Mission

The College of Natural Sciences Education & Outreach Center is an incubator for innovation in STEM education.

We serve both CSU and 4th-12th grade students and faculty through a variety of programs. Many of our programs focus on authentic scientific research experiences that aim to promote enthusiasm for the STEM disciplines, especially for students traditionally underrepresented in these fields.

Particular emphasis is on finding new ways to promote scientific creativity and innovation, attributes essential for global challenges in the 21st century.
Discovery Begins Here

The Natural Sciences are relevant to everyone. However, STEM (Science, Technology, Engineering, and Mathematics) subjects are not always presented in school in a way that captures imaginations and inspires students to pursue STEM careers. This is especially true for female and minority students.

Our solution to this problem harnesses the intellect of the College of Natural Sciences faculty at CSU. In addition to teaching, they are actively conducting basic and applied research relevant to the needs of society. We collaborate with these faculty to translate their top research into unique STEM experiences and kits for 4th through 12th grade students that aim to inspire the next generation to want to learn more about the sciences. Our programs have reached students and educators at all levels – local to global.
News from the Director

We have lots of exciting news and projects! Here is just a sampling of what we have going on this year:

Compass Community Collaborative School
Our long-term colleague, Jan Harrison, has undertaken the ambitious goal of re-imagining education in Fort Collins. Building on successful model schools like High-Tech High School in San Diego, Jan’s team is designing a school where students learn through meaningful work in the community. The Poudre School District has granted their charter application and they are now preparing their new space which is intentionally located beside the Spring Creek MAX station. This will allow Compass students (see cover) to easily come to the EOC and make it easy for our Natural Science Education majors to go apprentice with their teachers. Partnering with this school will be a phenomenal addition to our program!

Doubling the Time for Science Methods
We have been supporting professors Vincent Basile and Danny Birmingham in their quest to strengthen the pre-service STEM education program at CSU. One of our long-term dreams has been to make the EDUC 460 Science Methods course last a year, rather than just one semester. Professor Basile came up with a clever solution that we are really excited about. It merges the Tech Ed course with Science Methods and allows the course to align better with the Next Generation Science Standards.

CSU Energy Club Hosts Energy Fridays
Students at the Powerhouse Energy Campus hosted two pilot “Energy Fridays” using our Get Energized! STEM kits. We arranged the school groups and the energy club delivered the program, which included a tour of the high-tech campus. The program was a great success and we look forward to distributing more field trips like this around CSU.
NABT Paper
Our collaboration with professors Cameron Ghalambor and Lisa Angeloni continues to evolve! Our paper, “Small fish, big questions: Inquiry kits for teaching evolution” just came out in The American Biology Teacher and we are receiving positive feedback. Check it out on ResearchGate.

Chemistry Collaborations
We have a bunch of exciting collaborations ongoing with chemistry faculty: solid state chemistry with Jamie Neilson, nano imaging with Justin Sambur, “chemometers” with Chuck Henry, and a low-cost CO₂ sensor with Matt Shores and Tony Rappé.

Triunfo’s Todos Santos Pen Pals
We have been sending science activities from our Triunfo Mentoring Program students to 3rd through 5th graders at Escuela Pacifica in Todos Santos. Various forms of secret code messages have been very popular! Professor Ursula Quillmann is sponsoring a new kit on Ocean Plastics that they will take to the schools they visit in Todos Santos.

NPS Vital Ice STEM Kits
We held two teacher professional development sessions at the “Engaging Alaska Youth in STEM and Community Resiliency” workshop hosted by NOAA at the University of Alaska, Fairbanks. We were fortunate to get input on our Vital Ice kit from Alaskan Native Elders and science teachers from every corner of the enormous state. We also got to tour the Permafrost Tunnel Research Facility, Denali and Kenai Fjords National Parks. The kits put real park ice data into the hands of students in an engaging way. We will be heading back to
Hawai'i this fall to continue our kit design work with Kaloko-Honokohau National Historical Park!

**AASHE Recognition**
The Association for the Advancement of Sustainability in Higher Education selected our partnership with the National Park Service and our Vital Ice STEM kit as a model public engagement program in their annual report!

**National Western Water Resources Center**
CSU is collaborating with Denver Water and a number of other partners on the design of a new Water Resources Center at the National Western Center in Denver. I was invited to lead the CSU side of the water education planning.

**Platte River Power Authority Supports STEM Fridays**
PRPA provides our electricity and now they are also providing funds for our STEM Friday bus transportation. Transportation expenses are a major barrier for many schools and PRPA's generosity will help us keep the program strong.

**Mike Viney, Master Teacher, Joins the EOC**
After 30 years in the classroom, “Mr. Viney” decided to retire at the top of his game. Our center has been collaborating with him almost every summer for about 20 of those years. We are lucky to have him for a few hours each week as an hourly Teacher-in-Residence.

Every week we meet new undergraduate, graduate, post-docs, faculty, and community members interested in STEM outreach. Their passion helps energize us as we look for even more ways to connect the dots.

Andrew Warnock, Ph.D., Director
“There is a theme to all of the educational opportunities that the CNSEOC provides. Whether it is field research or investigations performed in the classroom, they ask students to seek natural patterns based upon observations, data collection, and analysis. The CNSEOC develops and shares educational experiences that model critical thinking skills central to promoting the advancement of science.”

— Mike Viney, Retired Science Teacher, Blevins Middle School
Focus 1 STEM Experiences

Research questions, data collection and analysis, interpretation, and scientific communication are the basic elements that weave through each of our programs. Mathematics, culture, and place are used to help connect students to the science.

STEM Fridays
Pre-service science teachers help facilitate weekly hands-on experiences for 4th through 12th grade students and their teacher in our high-tech experiential learning lab or in the field at our GetWET water science site.

Colorado Science and Engineering Fair
As one of the top state science fairs in the nation, we draw on thousands of middle and high school students from the best teachers across the state of Colorado. The fair encourages authentic student driven research mentored by leading scientists and engineers. (www.csef.colostate.edu)

Keynotes and Workshops
Each semester we host a variety of keynote lectures or hands-on professional development workshops attended by CSU and K-12 faculty and students, as well as informal educators.

SciTrek
Our summer camp for high school juniors and seniors from around the country is a capstone experience where students contribute to our ongoing tree ring research project at Lory State Park.

MST-Day
Math-Science-Tech Day brings together culture and STEM. Sixteen classes of 4th grade students from five local schools with the highest percentages of students receiving free or reduced lunches participate in three 45-minute hands-on sessions presented by faculty followed by an interactive cultural performance.
The EOC has coordinated the Colorado Science and Engineering fair for close to two decades. Student winners go on to compete in the International Science and Engineering Fair. The Center does an outstanding job coordinating the fair for the state of Colorado. An important strength of the EOC is the stability of the staff. The Center builds upon past experiences, develops new programs, and brings in new partners. This is critical for long-term sustainability.

– Nancy Kellogg, Ph.D., Colorado Science Education Network
Focus 2 STEM Kits

The STEM Kits that we create are derived from the research projects of CSU faculty. We delve into their research methods to find the essence that we distill into an educational kit. How does the researcher approach a problem? What sorts of experiments are used to solve the problem? How can we give students the joy of discovery? These are the elements that make a great educational experience. Kits focus on scientific process, scientific illustration, data collection and analysis, and communication of results.

We develop several categories of kits:

**Broader Impacts/CAREER**
Faculty seeking funding from the National Science Foundation are required to have a concrete plan for how they will inform society about the importance of their work. We make it easy for them to reach a wide audience.

**Distance Learning**
The Masters of Natural Science Education degree serves science teachers globally. A key piece of this exciting program is that every course includes a hands-on lab component. We work with faculty on the design of these labs. We also assemble and ship the kits.

**National Parks**
Since 2012, we have been collaborating with the National Park Service on the design of hands-on STEM kits for schools that surround National Parks in Hawai‘i and Alaska.

**Foundations & Donors**
We have developed kits with specific grants from foundations and gifts from private donors. We are always seeking new partnerships to support our kit lending program.
“I am grateful for having colleagues like the three of you who share a passion for improving science education. Your support of both research and teaching is invaluable. I love being able to brainstorm with all of you about how CSU can meet K-16 teachers’ needs to improve student learning outcomes and attitudes about science and mathematics.”

— Meena Balgopal, Associate Professor of Biology, CSU
Kits are packaged to be used individually or by pairs of students and are easy to transport. Teachers and informal educators can check out a classroom set of 15 kits for a week at a time. Because the kits are largely self-guided, students can work at their own pace and teachers are freed up to help the students who are struggling or suggest extensions for kids who want more.

**Biology**
Small Fish - Big Questions  
Hominid Skulls  
Secrets of the Marmot

**Chemistry**
Get Energized!  
The CO\textsubscript{2} Kit (*coming soon*)  
Solid State Diffusion (*coming soon*)  
Chemometers (*coming soon*)

**Computer Sciences**
Pico Pong

**Earth & Environmental Sciences**
Anchialine Pools  
Vital Ice  
Really Ancient Fossils  
Soil Carbon

**Engineering**
Solar Cars

**Physics**
Regen  
Get Critical!
“You have influenced my students directly through STEM Fridays, you have helped me maintain my enthusiasm as a teacher through seminars, and you have opened conversations with teachers and given us tools for teaching controversial topics such as fracking and evolution. You provide continuing education for me in a manner that is not readily available elsewhere.”

— Vicky Jordan, Retired Science Teacher, Wellington Middle School
Focus 4 Mentoring

Pre-Service Teachers
Our center offers opportunities for enthusiastic CSU students to see how effective hands-on teaching methods can be.

- The approximately 55 students in the Bachelors of Science in Natural Science major are advised through our center.

- Our center is the home of the STEM Educators Club, where we offer space to study, coffee and snacks, trips to conferences, and opportunities to connect with schools and teachers (e.g. STEM Fridays and Compass).

In-Service Teachers
The best teachers are life-long learners themselves. We offer a selection of opportunities for teachers to reinvigorate their passion for teaching.

- STEM Fridays allow us to show teachers in real-time what elements are needed to create successful hands-on STEM lessons for their students.

- A variety of Professional Development Workshops and Lectures provide networking opportunities and support for topics that are difficult to teach (e.g. data analysis).

Under-Represented in STEM Fields
All of our programs strive to encourage young women and minority students to consider a STEM career. Two programs in particular include their success as the primary goal.

- SciTrek and SummerVet are weeklong summer camps that attract mostly female students from across the nation.

- The weekly after-school Triunfo Mentoring Program pairs first-generation college students with mostly Hispanic youth for homework help and STEM activities.
Each pin represents a student or teacher who has participated in one of our programs or who uses our materials.
“The students were completely engaged. They love trial and error learning and this was perfect! They were learning from their mistakes and making minor adjustments and seeing instant changes. It was great!”

– Jayme Sneider, Westview Middle School, Longmont
The EOC staff is supported by the College of Natural Sciences and constitutes 0.5% of the college’s annual resident instruction budget. Additional funds are derived from participation in grants led primarily by college faculty at large and led by EOC staff from the National Park Service, Bohemian Foundation, and private individuals.

"As a teacher, I look forward every week to having the lessons of the week revisited and explained from a different point of view by college students. This is a tremendously valuable experience for these kids, especially because many of them have no family members who have had the college experience. My fourth graders get to actually sit in a college lab with college students just a few years older than they are and this makes the goal of attending college seem more attainable. Tutoring is the highlight of many of these kids' week.”

— César Fuentes, Teacher, Harris Bilingual Immersion School
Thanks to our Supporters!

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Numerous CSEF, Triunfo, and MST-Day volunteers

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