

Colorado State University



CSU STEM Center

2014-2015 Biennial Report



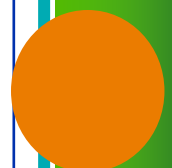
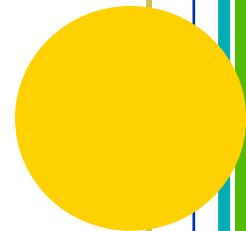
Prepared by:

Laura Sample McMeeking, Associate Director

Ernest Chavez & Paul Kennedy, Co-Directors

Cheryl Bowker, Evaluation Coordinator

September, 2015



LETTER FROM THE DIRECTORS

The STEM Center at CSU was established in 2011 in order to collaborate and coordinate CSU's science, engineering, mathematics departments and the teacher preparation and development programs. This was to be accomplished through three main goals:

- 1) to facilitate or collaborate on STEM 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
- 3) to serve as a liaison between CSU and off-campus organizations for PK-20 STEM education.

The STEM Center website (<http://stem.colostate.edu/>) has been up and active for over a year, and we continue to be active in the APLU STEM Centers organization and are included in their website. We continue to solicit news and content for our website. However, it has become clear to us that keeping an up to date site on all things STEM at Colorado State University is next to impossible with our current staffing. If you have a stem-education related news story, please email the following information to stem_center@mail.colostate.edu:

- Program/Project Title
- Department/Center/etc. (if this is collaborative across groups, please list them all)
- Contact Name and Title (who someone contacts with questions)
- Contact Email Address
- Contact Phone Number
- Short description (5-6 lines of text)
- Website Link (if available)

In addition to developing the website, the Center has continued its work in evaluation and evaluation research and increased its research budget dramatically. We have facilitated relationships with colleges and departments on campus, and maintained active involvement with individual schools and school districts in Colorado. We are also serving on state and national committees concerned with STEM education, outreach, and research. The Center can also boast of a 143% return on investment to the University based on its grant funding. We hope to continue our growth and development and hope to involve more faculty and staff from across the CSU campus.



Dr. Ernest Chavez
Colorado State University
Professor
CSU STEM Center Co-Director



Dr. Paul Kennedy
Colorado State University
Professor
CSU STEM Center Co-Director

STEM CENTER BIENNIAL REPORT

Table of Contents

Letter from the Directors	1
Executive Summary	3
Mission and Goals	4
Contracts and Grants	5
Scholarly Work.....	10
STEM Center Website	12
Service Activities	13
State and Local Communities	14
Research and Evaluation.....	17
STEM Center Evaluation Services	17
STEM Center Research Services.....	17
Choosing the STEM Center as Evaluators	18

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: the two co-directors, Drs. Ernest Chavez and Paul Kennedy, a full-time associate director, Dr. Laura Sample McMeeking, senior evaluator, Dr. Julie Maertens, and a full-time evaluation coordinator, Cheryl Bowker. As of the publication of this report, the Center also houses graduate students from the School of Education, Katie Boyd and the Department of Psychology, Carlie Trott, who are working on evaluation/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 October 2013 to September 2015. Since the founding of the Center in 2011, Center staff has been highly productive in achieving the three goals laid out by the original subcommittee:

- Through collaborations with other faculty and staff, the STEM Center has submitted 13 grants in 2014 and 2015 as both research PI and evaluator.
- The STEM Center contributed to proposals that have brought in over \$5.6 million to the university.
- STEM Center staff has several publications and presentation proposals related to research and evaluation work that have been published or are under review and plan to submit more publications.
- The STEM Center has been active in informing STEM education policy through work with the Colorado Department of Education, the Smithsonian, the Association for Public and Land-grant Universities, the Northern Colorado STEM Initiative, the Legacy Foundation, and Poudre School district.
- STEM Center staff is currently working with four area schools on various stages in planning and implementing STEM-centric aspects of the curriculum and collaborating with the schools on research/evaluation work related to the projects.

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.

MISSION AND GOALS

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 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 CSU and off-campus organizations for PK-20 STEM education.

Goal 1: Facilitate and collaborate on PK-20 STEM education-based program, research, or evaluation grants on and off campus

The CSU STEM Center will assist and collaborate with faculty involved with STEM education-based research and programming designing and carrying out research or evaluation as appropriate. This includes, but is not limited to, contributing to the intellectual merit of STEM education-based research proposals, developing and carrying out research plans, developing research questions, mentoring undergraduate and graduate students participating in research through funded proposals, and connecting with faculty across campus to bolster STEM education-based research proposals. In the case of program evaluation, the CSU STEM Center will develop evaluation plans and serve as internal evaluator for CSU faculty and staff as funding allows. The CSU STEM Center will also serve as external evaluator for STEM-education related projects funded to other universities and off-campus organizations. If CSU faculty and staff need an external evaluator, the CSU STEM Center will make every effort to connect them with reputable outside evaluators.

Goal 2: Host a clearinghouse in the form of the CSU STEM Center website for on and off campus STEM education-based projects

The CSU STEM Center will coordinate campus-wide STEM education-related activities through a website that will house information on active projects and faculty engaged in STEM education-related projects. This includes enabling users to search using specific terms, providing information to users who may be interested in participation or collaboration, highlighting faculty engaged in STEM education-related activities for the purpose of fostering collaboration within and outside CSU, and highlighting the contributions of individual colleges to STEM education and outreach research and programming.

Goal 3: Serve as a PK-20 STEM education liaison between CSU and off-campus organizations

The CSU STEM Center will serve as an entry point for questions concerning STEM education-related initiatives and activities, prospective collaboration within and outside of the CSU, and possible participation in STEM-education related activities on campus. In addition, the CSU STEM Center will represent CSU at the local and state levels in activities concerning STEM education and outreach.

CONTRACTS AND GRANTS

The STEM Center regularly collaborates on research and evaluation projects related to STEM education and outreach. Since the founding of the STEM Center, the staff has been actively involved in developing and submitting research proposals as principal investigators, co-principal investigators, and serving as internal and external evaluators on grant proposals. Proposals have been submitted with CSU faculty from the College of Engineering, the College of Agricultural Sciences, the College of Natural Sciences, and the College of Health and Human Sciences, and we have received several evaluation subcontracts from Rutgers University through our collaboration with Dr. Leonard Albright.

The STEM Center has led or collaborated on fifteen grant projects, which total over \$5.6 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.

Funded Contracts and Grants

- | | |
|-----------------|---|
| 9/2013 – 8/2015 | Siudzinski, L., Wings Aerospace Science Program (W.A.S.P.), subcontract evaluation done by Albright L. & Sample McMeeking, L.B. (\$16,200 total award amount). |
| 6/2013 – 8/2015 | Roberts, F. (DIMACS) & Cozzens, M. (Rutgers University), <i>The challenge of interdisciplinary education: Math-Bio</i> , subcontract evaluation done by Albright, L. & Sample McMeeking, L.B. , \$32,975 total subcontract award amount). |
| 6/2012 – 9/2015 | Cozzens, M. (Rutgers University), Carpenter, T. (DIMACS), Salzman, H. (Rutgers University), & Roberts, F. (DIMACS), <i>Mathematical and Computational Methods for Planning a Sustainable Future</i> , subcontract evaluation done by Albright, L. & Sample McMeeking, L.B. , (\$123,564 total subcontract award amount). |
| 6/2013 – 6/2015 | Cozzens, M. (Rutgers University) & Wright, R. (DIMACS) <i>The value of computational thinking across grade levels</i> , subcontract evaluation done by Albright, L. & Sample McMeeking, L.B. , (\$31,096 total subcontract award amount). |
| 7/2013 – 6/2016 | Randall, D. (College of Engineering), Schubert, W., Moeng, C.H., Helly, J., & Denning, S. <i>Center for Multi-Scale Modeling of Atmospheric Processes: Education and Outreach Initiatives</i> , evaluation done by Albright, L. & Sample McMeeking, L.B. , \$104,874 total subcontract award amount). |

- 2/2014 – 1/2017 Rocca, J. (College of Engineering) & De Miranda, M., *NSF EUV ERC RET in Engineering & Computer Science Site Program*, evaluation done by **STEM Center**, \$318,681 total award amount).
- 3/2014-2/2019 Khetani, S.R. (College of Engineering) *CARRER: Towards a stem cell-derived 3D human liver array for high-throughput screening*, subcontract evaluation done by **Sample McMeeking, L.B.**, (\$405,886 total award amount).
- 10/2014-9/2019 Fischer, E.V. (College of Engineering), **Sample McMeeking, L.B. (Co-PI, 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 (\$1,411,731 total award amount).
- 8/2014-7/2017 Atadero, R.A (College of Engineering), Rambo-Hernandez, K.E. (Co-PI) & **Maertens, J.A. (Collaborator)** *(EI)2: Exploring Inclusive Engineering Identities through Freshman Engineering Curriculum Change*, NSF (\$333,233* total award amount)
- 8/2014-8/2017 Liber, A. (College of Natural Sciences), & **Maertens, J.A. (Evaluator)** *Increasing Cell and Molecular Biology Underrepresented Faculty in the Professoriate*, US Department of Education (\$44,887* total award amount)
- 7/2015-7/2019 **Sample McMeeking, L.B. (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 award amount, \$371,323).
- 8/2015-7/2020 **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, \$1,088,484).

- 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, College of Health and Human Sciences), Siller, T.J. (Co-PI, College of Engineering), **Sample McMeeking, L.B. (Evaluator, CSU STEM Center)** *CSU Noyce Phase II: Empowering Scholars and STEM Teachers*, NSF Noyce Phase II (total award amount, \$799,487).
- 9/2015-8/2018 Siller, T.J (PI, College of Engineering), De Miranda, M.A. (Co-PI, College of Health and Human Sciences), **Sample McMeeking, L.B. (Evaluator, CSU STEM Center)** *Engineering and Education Partnership: Preparing the Next Generation of Cross Disciplinary Trained STEM Teachers*, NSF (total award amount, \$592,634).
- 11/2015-12/2016 Brinkworth, C. (PI, NCAR), Haacker-Santos, R. (Co-PI, UCAR), **Sample McMeeking, L.B. (Evaluator, CSU STEM Center)** *Professional Development Workshop for NSF Postdoctoral Researchers*, UCAR-NCAR (total evaluation budget, \$21,644).

**Note: The STEM Center is providing free evaluation services, because of unforeseen funding cuts from the funding agency with continued requirements for a program evaluation.*

Projects Under Review

- 2015 **Sample McMeeking, L.B. (PI, CSU STEM Center)** *Evaluation of the Infusing Climate Change Research into College Science curriculum through the Undergraduate Carbon Observatory Network (UCON)*, submitted to NSF RCN UBE, sponsor; Woods Hole Research Center (total award amount \$92,605; 1/1/16 – 12/31/18).
- 2015 Vasquez, R.V (PI, College of Health and Human Sciences) & **Maertens, J.A. (Collaborator)** *Collaborative Research: REE-Understanding the Development of Collaboration Skills in Engineering and Construction*, submitted to NSF (total award amount, \$160,326; 4/15-3/31/18)
- 2015 **Sample McMeeking, L.B. (PI, CSU STEM Center)** *Collaborative Research: Longitudinal Impact of Out-of-School Science Research Experiences on Teenage Learners' Attitudes, Knowledge, and Academic and Career Choices*, submitted to NSF ECR (total award amount, \$569,975; 4/1/16-3/31/21).

- 2015 Woerner, D. (PI, College of Agricultural Sciences), Weinberg, A.E. (Co-PI, College of Health and Human Sciences), **Sample McMeeking, L.B. (Co-PI, CSU STEM Center)** *NRT-IGE: An interdisciplinary Participatory Action Research Approach to Graduate Science Education*, submitted to NSF NRT IGE (total award amount, \$499,992; 9/1/15-8/31/18).
- 2015 Denning, S.A (PI, College of Engineering), Burt, M. (Co-PI, College of Engineering), **Sample McMeeking, Laura (Co-PI, CSU STEM Center)** *NRT-IGE: Collaborative Research: A partnership between academia and the private sector to prepare graduate students with competencies for employment in the private weather industry*, submitted to NSF NRT IGE (total award amount, \$107,956; 10/1/15-9/30/18).
- 2015 Martin, J.N (PI, College of Agricultural Sciences), Belk, K. (Co-PI, College of Agricultural Sciences), **Sample McMeeking, Laura (Co-PI, CSU STEM Center)**, Morley P.S (Co-PI, College of Veterinary Medicine and Biomedical Sciences), Weinberg, A.E (Co-PI, College of Health and Human Sciences), McConnel, C.S. (Co-PI, College of Veterinary Medicine and Biomedical Sciences), Yang, H. (Co-PI, College of Agricultural Sciences). *Determining Usage and Public Perception of Antibiotics in Animals: A Necessary Tool for Effective Mitigation of Antimicrobial Resistance*, submitted to USDA-NIFA (total award amount, \$962,319; 10/1/2015-9/30/2018).

Projects Submitted but Not Funded

- 2014 **Chavez, E.L (PI, College of Natural Sciences)**, Rhodes, M.G. (Co-PI), Pilgrim, M. (Co-PI) *Translating Evidence-based Teaching Approaches in College Algebra into Practical Pedagogy in the Community College*, submitted to NSF (\$49,997)
- 2014 **Sample McMeeking, Laura (PI, CSU STEM Center) & Maertens J.A.** (Co-PI) *Urban System Science for Sustainable Atmospheres*, sponsor; Portland State University (\$186,485)
- 2014 **Sample McMeeking, Laura (PI, CSU STEM Center) & Maertens J.A.** (Co-PI) *Sustainable Adaptation of the Environment in Urbanized Coastal Areas*, sponsor; Rutgers-State University of New Jersey (\$249,879)

- 2014 Reisfeld B. (PI, College of Engineering), Thompson, S. (Co-PI), Shipman, P.D. (Co-PI) & **Maertens, J.A. (Co-PI)** *Small-Scale Approaches in Engineering Education*, submitted to NSF (\$384,832)
- 2014 **Sample McMeeking (PI, CSU STEM Center)** *Resources for Math and Science Teacher Towards Implementing Standards*, submitted to NSF DR K-12, sponsor; Rutgers-State University of New Jersey (total award amount, \$900,125; 9/1/15 – 8/31/19).
- 2014 **Sample McMeeking, Laura (PI, CSU STEM Center)** *STEM Start*, sponsor; University of Idaho (total award amount \$161,887; 7/1/15 – 6/30/20).
- 2015 Tavener, S. (PI, College of Natural Sciences), Pilgrim, M. (Co-PI), Dysleski, L. (Co-PI), Balgopal, M. (Co-PI) & **Sample McMeeking (Evaluator, CSU STEM Center)** *Improving Engagement in STEM through Mathematics, (Meta) Cognition, and Community*, submitted to NSF IUSE (total award amount \$900,730; 8/1/15 – 7/31/19).

SCHOLARLY WORK

STEM Center staff has been actively engaged in scholarly writing collaborations with faculty across the university. Drs. Chavez, Sample McMeeking, and Maertens as well as graduate students Katie Boyd and Carlie Trott and STEM Center evaluation coordinator, Cheryl Bowker submitted over nine STEM education publications and conference proposals with colleagues from the Department of Psychology, the School of Education, the Department of Mathematics, the School of Teacher Education and Principal Preparation, the Department of Agricultural Economics, the Department of Bioagricultural Sciences & Pest Management, the Department of Ecosystem Science and Sustainability, the USDA, and Agricultural Research Services.

Related Publications

Balgopal, M.M., Klein, J.A, Brown, C.S, **McMeeking, L.B.S.**, Morgan, J.A. & Frasier, W.M. (2014). Linking Biophysical, Socioeconomic, and Political Effects of Climate Change on Agro-Ecosystems. *Journal of Geoscience Education*, 62:3, 343-352

Bessler, C.A. and **Chavez, E.L** (in press) Impact of living/learning communities on college algebra. *Learning Community Journal*.

Boyd, K.J., Weinberg, A.E., & **Sample McMeeking, L.B.** (Under Review). Student perceptions of interest, learning and engagement in an informal traveling science museum. *Journal of Science Education and Technology*..

Related Presentations

Sample McMeeking, L.B., Weinberg, A.E., & **Boyd, K.J.** (2015). Participatory Action Research Experiences for Undergraduates. Paper presented at the annual meeting of the American Educational Research Association. Chicago, IL.

Chavez, E.L. (April, 2014) STEM in Colorado and Middle Schools. Preston STEM Symposium for teachers, Fort Collins, CO

Chavez, E.L. (November, 2014) Key Note: Culture and Achieving our Educational Dreams. School Counselor Corps Grant Program Fall Workshop, University of Northern Colorado, Greeley, CO.

Weinberg, A. & **Sample McMeeking, L.B.** (2014). "Computational thinking: A scoping review of the existing scholarship and research". The American Educational Research Association Annual Meeting, Philadelphia, PA.

Balgopal, M.M., **Sample McMeeking, L.B.**, Howe, J., Nielsen, S. & Winey, T. (2014). "The Meme-ing of STEM at a STEM-centric Middle School". The National Association for Research in Science Teaching Annual Meeting, Pittsburgh, PA.

Sample McMeeking, L.B., Trott, C.D., Boyd, K.J. & Bowker, C. L. (submitted abstract) “Long-term academic and career impacts of undergraduate research: diverse pathways to geoscience careers following a summer atmospheric science research internship.” American Geophysical Union Annual Meeting, San Francisco, CA.

STEM Center Website

One of the three main goals of the STEM Center is to act as a clearinghouse of STEM education/outreach and STEM education research projects both on and off campus. The newly redesigned website is located at: <http://stem.colostate.edu>. It is also showcased at the Association of Public and Land-grant Universities website for STEM centers across the country.



We are looking for content to go on the website. If you have a STEM education-related program or project you would like us to highlight on the website, please email the following information to

stem_center@mail.colostate.edu:

- Program/Project Title
- Department/Center/etc. (if this is collaborative across groups, please list them all)
- Contact Name and Title (who someone contacts with questions)
- Contact Email Address
- Contact Phone Number
- Short description (5-6 lines of text)
- Website Link (if available)

We also showcase news items related to faculty and staff at CSU. If you have a news item you would like to see on the website, please send us a title and text for the news item. We will follow up with you for clarification or with questions.

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.

Administrative Meetings

The co-directors and associate director of the STEM Center meet weekly to discuss STEM Center administrative issues, future plans, upcoming meetings and events, and general program-related business.

Dr. Chavez and Dr. Kennedy attended meetings with the deans of the Colleges of Natural Sciences, Engineering, and Health and Human Sciences in August, 2014 to discuss the future of the STEM Center. In September 2014, Dr. Chavez developed a relationship with the School of Education in order to share accounting technology for the STEM Center.

Conference Hosting/Sponsor

The STEM Center co-sponsored the CO-AMP conference during May 29-30th.

The STEM Center hosted a series of NSF sponsored Interactive Web Based Workshops (IWBW) on IUSE Project Development/Proposal Preparation. The series was provided free for all interested attendees and were held at Colorado State University in January and November 2014, with a catered lunch provided. In total, this event drew 12 faculty and 9 staff representing 18 departments.

Advisory Boards and Committees

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.

Dr. Sample McMeeking served as an outside member on the School of Education's Diversity, Equity, and Inclusion cluster hire (2015).

Drs. Maertens and Sample McMeeking reviewed National Science Foundation proposals for CSU faculty before submission (2015).

Dr. Sample McMeeking served on both National Science Foundation and U.S Department of Education review panels (2015).

STATE AND LOCAL COMMUNITIES

Drs. Chavez, Kennedy, and Sample McMeeking have represented the STEM Center and Colorado State University at many state and local functions. They have also formed partnerships with local area schools, connecting school administrators to CSU faculty and staff, developing curriculum in collaboration with other CSU faculty and staff, and finding potential resources to be used in the schools. Research opportunities have also formed through these school partnerships.

The Louis Stokes Colorado Alliance for Minority Participation (CO-AMP)

Dr. Chavez attended the CO-AMP conference over two days in May, 2014. This same conference was co-sponsored by the STEM Center.

Rotary Club of Fort Collins, Colorado

Dr. Chavez has been attending regular meetings with the Rotary Club of Fort Collins. From these meetings, the development of a small \$7,000 grant to work with the Poudre School District has been discussed.

Collaboration Meetings outside of CSU

Dr. Chavez attended meetings with the University of Idaho (June 2014) and the Chair of CS department at South Dakota School of Mines (August 2014) regarding collaborations with the STEM Center at CSU.

STEM Education Policy

STEM initiatives

The STEM center has attended several meetings with local and regional schools to provide guidance and insight in developing and implementing STEM initiatives in their schools. More specifically, during 2014, Dr. Chavez has attended meetings with the Poudre School District (March), Adams City High School (April), Colorado State Alliance Schools (April, December) and DPS (October 2014)

Association for Public and Land-grant Universities STEM Education Center Network

The APLU's STEM Education Center network, funded through the Alfred P. Sloan Foundation, is in their final year of bringing together STEM Centers around the country that are engaged with research and faculty activities around transforming undergraduate STEM teaching and learning. In September CSU's STEM Center was represented at the STEM Education Center workshop in St. Louis. About fifty STEM Center directors from across the country attended as well. Our Center is fairly unique and no two centers seemed to be exactly the same. Some were housed in individual colleges and reported to the dean. Multi-college centers generally reported to the Provost or VPR. Many of the centers deal primarily with K-12 outreach and teacher preparations. One was an independent research entity.

Several large centers were quite broad in their approaches including funding for Math Science Partnerships, UTeach models, Noyce Scholars along with outreach. In the near future the CSU STEM Center will be showcased by APLU at <http://serc.carleton.edu/StemEdCenters/profiles.html>.

Colorado STEM Education Roadmap and Education Plan

The Colorado Legacy Foundation and the Colorado Department of Education are engaged in a three year project to improve STEM education in Colorado by developing and implementing a roadmap and action plan. Currently, the Foundation is running several working groups with Colorado teachers, university faculty, workforce representative, and others to inform the development and implementation of the Roadmap and Action Plan. Drs. Chavez and Sample McMeeking will participate in future development and implementation work through attendance at think tank meetings and commitments to participate in focus groups.

STEM Education Liaison

Roosevelt High School STEM Academy

The STEM Center has partnered with Roosevelt High School as they develop and implement a new Sustainability and Water Resources focused STEM Academy within the school. The 2013-2014 school year marked the first year of the STEM Academy, and as the first cohort of students progresses and new students are accepted into the program, the STEM Center will collaborate with CSU and Roosevelt High School faculty to develop curriculum, connect Roosevelt High School administrators and faculty to outreach opportunities on campus in which students can participate during school hours, and run a summer Algebra-focused camp to help prepare incoming freshman entering Geometry.

Overland High School Institute of Science & Technology

CSU STEM Center staff has met with the Institute of Science & Technology housed at the Overland-Prairie Campus in Cherry Creek School District. The program offers concentrations several STEM-related areas in order to inspire students to be creative, critical thinkers and collaborative learners who will be competitive in the global STEM workforce.

Denver Museum of Nature and Science Smithsonian Curriculum Implementation

Dr. Sample McMeeking has collaborated with several colleagues from CSU to forge a partnership with the Denver Museum of Nature and Science as they adapt and implement an effective Elementary and Middle School curriculum within Colorado. The STEM Center is currently working with the contracted evaluator for the Smithsonian LASER curriculum to train teacher observers for evaluation work.

Collaborative Research with Schools

What does STEM mean in a school community?

Drs. Balgopal (School of Education) and Sample McMeeking are collaborating with two Poudre School District schools who have become STEM-centric to evaluate the perceptions of administrators', teachers', and students' perceptions on what STEM means and how it impacts their lives. A publication in partnership with the administrators of one of the schools is forthcoming.

Little Shop of Physics Teacher Kits for Poudre School District

The Little Shop of Physics has partnered with the STEM Center to evaluate their teacher kits which have gone to almost all elementary schools in the Poudre School District. Evaluation work concerning teachers' use and adaptation of the kits for the classroom as well as changes in student engagement in science content will be studied.

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 principle investigator and co-principle 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 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.

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