Chapter 82
Environmental Science Education in the 21st Century:
Addressing the Challenges and Opportunities both Globally and at Home through Online Multimedia Innovation

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ABSTRACT

Technology is helping biology instructors redefine their pedagogical "toolboxes" for the 21st century classroom. Indeed, online multimedia learning tools are evolving to fill the niche to assist student transition from simple inquiry-based learning (textbooks, less student responsibility, rote memorization of facts) to professional science practice (higher-end inquiry, more student responsibility, higher order thinking). Moreover, these tools are creating interactive classrooms, empowering motivated instructors to be facilitators of learning who allow students opportunities to construct their own knowledge while exciting the next generation of thinkers, doers, and global-minded citizens. This chapter reviews one example of an online multimedia learning tool—the CHANCE research module—that is being used in high school and undergraduate classrooms in the United States, China, and other international locations to transform environmental science education by exposing students to international environmental issues and problems through the analysis and evaluation of real-research data from factual ecosystems, highlighting evidentiary support for the benefits and successes of these research-based modules, and showcasing what is being learned, through assessment research, about the use of these modules in Chinese undergraduate classrooms.

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INTRODUCTION

Introductory biology teaching at the undergraduate level must continue to evolve in order to keep pace with the rapidly changing and technologically complex, data-rich 21st century; to translate learning into productive skills and jobs; and to meet the urgent need to increase civic participation in science. The need for innovative, evidence-based teaching in undergraduate science curricula is well documented [for example, see Association of American Universities, 2012; Brewer & Smith, 2011; Singer, Nielsen, & Schweingruber, 2012). Nonetheless, science teaching continues to be dominated by traditional teaching approaches that focus on content rather than practice, eschew interdisciplinarity, and fail to engage a new generation of learners in the realities and challenges of today (Brewer & Smith, 2011). Research suggests that underrepresented minority groups in particular, fare more poorly than their majority peers in traditional science learning environments (Dirks & Cunningham, 2006; Huang, Taddese, & Walter, 2000; Seymour & Hewitt, 2000). A number of ethnic groups continue to be underrepresented in science, and this loss of talent is expected to impact the productivity of the nation in future years (Kelly, 2005; Nelson, 2007).

While traditional instruction continues to hold sway in many classrooms, there are new approaches to education that show promise for revolutionizing life science education. Today's introductory biology classrooms may be flipped, blended, flexed, integrated with technological tools, or be entirely online via pre-recorded videos and interactive tutorials, lectures or modules on defined topics. Laboratory courses may include pre-lab videos, virtual interaction with data sets in national data banks, and/or required online interactive readings of peer-reviewed papers provided by professional journals. Students may also learn through hands-on field experiences or in interactive websites created by non-governmental or governmental organizations, textbook publishers, and/or academic institutions.

Biology education is thus in the midst of a sea-change, described in the 2011 AAAS report *Vision and Change in Undergraduate Biology Education* (Brewer & Smith, 2011). Leaders in the field recognize the need for systemic change that will provide the learners of today with the skills they will need to be productive tomorrow while contributing to a more sustainable society, and as such, the *Vision and Change* report outlines the need for increased novel approaches to biology education. Implementation of new and transformative teaching approaches is difficult, as is the implementation of the interdisciplinary research to cultivate the transformation, because of numerous challenges within the classroom, across the college/university, or in the larger social arena (Roy et al., 2013). The present reality is that we are still far from complete nationwide adoption of innovative and more effective practice, and the *Discipline-Based Education Research* report (Singer, Nielsen, & Schweingruber, 2012), published after *Vision and Change,* highlights the continuing need for evidence-based research to drive curricular reform.

Optimism, however, is in the air; the trend for new and transformative pedagogical strategies and technologies is upward, and as such, more and more students and teachers are "breaking out of the box" of textbook-only coursework. Moreover, opportunities exist, now more than ever, for faculty to take a stand and test their pedagogical prowess by creating their own innovations and assessing the impacts their innovations have on student learning, attitudes, and behavior, while contributing to the nationwide momentum to move from *Vision* to *Change*. The focus of this chapter is to share one faculty member's quest to create—through partnerships around the globe—virtual, multimedia learning tools in which scientific concepts, actual research by real-world scientists, and global environmental realities come