

**Collaboration Group:** Susan Bush, Hebe Guardiola-Diaz, and Kent Dunlap with consultation from Claire Fournier and Mike O'Donnell

**Impediments to Learning:** The Biology department at Trinity College teaches more than 100 students each semester in its introductory biology course series, BIOL182 and BIOL183. These students are often first year students, students of color, students with varying degrees of preparedness for college biology, and first-generation college students – in short, a group of students ranging widely across many educational variables. Our collaboration group aims to improve student engagement and learning within the lectures of BIOL182 and BIOL183 by researching and enacting pedagogical practices that will help level the playing field for many types of student. These practices will also help students achieve the larger departmental learning goals, including gaining a broad fundamental background in biology as well as developing and applying critical thinking skills.

**Project Aims:** The Biology collaboration group's aims for this Inclusive Teaching Proposal are as follows.

- 1) **We aim to improve communication between students and instructors.** Specifically, development and communication of learning goals for each section of the course will improve transparency and perceived organization of the course material. Sharing these course learning objectives will help students feel more empowered about their learning and may engage student metacognition about their own learning and study habits.
- 2) **We aim to increase uniformity across course sections and units.** By developing learning objectives for each unit of the course, we will improve uniformity in several ways. First, in BIOL183 where multiple instructors teach in separate classrooms, identifying learning objectives will make the course coverage more standard. Thus, students enrolling in upper-level courses will enter with more consistent knowledge. Second, in BIOL182 where students are instructed by multiple professors during one semester, the identification and communication of learning objectives from each professor will help create a more even flow throughout the duration of the course. While students will still be exposed to a range of teaching and testing styles, the consistent use of learning goals will help students anchor their learning in each section of the course.
- 3) **We aim to increase student participation and retention of content.** Our collaboration team, in consultation with other members of the biology department, will research and explore contemporary pedagogical methods in biology, in introductory courses, in small and large classrooms, and in our peer institutions. Many education studies have shown that techniques other than lecture improve student performance especially for students of color or women; other studies focus on strategies that improve outcomes for first-generation students (for

example, see Palmer *et al.*<sup>1</sup> and Stephens *et al.*<sup>2</sup>). We aim to engage our department members in discussions of how these different methods might be used in our classrooms. In addition to fostering departmental engagement with novel pedagogical techniques, we will use faculty feedback to broaden our perspectives of how the techniques can be used in BIOL182/183.

- 4) We aim to focus learning on practical applications and problem solving.** A primary learning goal set by Trinity's Biology department is that students will come away with critical-thinking and problem-solving skills. Most often, these skills are learned in the laboratory where students grapple with questions they can test and data that can be measured. However, one pedagogical strategy that may help students achieve both learning outcomes and critical thinking outcomes is to use case studies and problem-based learning in the classroom. The use of these techniques is independent of course content, though of course examples and specific practical applications will vary. Asking students to consider material in the context of a problem, such as a medical emergency or a disrupted ecosystem, will ensure their grasp of the foundational content of a topic, as well as encourage advanced thinking about interactions within the system of interest or between topics that may seem independent to a new learner. Practicing skills like critical thinking and problem solving in BIOL182/183 will expand students' exposure to scientific thinking early in their biology careers and promote independent thinking.

**Positive Outcomes:** We believe by developing and communicating learning outcomes, as well as researching and enacting pedagogical strategies that will increase student engagement with course materials, we will see improved student learning and potentially increased student retention within the Biology department. To measure improvements in learning and retention of material, we would like to explore the use of pre- and post-tests in BIOL182/183, similar to the Genetics Concept Assessment published by Smith and colleagues<sup>3</sup>. Improving communication with students, specifically by sharing learning objectives, may enhance student learning and metacognition. Using problem-based learning across the curriculum in BIOL182/183 will increase uniformity between instructors; this technique may also help improve learning, especially for students of color and first-generation college students. These learning and teaching strategies can only improve the BIOL182/183 courses, and by including the larger Biology faculty in discussion of potentially useful pedagogical approaches, we may influence teaching and learning in other classes as well. We hope to pilot some of these methods in BIOL183 during Spring 2019; with feedback and modification, we can then use similar approaches in BIOL182 in Fall 2019.

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<sup>1</sup> Palmer RT, Maramba DC, Dancy II TE (2011) A Qualitative Investigation of Factors Promoting the Retention and Persistence of Students of Color in STEM. *The Journal of Negro Education* **80(4)**: 491-504.

<sup>2</sup> Stephens NM, Fryberg SA, Markus HR, Johnson CS, Covarrubias R (2012) Unseen disadvantage: How American universities' focus on independence undermines the academic performance of first-generation college students. *Journal of Personality and Social Psychology* **102(6)**: 1178-1197.

<sup>3</sup> Smith MK, Wood WB, Knight JK (2008) The Genetics Concept Assessment: A New Concept Inventory for Gauging Student Understanding of Genetics. *CBE – Life Sciences Education* **7**: 422-430.