**Active Learning, Participation, and Critical Thinking**

Prepared by Christopher Ruiz, ATL Graduate Fellow

**Burrowes, P A. (2003). A Student-Centered Approach to Teaching General Biology that really Works: Lord's Constructivist Model Put to a Test. *The American Biology Teacher* *65*(7), 491-502.**

Burrowes, upon viewing her teaching evaluations, read the following comment: “I sleep throughout most of my Biology lectures. My professor tries hard, but I just get tired of listening to so much information” (491). As a result, she suspected she might need to pivot away from lecturing as her primary method of instruction. Burrowes adopted an active learning model that leveraged group work and “offers students many chances to develop higher-order thinking skills through a variety of in class exercises” (497). She utilized what she calls a student-centered teaching approach, active learning, and cooperative groups (492). When comparing the outcomes of both her lecture-based classes and the new, active learning classes, Burrowes confirmed that the latter demonstrated significant improvement in both testing scores and satisfaction. Burrowes’ study provides evidence that employing active learning methods is “more effective than traditional instruction in promoting academic achievement, increasing conceptual understanding, developing higher level thinking skills, and enhancing students’ interest in biology” (500).

**Crone, J. A. (1997). Using Panel Debates to Increase Student Involvement in the Introductory Sociology Class. *Teaching Sociology* *25*(3), 214-218.**

Crone discusses how panel debates—when used in conjunction with lectures—help the whole class “become more conscious” of the course material. To organize a panel debate, Crone assigns four or five positions to a panel. Three or four of the positions will represent various viewpoints in the literature the class is studying, while the last will be a moderator position. The students are then tasked with fielding questions from the moderators and the class as a whole—arguing for their assigned perspective. In this way, students are challenged to see the interactions and nuance between the various positions. The passionate, sometimes heated, back and forth of friendly debate, “should help [students] become better critical thinkers” (214). Crone finds, in line with other literature, that the use of debates in class increased student motivation, “promoted critical thinking, and reinforced the material covered in class lectures, discussions, and assigned readings” (215). Crone suggests that panel debates could be employed in both large and small classrooms to beneficial effect (217).

**Freeman, S., Eddy, S.L., McDonough, M., Smith, M.K., Okoroafor, N., Jordt, H., & Wenderoth, M.P. (2014). Active Learning Increases Student Performance in Science, Engineering, and Mathematics. *Proceedings of the National Academy of Sciences of the United States of America* *111*(23), 8410-8415.**

The authors reviewed 225 studies “that reported data on examination scores or failure rates” in comparing STEM (science, technology, engineering, and mathematics) undergraduate courses. Their meta-analysis revealed that “average examination scores improved by about 6% in active learning sections” (8410). Additionally, the data showed lecture-based classes had a 55% higher failure rate in the analyzed examinations than those classes that employed active learning (8412). The active learning dimension of the assessed classes varied significantly, however. Classes were considered active learning classes if they included anything from “occasional group problem-solving, worksheets or tutorials completed during class, to the use of personal response systems with or without peers” (8410). Since the analysis covered such a wide swath of activities, isolating which exercises were most effective is difficult.

**Garside, C. (1996). Look Who's Talking: A Comparison of Lecture and Group Discussion Teaching Strategies in Developing Critical Thinking Skills. *Communication Education* *45*(3), 212-227.**

This study attempts to determine the difference in learning outcomes between lecture-based and small group discussion-based classes. Garside assessed learning outcomes in terms of both lower and higher-level learning, presupposing that critical thinking (higher-order) outcomes are more useful than rote memorization (lower-order) outcomes in a modern, complex society (212-213). Relying on Bloom’s Taxonomy, Garside describes lower-level learning as “knowledge, comprehension, and/or application of the material covered,” and higher-level learning as “analysis, synthesis, and/or evaluation of the material covered… (221).” The study concluded that no single method of instruction produced superior learning outcomes in both arenas, that is, it “did not find that these two instructional teaching strategies differentially impacted learning” (223). The lecture-based classrooms performed better on the lower-level learning, and—in line with existing literature—the discussion-based classes performed better on the higher-level learning metrics (223). Both instructional methods outperformed independent reading assignments (225).

**Michael, J. (2006). Where's the Evidence that Active Learning Works? *Advances in Physiology Education* *30*(4), 159-167.**

A growing body of research from the learning sciences, cognitive science, and educational psychology has demonstrated that active learning in science classrooms enhances student learning (159). This research has concluded that learning is not knowledge transfer, but rather a process of constructing and correcting models of understanding within each student (161). As such, students must construct their own models and endeavor to compare them against new evidence (161). Furthermore, learning the “facts” about something is much different than the process of learning how “to solve problems with those facts” (161). A primary component of active learning, therefore, is practice in using “facts” to address real situations, “having students engage in some activity that forces them to reflect upon ideas and how they are using those ideas” (160). The teacher has a decisive hand in creating “a learning environment that makes [active learning] more likely to occur” (164). With what Michael calls a “student-centered” approach, teachers can enable students to influence “the content, activities, materials, and pace of learning” (160). The student-centered approach can involve a variety of methods, including “open-ended problems and problems requiring critical or creative thinking that cannot be solved by following text examples, involving students in simulations and role plays, and using self-paced and/or cooperative (team-based) learning” (160). Additionally, while active learning techniques can be used for individual instruction, individuals likely gain even more when they learn in groups (161).

**Smith, D. G. (1997). College Classroom Interactions and Critical Thinking. *Journal of Educational Psychology* *69*(2), 180-190.**

Smith’s study analyzed twelve different courses to assess the effect participation has on critical thinking. The selected courses were “evenly divided between the humanities, social sciences, and natural sciences” (182). To measure critical thinking, Smith relied on the Watson-Glaser Critical Thinking Appraisal and Bloom’s Taxonomy, assessing behaviors that represent critical thinking both at the beginning of the semester and the end. The study found that classrooms that had more “student participation, encouragement, and peer-to-peer interaction” were connected to better student critical thinking (186). The results are admittedly “suggestive” rather than “definitive,” but do carry implications for how faculty should encourage participation (180).