The Power of Interdisciplinary/Multidisciplinary Courses and Curricula

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For the purposes of this section, I'm using the definitions proposed by Besselaar and Heimeriks in their 2001 paper presented at the 8th International Conference on Scientometrics and Infometrics, Sydney, Australia. Based on their definitions, multidisciplinary STEM courses can be thought of as courses that approach a topic from different angles, using different disciplinary approaches. Neither the theoretical perspectives nor the various disciplines are ultimately integrated. In contrast, they define interdisciplinary courses as those that create their own theoretical, conceptual, and methodological identity resulting in a more coherent and integrated view of the topic. There appears to be increasing evidence of the desire and need to break down the traditional "discipline silos" in favor of a more integrated study and understanding of complex systems. Such efforts are not easy and not without risk. However, the rewards in terms of improved student learning and understanding warrant increased emphasis of both interdisciplinary and multidisciplinary courses/curricula.

A discovery-based approach to learning in extended projects for first- and second-year biology and chemistry students is described by Moore and Fitchett. Frantz reported that an art and mathematics course provides new and different perspectives and insights into both disciplines within an interdisciplinary context. This is only one of a number of courses developed to achieve Mathematics Throughout the Curriculum (MTC), with the core course for the MTC project being Analytical Problem-Solving. A service-learning model that integrates community service with academic learning, the Engineering Projects in Community Service (EPICS) program, is discussed by Oakes and Jamieson. In the program, vertically integrated teams of 8–20 undergraduates from a variety of STEM and non-STEM disciplines work on community service projects. Educational links created among the sciences and between the sciences and mathematics fosters interdisciplinary learning. The Robotics Academy described by Dombach et al. is a means to achieve hands-on learning and constructivism in a multidisciplinary robotics design project. One of the essential findings of this approach is that students must be empowered to control the direction of the project if it is to be successful. Goldey describes two general education courses: a laboratory science course for non-science majors and a humanities course, linked by a common theme within the framework of a learning community. Each pair of courses has a teaching team consisting of two faculty members, one each from science and humanities, and two upper-class student "preceptors." The Mesolore Project described by Bakewell resulted in the development of an interdisciplinary course that explores Mesoamerican cultures from the integrated perspectives of biology, geography, history, linguistics, mathematics, literature, and the arts. In addition to achieving a broad understanding of Mesoamerican cultures, students develop an interdisciplinary approach that can be applied to complex inquiry and critical thinking in larger, non-Mesoamerican contexts.

Whereas there is a general understanding that interdisciplinary and multidisciplinary approaches to learning provide a more realistic and broader understanding of natural and manmade systems, discipline-based courses and curricula still dominate STEM education. Often institutional barriers impair the development and/or the sustainability of such efforts. Furthermore, such efforts can require a great deal of time, a commodity often in short supply at a university or college. Thus, the academy must place value on and provide support for interdisciplinary and multidisciplinary education and inquiry if it wishes to foster such activities.