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The "WOW Factor": Using Scanning Electron Microscopy to Stimulate Interest in STEM Disciplines.

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A Scanning Electron Microscope (SEM) is a technological asset that is typically reserved for the sole use of graduate students or research faculty. Can the SEM serve as a catalyst for sparking interest in STEM disciplines? Is it an effective teaching tool, and can it transform learning experiences for students, faculty and staff? At Schoolcraft College, the SEM is being used to strengthen basic science and critical thinking skills, foster partnerships, promote multidisciplinary projects and support college initiatives. In addition, the SEM has been discovered to be an incredibly useful tool to pique the interest of students and members of the community of all ages in STEM disciplines.

Schoolcraft College is an open door community college located in Livonia, Michigan. The total student enrollment tops 30,000. Schoolcraft serves the southeastern Michigan counties of Wayne, Oakland, Washtenaw and primarily surrounding Detroit suburbs. It serves as a feeder school for University of Michigan-Dearborn, Wayne State University, Eastern Michigan University, Madonna University and the University of Toledo.

In 2008, the new 48,000 sq. ft. Biomedical Technology Center opened on campus with the intent to bring science, technology, engineering and mathematics (STEM) focused programs together. Working interdepartmentally, the Sciences and Business & Technology Divisions proposed the purchase of a scanning electron microscope for use by natural sciences, metallurgy, materials science and eventual multidisciplinary projects. Purchase and installation of the Zeiss EVO LS-15 microscope was completed by the start of fall classes. The microscope specifications include a variable pressure system, a large 15" chamber, and an electronically cooled specimen stage with humidity injection that optimizes it for life sciences work.

The SEM is housed in the Imaging and Analysis Laboratory which was designed so the microscope would be a central feature of the classroom. The unique floor plan allows for both lecture delivery and collaborative work by incorporating group areas and front-facing seating. Media outputs and a high definition data projector facilitate presentation of SEM images and the microscope control software interface to the entire classroom. The combined equipment and configuration of this lab make it an excellent facility for both teaching and conducting community outreach.

The first step in making the SEM a transformational tool for learning was to train faculty and staff to use the SEM. Two faculty and one staff member received 40 hours of initial training from the microscope manufacturer. The next step was to train additional faculty and staff members from a variety of disciplines to use the SEM. As a result, a four hour introductory SEM workshop was developed. At the end of this concise workshop, participants receive an image acquisition and sputter coater certification. In addition, successful completion of the workshop entitles participants to schedule supervised lab time for use of the SEM and sample preparation equipment. This enables a wide range of faculty and staff to incorporate the SEM into their classes, projects and college initiatives.

The SEM was incorporated into the curriculum through development of Biology 140 Scanning Electron Microscopy. The BIOL 140 course introduces students to techniques necessary to prepare organic and inorganic specimens. Students also become familiar with the principles and operating modes of the SEM and the x-ray analysis system, electron-specimen interactions, image processing, elemental analysis, effects of microscope variables on images, routine maintenance and the use of various microscope accessories and digital outputs. The course does not have any prerequisites, with the intent to allow as many students as possible to utilize the SEM as a gateway to learn about science and the principles of scientific inquiry.

Schoolcraft College has continued to explore additional ways to utilize the SEM. Community outreach has been proven to be an effective way to reach a wide range of students. Typical community outreach activities include performing demos of the SEM to local middle school and high school students, community groups and to classes in a variety of different programs at Schoolcraft College. In October 2015, Schoolcraft College partnered with Michigan Technological University to bring the Mind Trekkers STEM Road Show to Livonia, MI. This event is geared toward sparking community-wide interest in the STEM fields by incorporating an astounding amount of experiments, demos and hands-on activities into a high-energy and fun atmosphere. The SEM demonstrations were received with a great deal of enthusiasm by kids and adults alike. Several techniques or "best practices" are used in each of these outreaches to keep the attention of the audience and to inspire an interest in STEM fields that stays with them beyond the event itself.

Figure 1. Students using the Zeiss EVO LS-15 microscope.

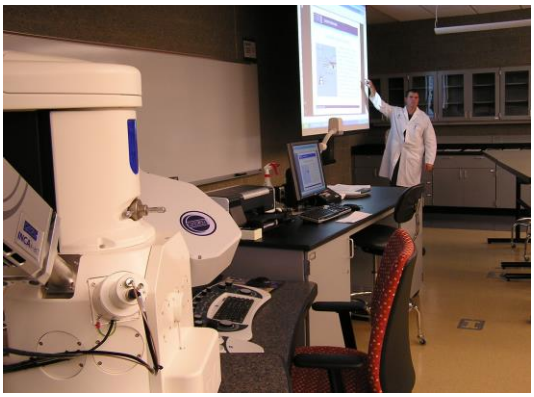

Figure 2. The SEM facilities at Schoolcraft College.

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