

Chapter 14

Getting to the Core: Undergraduate Research on Ocean Cores and Collaborative Scientific Project Management

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EXECUTIVE SUMMARY

A semester-long project for senior undergraduate students was completed in a capstone course that focused on the analysis of ocean cores from the northern Gulf of Mexico continental shelf. The course was designed to facilitate students' synthesis of their studies in geosciences by participating in laboratory studies, group work, and scientific writing on a complex project. The course structure, laboratory methods, technology uses and outcomes provide a framework for project-based courses in geosciences which hold inquiry as the central theme using ocean cores as instructional technology.

INTRODUCTION

Engaging students in the STEM classroom is a goal for STEM educators no matter what the age-group or discipline. Striving for that 'a-hah' moment, or having students engrossed in an experiment transcends the typical expert-novice dynamic that can pervade a scientific classroom. Teaching the process of research can help to break down those barriers and bring about a teamwork attitude of exploration

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which mimics the best research organizations in operation today. Searching for that elusive hook –the story that binds the research together– can be a worthwhile but daunting task. My professional development experience participating in a School of Rock expedition through the Integrated Ocean Drilling Program (IODP) and Deep Earth Academy led to developing a course on oceanographic exploration of extracted ocean sediment, or ocean cores. This research experience for senior geosciences students in a capstone course helped to facilitate the atmosphere of discovery in the classroom.

A research-based capstone course is best executed when it incorporates many high-impact practices into a cohesive course and more post-secondary institutions value integrative experiences in the undergraduate classroom. The Association of American Colleges and Universities (AAC&U) currently is supporting the LEAP initiative which outlines essential learning outcomes often achieved by adopting high-impact practices, which include writing intensive courses, undergraduate research, collaborative projects, service learning and capstone courses (Kuh, 2008). The collaborative problem-solving inquiry-based activity of executing a successful ocean core analysis requires analytical, teamwork and writing skills. The use of scientific experiments and communication technology can help facilitate the connection between the classroom and the greater scientific community, in particular when the ocean cores have been shipped from a distant body of water. What I will describe in the next few sections is how an ocean core analysis can become impetus for an inquiry-based writing-intensive course, a project-based curriculum and a narrative for the scientific world outside of the small confines of a state comprehensive university.

Oceanography can be a compelling discipline in which to engage students. Ocean exploration is considered one of the final frontiers, where the depths of the oceans remain largely unexplored. The current organization responsible for deep-sea drilling is the IODP which is a conglomerate of Japanese, European and US-funded programs. Scientific deep sea drilling has been occurring since 1964 with the *Glomar Challenger* leading the initial voyages of deep ocean drilling under the Deep Sea Drilling Program (DSDP) for the United States. The organization changed to an international consortium, the Ocean Drilling Project (ODP), in 1985 bringing the *JOIDES Resolution* into operation for scientific ocean drilling and retiring the *Glomar Challenger*. With the recent dedication of another drill ship, the *Chikyu*, a renovation of the *JOIDES Resolution* and a broader international consortium, deep sea ocean drilling has been conducted under IODP since 2003. Deep sea drilling today is accomplished by the large vessels the *Chikyu* and the *JOIDES Resolution* and smaller vessels, like the *Marion Dufresne*. Forty years worth of historic ocean cores are stored in three different repository facilities in Japan, Germany and the US, depending on the site location from which the cores were extracted. These cores have been instrumental in many discoveries in earth science and oceanography including:

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