



College of Agricultural Sciences



College of Engineering



College of Health and Human Sciences



College of Natural Sciences



College of Veterinary Medicine and Biomedical Sciences



Warner College of Natural Resources



State & Local



K-12



Other CSU Offices

STEM CENTER ANNUAL REPORT

2017 - 2018

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Executive Summary

The STEM Center operates on a set of three overarching goals:

1. Facilitate and collaborate on PK-20 STEM education-based program, research, or evaluation grants on and off campus
2. Host a clearinghouse in the form of the CSU STEM Center website for on and off campus STEM education-based projects
3. Serve as a PK-20 STEM education liaison between CSU and off-campus organizations.

The Center currently has five staff members: a part-time director, Dr. Ernest Chavez, a full-time associate director, Dr. Laura Sample McMeeking, a part-time senior evaluator, Dr. Julie Maertens, full-time research coordinator, Dr. Cheryl Bowker, and full-time post-doctoral researcher, Dr. Carlie Trott. The Center currently also houses two graduate students from the Department of Psychology, who are working on evaluation and research. This research and evaluation work comprises the bulk of STEM Center activities. These activities have helped us expand capacity by funding graduate students and others and supplement the university and community outreach we do.

This report provides details about the CSU STEM Center's activities for the period of September 2017 to September 2018. During this time, STEM Center staff members were productive in contributing to the intellectual merit of proposals, knowledge generation in multiple disciplines, and supporting education and outreach on campus:

- Through collaborations with other faculty and staff, the STEM Center has submitted and/or received funding from over 30 grants totaling more than \$30 million as research PI or evaluator.
- STEM Center staff members have contributed to and collaborated on over 20 publications and presentations related to research and evaluation work that have been published or are under review and plan to submit more publications.
- Dr. Sample McMeeking continues to serve on the National Western Center Sustainability Team 2 to collaborate with other members on beginning a CSU research agenda.
- The STEM Center sponsored 2 booths at the Science Olympiad held at CSU in May 2018, with several CSU education and outreach programs being featured at the booths.
- STEM Center staff helped organize outreach providers for multiple events; Science Olympiad (May 2018), Denver STEAM Festival (Sept. 2018), Denver Museum of Nature & Science Girls & Science Day (March 2018).
- The STEM Center continues to highlight programs on our website's homepage, including: Mechanical Engineering Summer Camps hosted by CSU's Department of Mechanical Engineering, STEM Cybersecurity Camp co-hosted by CSU, Math to the Future summer camp hosted by CSU's Department of Math, Neuroscience Experiment Kits for Students from Muscles Alive program at CSU, Introduce a Girl to Engineering Day at CSU, the GlobalMindED conference in Denver.

For more information on the research and evaluation services provided by the STEM Center, see the Research and Evaluation section at the end of this report. The Center is located in rooms B323 and B325 of the Natural and Environmental Science Building (NESB) near College of Natural Sciences Education and Outreach Center and the Little Shop of Physics.

Finally, we are also pleased to announce that our postdoctoral researcher, Dr. Carlie Trott, has successfully transitioned to a tenure-track faculty position in the Social/Community Psychology department at the University of Cincinnati (an R-1 institution). Dr. Trott had been with the STEM Center for several years as she worked toward her doctoral degree and then on her postdoctoral research.

Mission and Goals Updates

The mission of the CSU STEM Center is to facilitate collaboration and coordination among Colorado State University's science, engineering, mathematics departments, and the teacher preparation and development programs. To do so, the CSU STEM Center supports and collaborates with faculty, staff, and students who focus on STEM research and education and serves as an organizing point for large-scale projects on campus.

The goals of the Center are three-fold: **(1)** to facilitate or collaborate on STEM PK-20+ education-based program, research, or evaluation grants on and off campus; **(2)** to host a clearinghouse in the form of the CSU STEM Center website for on and off campus STEM education-based projects; and **(3)** to serve as a liaison between individuals and groups at CSU as well as between CSU and off-campus organizations for PK-20 STEM education.

Goal 1: Education Programming, Research, & Evaluation

The STEM Center has collaborated on or contributed to more than thirty proposals between September 2017 and September 2018. Proposals ranged from small-scale evaluation related work to larger-scale involvement in research. As well as these formal contributions to grants, STEM Center staff met with faculty from across CSU to discuss and provide feedback for education portions of grant proposals. One example of this is the STEM Center staff attending a panel discussion for the CAREER award and providing follow-up feedback to several of the faculty in attendance (March 2018). During this meeting, Drs. Sample McMeeking and Maertens discussed possible options for evaluations, informally consulted on the education ideas faculty member had, and helped faculty members identify useful resources for their education components. Several evaluation partnerships arose as a result of this panel, Dr. Sample McMeeking also provided internal reviews for several of the CAREER grant proposals.

Goal 2: Website & Clearinghouse

The STEM Center has been actively engaged in planning for a new website with the capacity to house a database of campus-wide activities and projects, which can be filtered and searched based on specific criteria. Our current website lacks this functionality, and the need for such a database varies based on the user. We have engaged CSU community members to better understand the various needs. We also spoke with a team at CU-Boulder who have a similar database and the requirements for to maintain such a database. We are now in the process of soliciting bids from website developers to complete the new website database.

As the next step in our website design, we have met and are almost under contract with Road Warrior Creative to develop and host the new website. Discussed features, easily searchable database of activities, resources, and funding opportunities; information specific to collaborating with the STEM Center; and the ability to connect with materials specific to the user's needs. As part of this website, the STEM Center is also in discussions with the OVPR to provide program evaluation training materials for CSU faculty and staff as a precursor to regular in-person or online trainings.

Goal 3: Liaison Within and Outside CSU

STEM Center staff have also attended several Poudre School District events around STEM teaching and learning. For example, Drs. Sample McMeeking and Bowker both attended the Shepardson Elementary Community Breakfast, where discussions arose about the school's STEM needs and potential collaboration with the school. In addition, Dr. Sample McMeeking attended the Network of STEM Education Centers

Mission and Goals Updates

annual conference in Columbus, OH, which focused on communication and marketing of STEM Centers, allowed time to collaborate on solutions to common problems seen across the country, and enabled the beginnings of our own marketing plan. STEM Center staff have also engaged in research with collaborators at more than five other institutions.

Contracts and Grants

The STEM Center regularly collaborates on research and evaluation projects related to STEM education and outreach. Proposals have been submitted with CSU faculty from the College of Engineering, the College of Health and Human Sciences, the College of Liberal Arts, Warner College of Natural Resources, and the College of Natural Sciences, and we have collaborated on proposals with faculty members from Rutgers University, the University of Wisconsin-Madison, and Texas A&M University. Additionally, the STEM Center has collaborated on proposals with researchers from the the American Geophysical Union, and the University of Northern Colorado, to name a few.

The STEM Center has led or collaborated on 37 grant projects between September 2017 and September 2018, which total over \$30 million, for federally, state and regionally funded projects. Funded grants and contracts allow us to supplement funding from the University and hire more students and staff.

Current Funded Contracts and Grants

8/2018 – 7/2021

Sloan, D. (PI, College of Natural Sciences), Sharbrough, J. (Co-PI, College of Natural Sciences), **Maertens, J.A.** (Evaluator, CSU STEM Center) Research PGR: The cytonuclear dimension of allopolyploidy (total award amount, \$1,829,880; total evaluation budget, \$19,433)

8/2018 – 7/2019

Rasussen, K. (PI, College of Engineering), **Maertens, J.A.** (Evaluator, CSU STEM Center) IRES Track II: Advanced study institute: Field studies of convection in Argentina (total award amount, \$154,378; total evaluation budget, \$3,600)

7/2018

Trott, C.D. (PI, CSU STEM Center), Even T.L., Frame, S. Engaging key stakeholders in water policy: A STE(A)M environmental justice program in Jacmel, Haiti. Public Policy Grant, Society for Community Research & Action, APA Division 27 (total award amount, \$5,000)

8/2017 – 7/2020

Marin-Spiotta, E. (PI, University of Wisconsin-Madison), Berhe, A.A. (PI, University of California – Merced), Barnes, R. (PI, Colorado College), Hastings, M. (PI, Brown University), Mattheis, A. (PI, California State L.A. University Auxiliary Services Inc.), & **Sample McMeeking, L.B.** (External Evaluator, CSU STEM Center) ADVANCE Partnership: From the classroom to the field: Improving the workplace for Geosciences, NSF ADVANCE (total evaluation budget, \$41,111.00)

7/2017 – 6/2022

Neilson, J. (PI, College of Natural Sciences), **Sample McMeeking, L.B.** (Evaluator, CSU STEM Center) CAREER: Towards a paradigm of molecular-level control of solid-state chemistry, NSF (total award amount, \$588,519; total evaluation budget, \$12,208.00)

7/2017 – 6/2021

Sloan, D. (PI, College of Natural Sciences), **Maertens, J.A.** (Evaluator, CSU STEM Center) Conflict and Co-Evolution in a Plastid-Nuclear Enzyme Complex, NSF/MCB (total award amount, \$675,926; total evaluation budget, \$15,639.00)

Contracts and Grants

5/2016 – 4/2019

Donahue, S. (PI, College of Natural Sciences), **Maertens, J.A.** (Evaluator, CSU STEM Center) Endocannabinoid regulation of bone metabolism in hibernating marmots, NSF (total award amount, \$455,151; total evaluation budget, \$6,865.00)

1/2016 – 12/2021

Balgopal, M.M. (PI, College of Natural Sciences), Nerger, J.L. (Co-PI, College of Natural Sciences), Weinberg, A.E (Co-PI, Arizona State University), Siller, T.J. (Co-PI, College of Engineering), **Sample McMeeking, L.B.** (Senior Personnel, CSU STEM Center) CSU Noyce Phase II: Empowering Scholars and STEM Teachers, NSF Noyce Phase II (total award amount, \$799,487; total evaluation budget, \$38,737.50).

9/2015 – 7/2020

Chavez, E.L. (PI, College of Natural Sciences) & Laybourn, P.J (Co-PI) Colorado State University Bridges to the Baccalaureate, NIH, subcontract evaluation done by **Sample McMeeking, L.B.** (total award amount, \$1,605,844; total evaluation budget, \$255,798).

9/2015 – 8/2018

Siller, T.J (PI, College of Engineering), De Miranda, M.A. (Co-PI, College of Health and Human Sciences), **Maertens, J.A.** (Evaluator, CSU STEM Center) Engineering and Education Partnership: Preparing the Next Generation of Cross Disciplinary Trained STEM Teachers, NSF (total award amount, \$570,007; total evaluation budget, \$81,557.00).

7/2015 – 7/2019

Sample McMeeking, L.B. (CSU PI, CSU STEM Center) Mathematical and Computational Methods for Planning a Sustainable Future II (PS-Future II), NSF DR K-12, sponsor; Rutgers-State University of New Jersey (total evaluation budget, \$256,145.00).

1/2015 – 6/2020

Maciejewski, A. (PI, Electrical & Computer Engineering, CSU), Byrne, Z. (Co-PI, Psychology, CSU), De Miranda, M. (Co-PI, Texas A&M University), Chen, T. (Co-PI, Engineering, CSU), & **Sample McMeeking, L.B.** (Co-PI STEM Center, CSU) Revolutionizing Roles to Reimagine Integrated Systems of Engineering Formation, NSF ISE PFE/RED (total award amount, \$1,988,663; total evaluation budget, \$67,875.00).

1/2015 – 12/2019

Denning S.A. (College of Engineering), & Burt, M.A (College of Engineering. REU Site: Research experiences for undergraduates in climate science at Colorado State University, **evaluation done by STEM Center** (total award amount, \$595,766; total evaluation budget, \$30,310.00).

10/2014 – 9/2019

Fischer, E.V. (College of Engineering), **Sample McMeeking, L.B.** (Evaluator, STEM Center), & Hernandez, P.R (Co-PI). Collaborative Research: Improving the Recruitment and Persistence of Women in the Geosciences: Exploring Deliberate Mentoring Approaches Aimed at Undergraduate Students, NSF IUSE (total award amount, \$1,411,731; total evaluation budget, \$266,923.00)

Contracts and Grants

Projects Under Review

1. Gilber, J. (College of Veterinary Medicine and Biomedical Sciences), **Maertens, J.A.** (Evaluator, STEM Center) NIH R25: Graduate pre-doctoral research scholars program (total award amount, \$675,000, total evaluation amount, \$3,000; 6/01/2018-5/30/2023)
2. Grasley, Z. (Texas A&M University), **Maertens, J.A.** (Evaluator, STEM Center) NSF NRT: Engineering creativity for advanced infrastructure manufacturing and materials (AIMM) (total award amount, \$3,000,000; total evaluation amount, \$88,563; 9/01/2018-8/31/2023)
3. Balgopal, M. (College of Natural Sciences), **Maertens, J.A.** (Evaluator, STEM Center) NSF NRT: TERRAS-Transdisciplinary education for resilient rangeland action (total award amount, \$2,999,565; total evaluation amount, \$25,000; 6/1/2018 - 5/31/2021)
4. Bhaskar, A. (College of Engineering), **Maertens, J.A.** (Evaluator, STEM Center) CAREER: Sustainability of urban water resource in semi-arid regions (total award amount, \$509,260; total evaluation amount, \$9,321; 5/1/2019-4/30/2024)
5. Covino, T. (College of Natural Resources), **Maertens, J.A.** (Evaluator, STEM Center) CAREER (resubmission): Proposal to enhance education and understanding of the role of river-floodplain connectivity in providing beneficial hydrologic services in mountain landscapes (total award amount, \$796,188; total evaluation amount \$33,408; 4/15/2018-4/14/2023)
6. Stasevich, T. (College of Natural Sciences), **Maertens, J.A.** (Evaluator, STEM Center) CAREER: Multicolor imaging of single mRNA translational heterogeneity in living cells (total award amount, \$926,173; total evaluation amount, \$6,182; 7/1/2019-6/30/2024)
7. Fischer, E. (College of Engineering), **Maertens, J.A.** (Evaluator, STEM Center) CAREER: Beyond a snapshot: harnessing new observations to explore seasonal cycles, interannual variability, and trends in PAN (total award amount, \$809,043; total evaluation amount, \$32,912; 7/1/2019-6/30/2024)
8. Wilusz, C. (College of Veterinary Medicine and Biomedical Sciences), **Maertens, J.A.** (Evaluator, STEM Center) NIH T32: Predoctoral training in quantitative cell and molecular biology (total award amount, \$1,274,944; total evaluation amount, \$3,000; 7/1/2019-6/30/2024)
9. Anderson, G.B. (College of Veterinary Medicine and Biomedical Sciences), Gonzalez-Juarrero M., Lyons, M.A., Tamayo, M.I., Robertson, G.T., **Maertens, J.A.** (Evaluator, STEM Center) NIH R25: Improving reproducibility of recording and pre-processing experimental biomedical data (total award amount, \$261,208; total evaluation amount, \$3,000; 4/1/2019-3/31/2022)
10. Rogers, M. (PI, Cooperative Institute for Research in the Atmosphere, CIRA), **Maertens, J.A.** (Evaluator, STEM Center) NOAA ELG: Mountain Strong, fire and flood education (total award amount, \$499,355, total evaluation amount, \$72,000; 10/01/18-9/30/21).
11. Reddy, A (PI, College of Natural Sciences), **Maertens, J.A.** (Evaluator, STEM Center) NSF: Leveraging large-scale transcriptome data to elucidate the plant splicing regulatory code (total evaluation amount, \$12,280; 01/01/2019-12/31/2021)
12. Cozzens, M. (Rutgers University), Weiberg, A. (Arizona State University), Jordan, R. (Rutgers), **Sample McMeeking, L.B.** (Evaluator, STEM Center) NSF, iTEST Strategies: High School

Contracts and Grants

interdisciplinary citizen science (total award amount, \$1,200,000; total evaluation amount, \$100,093; 2/15/2019-2/14/2022).

13. Roy, S. (College of Engineering), **Sample McMeeking, L.B.** (Evaluator, STEM Center), NSF CAREER: Lossless information compression and model reduction algorithms for the fast full-parameter exploration of mathematical models in the presence of mixed uncertainty (total award amount, \$435,896; 7/1/2019-6/30/2024)

Projects Submitted but Not Funded

1. Kreidenweis, S. (College of Engineering), **Sample McMeeking, L.B.** (Evaluator, STEM Center) REU Site: Transdisciplinary research experiences for undergraduate in engineering and natural resources at Colorado State University (total award amount, \$381,471; 1/1/2018-12/31/2021).
2. Munsky, B. (College of Engineering), Krapf, D. (College of Engineering), Shipman, P. (College of Natural Sciences), Prasad, A. (College of Engineering), The q-bio Career Development Program, evaluation done by the STEM Center (total award amount, \$1,501,100; total evaluation amount, \$42,650; 12/01/2017-11/30/2022)
3. Pilgram, M. (College of Natural Sciences) CAREER: Using Online Learning Behaviors to Detect At-Risk Students, evaluation done by the STEM Center (total award amount, \$557,408; total evaluation amount, \$42,650; 6/2018-5/31/23)
4. Kota, A. (College of Engineering) CAREER: Towards a Paradigm of Sustainable Liquid-Repellent Surfaces, evaluation done by the STEM Center (total award amount, \$100,000; total evaluation amount, \$7,350; 1/2018-12/31/2022)
5. Covino, T. (College of Natural Resources) CAREER: Proposal to Enhance Education and Understanding of the Role of River-Floodplain Connectivity in Providing Beneficial Hydrologic Services in Mountain Landscapes, evaluation done by the STEM Center (total award amount, \$796,188; total evaluation amount, \$34,120; 4/14/2018-4/14/2023).
6. Stenglein, M. (College of Natural Sciences) CAREER: Computational Tools for Taxonomically Reliable Genomics, evaluation done by the STEM Center (total award amount, \$957,374.00; 3/1/2018-2/28/2023).
7. Belyanin, A. (Texas A&M University) DEEP: Discover, Explore, and Enjoy Physics, evaluation done by the STEM Center (total evaluation amount, \$60,055.00; 6/1/2018-5/31/2021).
8. Kuehl, E. (College of Natural Sciences) Colorado Rural Work-Based Learning Initiative (CRWBL Initiative), evaluation done by the STEM Center (total evaluation amount, \$72,843.00; 5/1/2018-4/30/2021)
9. Kreidenweis, S. (College of Engineering) REU Site: Transdisciplinary Research Experiences for Undergraduates in Engineering and Natural Resources at Colorado State University, evaluation done by the STEM Center (total award amount, \$381,471.00; 1/1/2018-12/31/2021).
10. Balgopal, M. (College of Natural Sciences), Bimper, A. (College of Liberal Arts) & Doe, S. (College of Liberal Arts), Writing about Real-world Issues to Engage Science Students, evaluation done by the STEM Center (total award amount, \$989,490.00; 8/1/2018-7/30/2023)

Contracts and Grants

11. Byrne, Z. (College of Natural Sciences), Balgopal, M. (College of Natural Sciences), Atadero, R. (College of Engineering), NSF Research: A process model for creating the team-based engineering identity, evaluation done by the STEM Center (total award amount, \$350,000; 7/1/2018-6/30/2021)

Scholarly Work

STEM Center staff members have been actively engaged in scholarly writing collaborations with faculty across and outside the university. Drs. Chavez, Sample McMeeking, Maertens, Trott and Bowker submitted over 20 STEM education publications and conference proposals with colleagues from the Department of Psychology, the School of Education, the Department of Atmospheric Science, and the Department of Biology as well as faculty from Arizona State University.

Related Publications

Published or Accepted

1. Trott, C.D., Weinberg, A.E., & Sample McMeeking, L.B. (Accepted). Prefiguring sustainability through participatory action research experiences for undergraduates: Reflections and recommendations for student development. *Sustainability*.
2. Sample McMeeking, L.B., Weinberg, A.E., & Trott, C.D. (Accepted). A scoping review of integrated mathematics and science education for student achievement: A methodological overview of 50 years of research. *School Science & Mathematics*.
3. Trott, C. D. (In Press). Photovoice for children's climate change engagement: Using digital photography to bridge knowledge and action. *The Earth Scientist*.
4. Weinberg, A.E., Trott, C.D., & Sample McMeeking, L.B. (In Press). Who Produces Knowledge? Transforming Undergraduate Students' Views of Science through Participatory Action Research. *Science Education*. Advance online publication. doi:10.1002/sce.21453
5. Wright, D.†, Balgopal, M.M., Weinberg, A.E., & Sample McMeeking, L.B. (Forthcoming; February 2019). Developing resilient K-12 STEM teachers. *Advances in Developing Human Resources*.
6. Chapman, D., Trott, C. D., Silka, L., Lickel, B., & Clayton, S. (2018). Psychological perspectives on community resilience and climate change: Insights, examples, and directions for future research. In S. Clayton & C. Manning (Eds.), *Psychology and climate change: Human perceptions, impacts, and responses* (pp. 267-288). Amsterdam: Elsevier. doi:10.1016/B978-0-12-813130-5.00011-4
7. Weinberg, A.E & Sample McMeeking, L.B (2017). Toward meaningful interdisciplinary education: High school teachers' views of mathematics and science integration. *School Science and Mathematics*, 117(5), 204-213.
8. Maciejewski, A.A., Chen, T.W., Byrne, Z.S., De Miranda, M.A., Sample McMeeking, L.B., Notaros, B.M., Pezeshki, A., Roy, S., Leland, A.M., Reese, M.D., Rosales, A.H., Siller, T.J., Toftness, R.F., & Notaros, O. (2017). A holistic approach to transforming undergraduate electrical engineering education. *IEEE Access*, 5, 8148-8161
9. Dickens D.D. and Chavez E.L. (2017) Navigating the Workplace: The Costs and Benefits of Shifting Identities at Work among Early Career U.S. Black Women Sex Roles <http://link.springer.com/article/10.1007/s11199-017-0844-x>

Manuscripts Under Review or In Revision

1. Trott, C. D. (under revision). Collaborating with children for community-based climate change action: Integrating transformative, arts-based, and participatory methods. *Action Research*.

Scholarly Work

2. Trott, C.D., Sample McMeeking, L.B., Bowker, C.L., & Boyd, K.† (In Review). Exploring the long-term academic and career impacts of undergraduate research in geoscience. *Science Education*.
3. Bloodhart, B., Balgopal, M.M., Casper, A.A., Sample McMeeking, L.B., & Fischer, E.V. (In Review). Outperforming yet undervalued: Undergraduate women in STEM. *Science*.
4. Trott, C. D., Sample McMeeking, L. B., & Weinberg, A. E. (In Review). Participatory action research experiences for undergraduates: Forging critical connections through community engagement. *American Journal of Community Psychology*.

Related Presentations

Invited Talks

1. Sample McMeeking, L.B., Chavez, E., Jones, B., Warnock, A., & Atadero, B. (April, 2018) NSF Broader Impacts Resources at CSU. Colorado State University OVPR.

Conference Presentations:

1. Reed, K., Dik, B., Bloodhart, B., Hernandez, P., Pollack, I., Adams, A., Barnes, R., Burt, M., Clinton, S., Godfrey, E., McMeeking, L., Bowker, C., & Fischer, E. (August 2018). How women's calling for science careers relates to psychological predictors persistence in science. Poster presentation for the American Psychological Association annual conference, San Francisco, CA.
2. Sample McMeeking, L.B., Weinberg, A.E., & Trott, C.D. (2018, June). Participatory action research experiences for undergraduate: Exploring challenges and opportunities of a coordinated approach. Annual Meeting of the National STEM Education Centers, Columbus, OH.
3. Roy, S., Notaros, B.M., Pezeshki, A., Chen, T.W., Siller, T.J., Maciejewski, A.A., & Sample McMeeking, L.B. Active learning model as a way to prepare students for knowledge integration (2018, June). Proceedings of the American Society for Engineering Education, Salt Lake City, UT.
4. Maciejewski, A.A., Chen, T.W., Byrne, Z.S., Sample McMeeking, L.B., Notaros, B.M., Pezeshki, A., Roy, S., Leland, A.M., Reese, M.D., Rosales, A.H., Siller, T.J., Toftness, R.F., & Notaros, O. (2018, June). Throwing away the course-centric teaching model to enable change. Proceedings of the American Society for Engineering Education, Salt Lake City, UT.
5. Fischer, E.V., Adams, A., Barnes, R.T., Bloodhart, B., Bowker, C., Burt, M., Clinton, S.M., Godfrey, E., Pollack, I.B., Hernandez, P. (December 2017). A blueprint for expanding the mentoring networks of undergraduate women in the earth and environmental sciences. Poster presentation for the American Geophysical Union annual meeting, New Orleans, LA
6. Godfrey, E., Clinton, S.M., Adams, A., Pollack, I.B., Barnes, R.T., Bloodhart, B., Bowker, C., Burt, M., Henderson, H., Hernandez, P.R., Maertens, J.M., Sample McMeeking, L.B., Sayers, J., Fischer, E.V. (December 2017) A best practices approach to working with undergraduate women in the geosciences. Poster presentation for the American Geophysical Union annual meeting, New Orleans, LA
7. Sample McMeeking, L.B., Weinberg, A.E., Trott, C.D. (November 2017). Integrated mathematics and science education: A scoping review. Paper presentation for the School Science and Mathematics Association conference, Lexington, KY.

Scholarly Work

8. Bloodhart, R., Henderson, H., Hernandez, P. R., Sayers, J., Pollack, I. B., Adams, A., Barnes, R. T., Burt, M., Clinton, S. M., Godfrey, E., Sample-McMeeking, L., Bowker, C., and Fischer, E. V., (September 2017) Gender identity moderates the effect of stereotypic beliefs on women's scientific career intentions, American Psychological Association Convention, Washington, DC, United States.
9. Henderson, H.L., Hernandez, P.R., Bloodhart, B., Sayers, J., Pollack, I.B., Adams, A., Barnes, R.T., Burt, M., Clinton, S.M., Godfrey, E., Sample McMeeking, L., Bowker, C., Fischer, E.V. (September 2017) Enhancing female undergrads' science -identity, -values, and -interest through mentoring. American Psychological Association Convention, Washington, DC, United States.

National, State, & Local Service Activities

As part of the STEM Center's daily operations and commitment to STEM-related activities on and off campus, the staff at the STEM Center has attended and hosted several meetings and events. For example, Dr. Sample McMeeking continues to serve on the National Western Center Sustainability Team 2 to collaborate with other CSU faculty members from across all colleges. This committee has been tasked with helping to develop the CSU interdisciplinary research agenda leveraging the NWC resources and site.

The STEM Center has also been engaged in showcasing education and outreach happening on campus. For example, we sponsored 2 booths at the Science Olympiad held at CSU in May 2018 and invited several education and outreach programs, who did not already have booths, to showcase their programs. The STEM Center staff also helped organize outreach providers for multiple events, including Science Olympiad (May 2018), Denver STEAM Festival (Sept. 2018), Denver Museum of Nature & Science Girls & Science Day (March 2018).

The STEM Center continues to highlight programs on our website's homepage, including: Mechanical Engineering Summer Camps hosted by CSU's Department of Mechanical Engineering, STEM Cybersecurity Camp co-hosted by CSU, Math to the Future summer camp hosted by CSU's Department of Math, Neuroscience Experiment Kits for Students from Muscles Alive program at CSU, Introduce a Girl to Engineering Day at CSU, the GlobalMindED conference in Denver. During this upcoming year, we will be collecting program information through email, phone, and in-person requests that we will add to our new website, with the ability to search based on the user's needs.

Panels & Committees

Drs. Chavez and Sample McMeeking served on a review panel for the National Science Foundation.

Drs. Sample McMeeking and Bowker are serving as classroom observers for the Smithsonian Museum LASER evaluation.

Dr. Sample McMeeking serves as an advisory board member for a large-scale NSF-funded project hosted in the Texas A&M University system focused on improving the pathways for underrepresented students to move into the professoriate.

Dr. Sample McMeeking serves on the advisory board for Power Mountain Engineering (<https://www.facebook.com/powermountainengineering>), a non-profit after school STEM program for students in grades 8-12 focused on creating complex working devices.

Drs. Maertens and Sample McMeeking reviewed National Science Foundation proposals for CSU faculty before submission.

Dr. Sample McMeeking reviewed graduate student posters at the Graduate Student Showcase for the College of Engineering students.

Dr. Bowker served as a Grand Awards Judge for the 2018 Colorado Science and Engineering Fair (April, 2018), and an all-around judge for CSU's Celebrating Undergraduate Research and Creativity (CURC) awards (May 2018).

Research and Evaluation

STEM Center Evaluation Services

The CSU STEM Center staff develop and implement evaluations tailored to meet your specific needs at any project stage. Different roles we may take on include the following or any combination of the following:

- Front-End Evaluation: Gauge the interests and preferences of possible participants or identify potential barriers to address during project development
- Logic Model Development: Create a visual model of a program's goals, components, and related outcomes
- Formative Evaluation: Provide feedback about an intervention as it is being developed or implemented
- Process Evaluation: Give oversight concerning processes and structure in complex projects
- Summative Evaluation: Assess the impact of an intervention at the end of a project or near the end of a project.

STEM Center evaluations include the use of both rich, qualitative method (such as descriptions of program activities) and varied quantitative methods as appropriate to each project. If program impact is to be assessed, we also develop and implement experimental and quasi-experimental evaluation designs. Examples of data that may be collected during the course of an evaluation include observations, individual and group interviews, surveys, logs and journals, artifacts, and tests/assessments. Our evaluations are developed using current evaluation frameworks documented in the evaluation literature.

CSU STEM evaluators have experience in both science research and STEM education, allowing us to serve as advisors on project development while maintaining enough distance to provide objective feedback within the evaluations themselves. Part of this process includes listening to your needs, offering alternative perspectives, directing you toward key literature, and encouraging a collaborative relationship.

STEM Center Research Services

STEM Center staff also serve as principal investigator and co-principal investigator where the content of the projects are related to the expertise of particular staff members. In such cases, the process of defining roles, developing the proposal, and negotiating budget are the same as any collaboration between faculty and staff on CSU campus. In addition, in some cases, evaluation plans may closely resemble research plans based on the needs of the project and requirements of the funding agency. We often refer to these types of projects as research/evaluation, as the work is informing both the project and the overall literature in the field.

Choosing the STEM Center as Evaluators

The following frequently asked questions are meant to help guide you as you determine if the STEM Center is right for serving as evaluator on research projects. The questions explain how to get started with us and what we need in order to develop the best evaluation. For other questions regarding research collaboration or evaluation services, please call Dr. Sample McMeeking at (970) 491-3179 or email stem_center@mail.colostate.edu.

How do I get started?

Send an email to stem_center@mail.colostate.edu describing your project and providing contact information for us to reach you. If available, you should also attach pertinent documents such as a Letter of

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Intent or project summary. We will then contact you to set up a meeting or phone call to discuss your project and needs in more detail. The discussion we have will inform us and you on the appropriateness of our role as evaluator on your project.

What will you want to know when we talk?

In addition to the background information on your project, we will ask you questions such as the following to better understand your needs:

- What are the intended goals and outcomes of the project?
- What do you want to learn about the project?
- Do you have an evaluation role in mind for the STEM Center? If so, what is it?
- What's the timeline for the project and when would the STEM Center be involved?
- If submitting a proposal, what is the timeline for proposal submission?
- Have you already budgeted for the evaluation? If so, what did you budget?

If you don't have answers to all these questions, don't worry! Given enough lead time, we can help you flesh out the different aspects of your program that will enable you to answer these questions.

How much should I budget for evaluation? What does that cover?

Guidelines for evaluation budgets vary by funding agency and other factors. While there are general guidelines for evaluation budgets (about 10-15% of the overall budget), ultimately the cost for individual evaluations will depend on the nature and scope of the work proposed in the evaluation plan. Some examples are below:

- Process evaluations and more advisory roles that do not entail as much data collection and analysis as other types of evaluations may cost less than 10% of the total budget.
- Summative evaluation assessing project impact involves work throughout the life of the project to develop and pilot methods and measures, in addition to the works at the end of the project to address the evaluation goals. This may cost 10-15% of the total project budget.
- Evaluation research, where program impact is one of the primary goals, may cost half or more of the overall budget.

These are just examples of possible evaluation costs. Ultimately evaluation cost will be affected by the design of the overall evaluation, including: numbers of participants, types of data and analyses, extent of measure and instrument development required, amount of travel, and other factors. These all affect the amount of time and resources used by evaluators to complete the evaluation.

Other costs to consider for the evaluation budget are costs for travel and stipends for evaluation participants who will most likely be a subset of program participants engaging in extra evaluation activities as appropriate. You should also include our own indirect overhead costs if your funding agency allows for the collection of indirect costs. We will work with you to develop a scope for our evaluation work that matches your needs and budget and aligns with the overall scope of the project. Generally, we will not charge you for the cost of our time in developing the proposal with you.

****Because the STEM Center operates at CSU and will, in most cases, contribute to the overall success of the project, internal collaborations (i.e., projects that originate through CSU), should include the STEM Center on internal documents concerning the split of F&A funds.****

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How long will it take to develop an evaluation plan?

The time it takes us to develop an evaluation plan for you may be different for each project as it depends on your project and the role of the evaluator in developing your research and/or evaluation plan. Generally, we ask that you contact us as soon as you have a project conceptualized and know you will need evaluation work done. However, because the timeline for evaluation plan development is so situational, some examples are provided below:

If you have already clearly defined your project and the role you have in mind for the evaluator, it may take as little as two weeks to develop an evaluation plan after the initial discussion (although we prefer a longer lead time if possible).

After reading through the project description and implementation plan, we may find areas that are less clear than originally thought. We may also find aspects of the plan that would be difficult, unethical, or expensive to carry out during an evaluation. In such cases, we would suggest changes project for the sake of clarity and feasibility. This process would likely take a few weeks in addition to the example above of collaborative discussion.

If you would like the CSU STEM Center to collaborate on the development and implementation of a research plan, we usually recommend contacting us before drafting the proposal, as we would play an integral role in development of the proposal and would likely be involved in the project as a Co-PI rather than an evaluator. This might begin a few months or more before the proposal is due, depending on the project's complexity.

Are there specific documents I will need from the CSU STEM Center?

Specific documents needed for proposal submission or for currently funded projects vary by funding organization. We will provide you with any support documents required in your particular situation in addition to the evaluation plan narrative, any tables or figures relevant to the evaluation, and citations used in the evaluation. Examples of documents we have provided on past projects are presented below:

- Biographical sketches for pertinent CSU STEM Center staff (formatted for individual agencies)
- Statements of organizational capacity
- Letters of support or commitment
- Curriculum vitae for pertinent CSU STEM Center staff
- Current and pending support statements for pertinent CSU STEM Center staff
- Budgets and/or budget justifications for evaluation work

As contributors to the overall project, on federal grants, we should be listed as "Senior Personnel" or equivalent based on the agency. Listing an evaluator as a Co-PI may appear to be a conflict of interest, so we do not recommend doing so.

What will I need to do after the grant is submitted?

Directly after the grant proposal is submitted, you will need to send the STEM Center a copy of the proposal and the final budget for our records. This information will not be shared, and it will only be used to ensure the STEM Center will be adequately staffed in the case of the grant being funded.

If the grant is funded, you will need to inform the STEM Center and arrange a meeting to discuss any changes that may have occurred between submission and funding, the timeline, and any immediate evaluation activities that need to take place