In the development of course materials for secondary education, it is essential to provide content that is exciting, current, and relevant to the students in order to promote their interest and engagement. This fact is especially true in the STEM (science, technology, engineering, and mathematics) fields. One method to encourage increased student engagement and interest is to provide visual demonstrations and hands-on experiences of the principles that are being discussed in a context that students can relate to in their own lives.

Using the field of biogeochemistry, an interdisciplinary geoscience that focuses on the relationship among biology, chemistry, and the environmental sciences, Dr. James Harrington and his co-workers at North Carolina State University designed and conducted a workshop to assist high-school and middle-school instructors in the development of learning modules aimed at teaching core chemical, biological, and soil science principles. The workshop is described in the 2013 volume of Natural Sciences Education.

The workshop, which was held over the course of two days at the Science House at North Carolina State University, was broken into modules that gave a broad perspective on metal biogeochemistry. The topics discussed included the sources, speciation, and fate of metals in the environment, as well as the role of metals as nutrients and toxicants in biological systems. The teachers were provided a PowerPoint presentation and interactive demonstrations that spoke to each of the topics and number of online resources that would allow them to explore the real-world applications of principles.

As an example of workshop activities, toxic metals in the environment focused on activities and experimental demonstrations, the occurrence, status, and geographic Superfund sites in the United States were explored via the “Scorecard website’s presentation of USEPA Scorecard website (http://scorecard.goodguide.com). The use of toxic metals in paint and their non- or less-toxic replacement in modern times was explored via the “Pigments through the Ages” website (www.webexhibits.org/pigments). Two demonstrations were presented to allow the participants to explore the concept of chemical contamination through the use of hard water. The first revolved around the effect of hard water on soap bubbles, showing that the calcium and magnesium ions in hard water inhibit bubble formation. A second demonstration presented a quantitative approach to determining calcium content through a colorimetric titration with EDTA solution spiked with calmagite solution. Additional modules containing interactive activities related to chemical reactions and fate of pollutants in the soil environment were included in the workshop.

Following the presentations by the workshop instructors, the participants were given time to develop lesson plans. They were also given an evaluation form where they rated various aspects of the workshop and their comfort with teaching the materials presented on a modified 4-point Likert scale. All of the participants expressed a high degree of confidence in their ability to integrate the materials they had learned into the body of their courses. Furthermore, the results of the survey taken after the conclusion of the workshop indicated a statistically significant improvement in the participants' confidence in their ability to teach the materials presented on the modified 4-point Likert scale.