee</i> , PhD Student Representative. Arizona State University, Tempe, AZ	2019-2020
<i>Women's and Men's Rowing Clubs</i> , Advisor. Arizona State University, Tempe, AZ	2019-2020
<i>Disability Resource Center</i> , Volunteer notetaker, COE 691: Interview Techniques and Dialogue. Mary Lou Fulton Teachers College, Arizona State University, Tempe, AZ	Fall 2019
<i>Teachers College Doctoral Council (TCDC)</i> , Communications Officer. Mary Lou Fulton Teachers College, Arizona State University, Tempe, AZ	2018-2019
<i>ASU Graduate Women's Association</i> , Mary Lou Fulton Teachers College Representative. Arizona State University, Tempe, AZ	2018-2019
<i>Tempe Union High School District Chem/Physics Curriculum and Assessment Cadre</i> , Member. Tempe, AZ	2016-2017
<i>Scheduling Committee</i> , Member. Dolores Mid/High School, Dolores, CO	2013-2014
<i>Leadership Committee</i> , Member, Career Prep High School, Shiprock, NM	2012-2013
<i>Advisory Program</i> , Head. Dulce High School, Dulce, NM	2011-2012
<i>Scheduling Committee</i> , Member. Dulce Independent School District, Dulce, NM	2010-2011
<i>Mancos School District Science Fair</i> , Co-Chair. Mancos School District, Mancos, CO	2002-2006

**Professional**

<i>National Association for Research in Science Teaching (NARST)</i> , Graduate Research Symposium Committee member, Reston, VA	2022-Present
<i>Association for Women Geoscientists (AWG)</i> , Steering Committee member, Saguaro, Chapter, Tempe, AZ	2022-Present
<i>Institutional Review Board</i> , Member. University High School, Tolleson, AZ	2019-Present
<i>Association for Women Geoscientists (AWG)</i> , Steering Committee member, Arizona State University Student Chapter, Tempe, AZ	2019-2020
<i>PME-NA, Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education</i> , Proposal reviewer, Columbus, OH	2019
<i>NARST Annual International Conference</i> , Proposal reviewer. National Association for Research in Science Teaching, Reston, VA	2018-2019
<i>Tribal Youth Environmental Summer Camp</i> , Geology Instructor. Eight Northern Indian Pueblos Council and the Office of Environmental Technical Assistance. Dulce, NM	2012-2013
<i>Session II: The San Juan Basin</i> , Chair. <i>Coalbed Methane Development in the Intermountain West Conference</i> , University of Colorado Boulder Natural Resources Law Center, Denver, CO	2002
<i>Four Corners Geological Society</i> , Book Sales Chair. Durango, CO	2000-2001
<i>San Juan Basin Regional Science Fair</i> , Judge. Durango, CO	1999-2001
<i>Association for Women Geoscientists (AWG) Board of Directors</i> , Arizona Chapter Delegate. Flagstaff, AZ	1996-1997
<i>United States Geological Survey</i> , Volunteer Geologist. Flagstaff, AZ	1995-1997

**Other Volunteer Service**

<i>Arizona Collegiate Rowing Foundation</i> , Advisory Board Member. Tempe, AZ	2018-Present
<i>Princeton University Alumni Schools Committee</i> , Alumni Interviewer. Princeton, NJ	2010-Present
<i>Jinsei Foundation</i> , Vice Chair. Durango, CO	2003-2007
<i>Brownie and Junior Girl Scout Troops</i> , Assistant Leader. Mancos, CO	2004-2006

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**RESEARCH INTERESTS**


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- Earth Science / Geoscience education
- Elementary and secondary teacher education
- Teacher knowledge and teacher learning
- STEM education
- ICAP and active learning
- Place-based education

## AFFILIATIONS and CERTIFICATIONS

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### Professional Affiliations

National Association for Research in Science Teaching (NARST)  
 American Education Research Association (AERA)  
 Geological Society of America (GSA)  
 Association for Women Geoscientists (AWG)  
 American Geophysical Union (AGU)  
 National Association of Geology Teachers (NAGT)

### Certifications

<i>Sixth Degree Blackbelt, Kokikai Aikido</i>	2023
Level One Fingerprint Clearance Card, State of Arizona Department of Public Safety	2016-2028
Collaborative Institutional Training Initiative (CITI Program) Certification	2017-2026
<i>Wilderness First Responder, Wilderness Medical Associates</i>	2008-2024
<i>Youth Mental Health First Aid, National Council for Behavioral Health</i>	2016-2019
<i>Outdoor Educator, Bioregional Outdoor Education Project, Four Corners School of Outdoor Education, Monticello, UT (Training included mentoring other teachers in Place-Based teaching methods.)</i>	2005
<i>Outdoor Skills I, II, III, and Backpacking, Girl Scouts of Chaparral Council, NM</i>	2005
<i>Hazardous Waste Operations and Emergency Response (HAZWOPER). Occupational Safety and Health Administration (OSHA) certified</i>	1999-2002