

Integrating Undergraduate Research into the Geosciences at a Two-Year College Kaatje Kraft, Mesa Community College

Research supports that undergraduate research (UGR) is critical for preparing students to be successful in STEM domains. In addition, there is evidence that participating in UGR can lead to greater persistence and can also result in an increase in STEM majors, particularly underrepresented minorities (Espinosa, 2011; Brandt & Hayes, 2012). It should not be a surprise that the Presidents Council of Advisors on Science and Teaching (Holdren & Lander, 2012) have identified UGR at the two-year college (2YC) as an important initiative in possibly broadening the participation of STEM majors. The challenges to integrating UGR at 2YC's are not ones to be taken lightly. Students may not be prepared for the rigor that is entailed in authentic research. For example, more than 50% of all students entering MCC require at least one developmental course in English, reading and/or math. Geology at MCC does not have any prerequisites, and as such, many students are co-enrolled in developmental courses and geology courses. This is mixed with students who are high achieving honors students looking to have a cheaper education for their first years prior to transfer. In addition, research often requires equipment that is expensive and time outside of the classroom that may not be available to commuter students. Finding creative ways to provide quality UGR experiences for students is an important challenge to tackle, but one that requires creativity and tenacity by the faculty member.

Kaatje Kraft (geology) and Niccole Cervený (physical geography) have both found creative ways to implement UGR for their students. Dr. Cervený was awarded an NSF grant (#0837451) to develop a curriculum and do research on the rock art stability in the Petrified Forest National Park. She brought students up multiple times during the semester as extra credit opportunities, offered a field course in the summer for those students who wanted to spend more extended time periods and used partnerships with colleagues at ASU and CSU for student who chose to pursue deeper research opportunities. Each trip, students were trained in assessing the risk of the rock art using the Rock Art Stability Index (RASI), developed by Dr. Cervený and students were gathering data for a larger research assessment. So while no one student did all of the research, each student was able to experience what it means to collect real data in the field. Several of these students are now completing their undergraduate and/or graduate degrees in the geosciences.

Dr. Kraft used a serendipitous encounter with erosion problems on campus to develop a course-based undergraduate research opportunity for students. She brought a case of differential weathering into her geologic disasters lab and asked them to determine the cause of the erosion patterns. Students worked in teams to develop hypotheses, collected data and presented their findings, including recommendations for remediation to the administration on campus. Students used the tools available, which at times were extremely rudimentary (e.g., used a junior Brunton compass to measure the slope of the parking lot in 10 foot increments), but each group was able to answer their own hypothesis. Different groups had different levels of complexity with their research projects based on their own background knowledge and capabilities, which allowed for

differential instruction. All of the student successfully completed the lab course and two students collaborated with Dr. Kraft to present their findings at the annual GSA meeting in Denver. Only one student from that class is pursuing the geosciences as a major, however, the skills the students developed in that project are the kinds of soft skills employers are looking for with all students and prepares them to be successful in future courses.

Pursuing UGR at a two-year college takes time, energy, and creativity, but in the end students learn skills beyond the content, they are more likely to persist and we can prepare students to make successful transitions to four-year institutions so they can pursue their passion and be successful doing so.

Brandt, L. S. E., & Hayes, J. L. (2012). Broader impacts of undergraduate research at a community college: Opening doors to new ideas. *CUR Quarterly*, 33(1), 17-21.

Espinosa, L. L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. *Harvard Educational Review*, 81(2), 209-240.

Holdren, J. P., & Lander, E. (2012). *Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering, and mathematics*. President's Council of Advisors on Science and Technology.