Leveraging Remote Instrument Operation Technologies to Bring Real Research Experiences into Undergraduate Geoscience Courses

JEFFREY G. RYAN[1], JAMES H. MACDONALD[2], ROSEMARY HICKEY-VARGAS[3], MARY BECK[4], CHRIS VIDITO[3], VICTOR J. RICCHEZZA[1]

[1]School of Geosciences, University of South Florida (USF), Tampa, FL. USA; ryan@mail.usf.edu
[2]Marine and Ecological Sciences, Florida Gulf Coast University (FGCU), Fort Myers, FL
[3]Earth and Environment, Florida International University (FIU), Miami, FL
[4]Valencia College, Orlando, FL

Undergraduate research is recognized as a high-impact STEM pedagogy, and strategies for providing research experiences in undergraduate STEM courses and curricula has been identified as a key priority in the USA (PCAST, 2012; NRC, 2015). However, course-based undergraduate research experiences (CUREs) pose serious challenges in terms of costs and sustainability, especially as regards using any kind of analytical instrumentation.

With support from the National Science Foundation, we have been examining the educational efficacy of building research microbeam instrumentation (SEM and EPMA, at the Florida Center for Analytical Electron Microscopy, FIU) into upper- and lower-level geoscience courses via remote operations technologies, which allow students to use these instruments in the classroom in structured labs and more open-ended investigations.

Two of our current implementations constitute CUREs: examining feldspar compositional variations in western US granitoids (FGCU), and boninite mineral chemistry variations in samples from IODP Expedition 352 (USF). In both cases students explore samples and thin sections that are the focus of faculty research, and the data collected both address hypotheses posed in class, as well as support faculty scholarly objectives.

Student responses to these experiences have been strongly positive. A subset of students in both courses (~20-25% each year at USF) pursue post-course investigations using the FCAEM instrumentation they have learned to use. Course fees cover the comparatively modest expenses involved with sample preparation and instrument use, though extended lead times (for thin section preparation and sample acquisition) can be an issue. International initiatives such as IODP afford a rich source for samples to investigate, as well as extensive cruise-related datasets to support student research efforts.