Chapter 9
Collaborative Teams as a Means of Constructing Knowledge in the Life Sciences: Theory and Practice

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EXECUTIVE SUMMARY

The use of small collaborative learning teams in STEM classrooms is not new to the field of education. At the undergraduate level, evidence continues to accumulate that organizing students into groups in which they engage in knowledge construction by completing active learning tasks is an effective means to achieve student-learning objectives. However, this teaching method is rarely used by postsecondary faculty, especially in large-enrollment classes. An argument for the efficacy of this method is presented in three parts. This chapter first outlines the theoretical basis for collaborative group learning. Grounded in the literature, this theory is then translated into practice by discussing evidence-based advantages and challenges to creating collaborative learning environments. The chapter concludes with a discussion of a case study examining how the first author has implemented this method of collaborative instruction with a unique means of structuring groups within a large-enrollment non-majors biology classroom.

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ORGANIZATION BACKGROUND

Recent science education policy documents recommend that students learning science at all levels should be modeling the process of scientific discovery in their classrooms through inquiry-driven learning experiences (National Research Council, 2000). In the context of undergraduate life sciences education the American Association for the Advancement of the Sciences' (2011) *Vision and Change in Undergraduate Biology Education* also highlights the benefits of modeling the process of science after and during formal instruction by adopting student-centered classrooms at all levels from K-16. "In practice, student-centered classrooms tend to be interactive, inquiry-driven, cooperative, collaborative, and relevant. Classes authentically mirror the scientific process, convey the wonder of the natural world and the passion and curiosity of scientists, and encourage thinking" (AAAS, 2011, p. 7). This pedagogy, often called *scientific teaching*, is based on the idea that both the teaching and learning of science should model the methodologies of science and worldviews of scientists (Handelsman, *et al.*, 2004).

One of the most common means through which inquiry-based, student-centered instruction is implemented is by organizing students in larger classroom environments into small learning teams that promote cooperation, collaboration, and interaction in a more targeted manner than attempting to promote student-learning at the whole class level. These teams are typically groups of four to five students that work together to achieve classroom learning objectives in conjunction with, or independent of, the instructor (depending on the particular instructional methodology being implemented). At the postsecondary level, organizing students into collaborative groups in which they engage in knowledge construction by completing active learning tasks (within these groups) has been shown through Discipline-Based Education Research (DBER) to be an effective means to achieve critical learning objectives in Science, Technology, Engineering, and Mathematics (STEM) fields (Bowen, 2000; Springer, Stanne, & Donovan, 1999). More specifically, collaborative group work in in STEM classrooms increases academic achievement, promotes positive attitudes, increases students' reasoning ability and promotes student retention (Armstrong, Chang, & Brickman, 2007; Bowen, 2000; Jenson & Lawson, 2011; Johnson, Johnson, & Smith, 1998; McKinney & Graham-Buxton, 1993) as well as numerous other cognitive and affective advantages.

Despite the voluminous evidence base for team learning as a means for structuring effective student learning environments, widespread implementation and sustainability of these types of classrooms models at the undergraduate levels remains a challenge. This is often due to STEM faculty being uncomfortable with, or outright resistant to these research-based methodologies. As Tanner (2009) states in her series on undergraduate biology teaching and learning, "(O)ften, we as instructors feel that

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