

I. Abstract

To increase the visibility of the PI's efforts to integrate electron microscopy into K-12 project-based curriculum, we propose to solidify a collaboration between PSU faculty who are electron microscopy experts and local high school science teachers who want to bring a scanning electron microscope (SEM) into their classrooms. The modern SEM is an ideal tool to introduce to high school students. It is easy, fun to operate, and produces a rich accessible dataset that can reinforce learning standards and excite students about science. This project will enhance the PI's existing courses designed to empower teachers with the skills and experiences needed to mentor project-based activities that utilize a SEM.

Our program will generate (a) a high-school textbook that introduces how and why a SEM works and explains with numerous examples how to use a SEM in inquiry driven project-based curriculum modules that reinforce key science and engineering learning standards; (b) scholarly publications that report our innovative curriculum and its impact on teachers and students; and (c) two new grant proposals that will expand this project to high school classrooms located across the United States, essentially to wherever there are teachers with access to an SEM and a desire to reveal to their students a new submicroscopic perspective on the world.

II. Overview and Expected Outcomes

In summary, this project will combine the existing teaching and research efforts of the PIs in a creative new way that will increase their national visibility: it will lay the foundation for a large-scale project that Cady will champion to connect electron microscopy experts at universities and companies nationwide with high school teachers who are motivated to advance student's comprehension of scientific concepts via a research-grade technology tool (SEM) and give students access to a new portal into the submicroscopic world. The PIs and high school teachers will draft an innovative textbook focused on SEM user training (i.e., the teacher-training section) and inquiry driven project-based modules (i.e., the curriculum module section) designed to allow teachers to integrate the technology tool into their existing curriculum for the purpose of reinforcing core topics aligned with national and state science benchmarks. The PIs will pilot test the teacher-training section of the textbook in their existing undergraduate and pre-service/in-service professional development courses. The local high school teachers, in collaboration with the PIs, will pilot test the curriculum module section of the textbook in their classrooms. After teacher and student and collaborative feedback (i.e., from collaborators at PSU's Center of Science Education and colleagues involved in geoscience teacher education), a modified textbook will be pilot tested in a select number of urban and rural school districts across Oregon. The PIs and high school teachers will produce scholarly papers that describe key curriculum modules as well as our assessments of the impact the curriculum and technology exposure has had on the teachers trained on a SEM in our classes at PSU and on the high school students trained by these teachers on a SEM in their classrooms (i.e., using a standard research-grade SEM accessed remotely or via a portable table-top research-grade unit or by using SEM simulation software). The PIs will use this project to strengthen related renewal proposals and as a seed grant to pursue major large-scale funding proposals to test the curriculum in high schools across the US.

III. The Impact of a New Community Partnership

The project will have a significant impact on PI Cady, who will take the lead on drafting a textbook (essentially a teaching manual) and writing a major proposal to expand this project on a national level. The first section of the textbook (teacher-training section) will explain how a scanning electron microscope works and how to use it. Experiential training exercises that require access to a SEM or SEM simulation software will be provided. The second section of the textbook (curriculum module section) will consist of project-based modules in which students can use a SEM to complete the curriculum assignments, prepare for regional and national science fair competitions, and acquire data for their college entry portfolios (i.e., via inquiry-driven research projects conducted with the use of a SEM (i.e., an advanced research-grade technology tool)). Six initial project-based instructional modules will cover topics in Forensic Science, Material Science, Geology, Physics, Chemistry, and Biology. Though PI Cady is still currently exploring which potential federal programs will be optimal in terms of competitiveness and magnitude of funding stream with colleagues at the Center for Science Education, she is modeling her vision of a large-scale project after Project MICRO (Microscopy in Curriculum-Research Outreach) (also see link to Bergman and Schooley (2003) on the Project MICRO home page: "<http://www.microscopy.org/ProjectMICRO/HomePage.html>"). Project MICRO is a self-sustaining program that puts trained Microscopy Society of America members,