

Biology 1113 Course Redesign

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Evidence of achievement gaps in introductory biology:

- Retention of African-American and female students in STEM majors
- Performance in major courses, especially students with low ACT scores, no AP Biology credit

Strategies to reduce achievement gaps:

Summer Institute: Instructors develop skills in “scientific teaching,” *i.e.* using practices familiar to scientists to design teaching materials, assess student learning, and address the needs of diverse learners.

- Many years of data indicate that “SI alumni disseminate the principles of scientific teaching, thereby acting as a coherent force for advancement in science education and improvement in student learning,” Pfund, C, *et al.* (2009) Summer Institute to Improve University Science Teaching. *Science* 324: 470-471.

Peer-led team learning (PLTL): Peer leaders lead workshops in which small groups of students work collaboratively to solve problems related to course concepts.

- PLTL has a “positive impact on student attitude and success in the study of science and mathematics,” Varma-Nelson, P, Cracolice, M & Gosser, D (2004) Peer-Led Team Learning: A Student-Faculty Partnership for Transforming the Learning Environment in Invention and Impact: Building in Undergraduate Science, Technology, Engineering, and Mathematics Education. (http://www.aaas.org/sites/default/files/03_Suc_Peds_Varma_Nelson.pdf)

Course-based Undergraduate Research Experiences: Students engage in authentic research experiences that replace some or all of the traditional laboratory exercises.

- Engaging students in authentic science “stimulates students’ interest in science, positively influences academic achievement, and enhances persistence in science, technology, engineering, and mathematics (STEM) disciplines,” Jordan, TC, *et al.* (2014) A broadly implementable research course in phage discovery and genomics for first-year undergraduate students. *MBio* 5(1):e01051-13. doi: 10.1128/mBio.01051-13.

Active Learning in the Classroom: Instructors develop and implement student-centered learning activities that replace lectures in the classroom.

- Metaanalysis of hundreds of studies indicate that, “average examination scores improved by about 6% in active learning sections, and that students in classes with traditional lecturing were 1.5 times more likely to fail than were students in classes with active learning,” Freeman, S, *et al.* (2014) Active learning increases student performance in science, engineering, and mathematics. *Proc. Natl. Acad. Sci. USA* 111:8410-8415.

Measuring successful implementation:

Glynn, SM, Brickman, P, Armstrong, N & Taasobshirazi, G (2011). Science Motivation Questionnaire II: Validation with science majors and nonscience majors. *J. Res. Sci. Teach.* 48: 1159-1176.

<http://coe.uga.edu/outreach/programs/science-motivation>

Gormally, C, Brickman, P & Lutz, M (2012) Developing a Test of Scientific Literacy Skills (TOSLS): Measuring Undergraduates’ Evaluation of Scientific Information and Arguments. *CBE-LSE* 11: 364-377. <http://www.lifescied.org/content/11/4/364.full.pdf+html?with-ds=yes>

Student Assessment of their Learning Gains (SALG): <http://www.salgsite.org/about>

Smith, MK, Jones, FHM, Gilbert, SL, & Wieman, CE (2013) The Classroom Observation Protocol for Undergraduate STEM (COPUS): A New Instrument to Characterize University STEM Classroom Practices. *CBE-LSE* 12: 618-627. <http://www.lifescied.org/content/12/4/618.full.pdf+html>

