“It was an awesome experience being able to feel what it’s really like to work on research and come up with answers that are actually important in the real world.”

Re-imagining

Undergraduate Research in CEAS

Undergraduate research (UGR) is an important part of the student experience in the College of Engineering and Applied Science (CEAS) at CU Boulder. Research is a primary way students can “Gain Relevant Experience,” a key variable in the College’s ProReady initiative. CEAS students who have participated in UGR cite positive learning outcomes from their experience and develop critical workplace competencies, such as communication, critical thinking, teamwork, networking, and problem solving. In addition, UGR participants learn how to approach real-world problems and projects first hand.

UGR also positively impacts persistence, retention, and career success, especially for underrepresented minority (URM) students. Many CEAS students reported increased excitement and motivation about their academic program once involved with UGR, with some beginning to consider graduate school as a viable post-graduate option. URM students who participate in UGR programs, such as CU Boulder’s Biological Sciences Initiatives (BSI) Scholars, have six-year graduation rates over 40% higher than other CEAS URM students (CU Boulder, 2018). The technical and workplace competencies students develop in their UGR experiences are positively viewed and highly sought after by employers who hire CEAS students (Employer Survey, 2020).
“The great thing about this program is that it forces you to develop independent learning skills.”

Currently, CEAS has many UGR options for students, including Summer Program for Undergraduate Research (SPUR), Discovery Learning Apprenticeship (DLA), Spring Break for Research, and Your Own Undergraduate Research Experience at CU (YOU'RE@CU). Approximately 160 CEAS students participate in these programs annually, with many more engaged in UGR outside these programs.

At the CU campus level, CEAS students can connect with programs including Undergraduate Research Opportunities Program (UROP), Biological Sciences Initiatives (BSI) Scholars, McNair Scholars, Summer Multicultural Access to Research Training (SMART) Scholars, and Colorado Space Grant Consortium (COSG). UGR opportunities are also available on a national level, including NSF Research Experiences for Undergraduates (REUs).

Though opportunities are available, CEAS does not have a unifying strategic vision for UGR that tie these programs together in a cogent, intentional way. UGR opportunities are not well known amongst the student body, nor are the accomplishments of students or faculty/graduate student mentors. We want UGR opportunities to be more accessible and demonstrate to students how UGR can impact their academic and ProReady goals.

By shining a spotlight on UGR opportunities in CEAS and across campus, we hope to demystify the idea of UGR research and help students realize that they can, and should, be involved in cutting edge research at CU Boulder.
The Council on Undergraduate Research (CUR) defines UGR as “an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline.” CUR outlines the benefits of involving students in undergraduate research to include:

- Enhancing student learning through mentoring relationships with faculty
- Increasing student retention
- Increasing enrollment in graduate education and providing effective career preparation
- Developing critical thinking, creativity, problem solving and intellectual independence
- Developing an understanding of research methodology
- Promoting an innovation-oriented culture

The extant literature on the impact of UGR is fairly conclusive. Kuh (2008) identifies UGR as a “high-impact practice,” or an intentional activity that contributes to the learning and engagement of college students. Specifically, Kuh notes that UGR “[involves] students with actively contested questions, empirical observation, cutting-edge technologies, and the sense of excitement that comes from working to answer important questions.”

Further literature on STEM-focused UGR supports Kuh’s assertion. UGR participation has shown to have a positive impact on persistence and retention, engagement with faculty, and academic success and self-efficacy of STEM students. UGR participants also experienced deeper levels of curricular learning and technical development, solidification of career and graduate school/research interests, and ProReady competency development. In addition, UGR has been linked to similar (or better) outcomes for underrepresented minority (URM) and female students.
Undergraduate Research (UGR) Strategic Vision & Pillars

With a broad foundation of current opportunities and the ProReady initiative, CEAS is well-positioned to achieve a Strategic Vision “to scale our existing UGR capacity to intentionally impact more students.” We can achieve this Strategic Vision through the following Pillars:

1. Create a culture where UGR is a signature component of the CEAS student experience

2. Maximize UGR impact and participation by fostering an inclusive environment

3. Invest in UGR faculty and graduate student mentors

4. Align and maximize financial, human, and analytical UGR resources
Pillar #1: Create a culture where UGR is a signature component of the CEAS student experience

CEAS will actively work to create a culture where UGR is a signature part of the student and ProReady experience. To achieve this goal, action items may include:

- Establish a named UGR program that unifies existing and future UGR opportunities across CEAS
- Develop a clear programmatic mission and appropriate goals, learning outcomes, and key performance indicators that align with the CEAS Strategic Vision and campus-level goals
- Cultivate support for UGR by involving key stakeholders in the development of the UGR program (ex: CEAS leadership, chairs, research centers, mentors, students, alumni, etc.)
- Develop a comprehensive marketing strategy to drive awareness of the UGR program in compliment with CEAS’s overall marketing, communication, and reputation building goals.
Pillar #2: Maximize UGR impact and participation by fostering an inclusive environment

UGR is shown to make a significant impact on persistence, retention, graduation, and ProReady outcomes. We believe CEAS has capacity to support more UGR participants, especially underrepresented minority (URM), first-generation, Pell-eligible, and women students. To achieve this goal, action items may include:

• Leverage the UGR program as a key driver of student persistence, retention, graduation, and ProReady outcomes.
• Communicate the value of UGR participation to students across the life cycle, including prospective, admitted, and incumbent students.
• Expand the number of research opportunities available to students to meet the current unmet demand.
• Educate CEAS faculty, staff, advisors, and relevant stakeholders on the benefits of UGR participation.
• Develop and implement a program structure that promotes diversity, equity and inclusion.
• Develop and implement a marketing campaign that would feature inclusivity and communicate norms surrounding UGR.
Pillar #3: Invest in UGR faculty and graduate student mentors

Development of a quality, comprehensive UGR program is not possible without the support of faculty and graduate student mentors. In order to more deeply invest in UGR mentors, action items may include:

- Equip faculty and graduate students to be successful UGR mentors by developing a training and support infrastructure steeped in research and best practices.
- Develop meaningful incentives to increase faculty and graduate student participation in UGR mentorship.
- Celebrate UGR mentors and amplify their contributions, such as a College-level spotlights and an annual recognition program.
- Develop incentives for faculty/graduate student mentors for new and ongoing UGR student hires in their labs, including financial support and affirmation of mentorship in the reappointment, tenure, and promotion process.
Pillar #4: Align and maximize financial, human, and analytical UGR resources

Proper commitment and alignment of financial, human, and analytical resources will ensure the long-term growth and sustainability of UGR in CEAS. To achieve this goal, action items may include:

- Allocate 1.0 FTE for a professional staff member (with Instructor credentials, if applicable) to grow and manage a comprehensive UGR program rooted in strategic vision, goals, and best practices.
- Allocate appropriate operating budget and leverage all possible funding sources (ex: CU/CEAS funds, Engineering Excellence Fund, external grants, advancement, etc.)
- Implement a comprehensive assessment plan of UGR experiences to measure for impact, effectiveness, and areas for improvement.
References


Kuh, G.D., (2008). High impact educational practices: What they are, who has access to them, and why they matter. AAC&U.


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