

COMPETENCE **VS.** COMPLETION: *Does Passing Equate to Learning?*

BY CHERYL HOKE, MAGGIE RICHARDS, ANN RIEDL, AND TINA BURKE

Science education is in crisis. Students in STEM programs across higher education fail, drop out, or change their majors at alarming rates. Two years ago, we challenged ourselves to do better for our science students.

We implemented competency-based education (CBE) as a means to increase student learning and success in our courses. CBE is built on the premise that students should become competent in every outcome in a course. It gives students the opportunity to master foundational material before moving on to more complex topics. Science courses are excellent choices for CBE since foundational concepts build both within a course and in subsequent courses.



We implemented CBE in three general biology and chemistry transfer courses at Front Range Community College (FRCC). Our CBE model includes active learning, an emphasis on study skills, robust student support, multiple opportunities for students to demonstrate mastery, and higher grading standards.

Students must demonstrate mastery (A or B) on every unit and of all outcomes in order to pass the course. Since we are challenging students with high expectations, we give them multiple attempts to show competence. To earn the opportunity to take a different version of an exam, students must complete defined extra practice and meet with the instructor to discuss research-based study strategies. These remediation requirements are essential for most students to improve their understanding. Active learning and embedded peer instruction are also critical components of all of our CBE courses. These strategies combine to help students engage with and master the content.

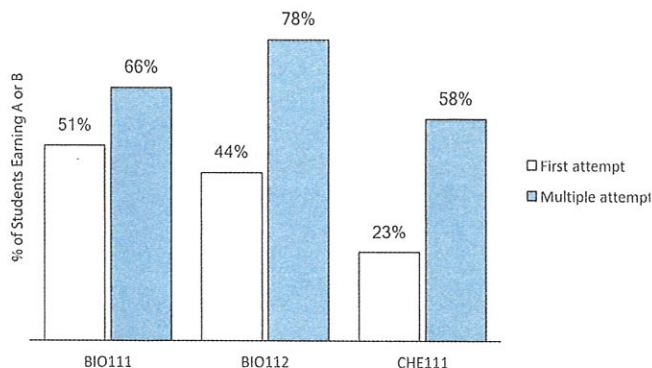
Other strategies were also implemented in individual classes:

- Skill competencies focused on scientific inquiry and application of biological principles
- Team teaching multiple sections, allowing students to proceed at different paces
- Personalized learning paths through homework to identify and remediate gaps in prerequisite knowledge
- Final course grades based on competence in every category (e.g., exams, labs) rather than percentages

We discovered that a major impediment to student success was ineffective study habits. Individual student-faculty meetings and peer instructor-led study groups helped students alter their study strategies. As one student expressed, "It challenged me to think differently about how I learn." The opportunity to repeat exams allowed students to implement these new strategies to improve their performance on essential foundational material. According to one student, "Letting us take exams again is the best thing that has happened to me in college."

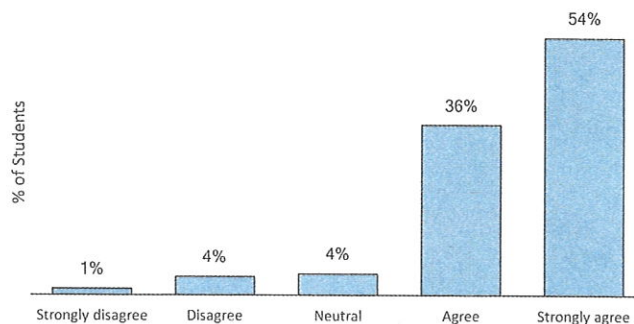
Previous data show that, for our students, earning an A or B is a much better predictor of success in future science courses than pass rates alone. In all of our CBE courses, multiple exam attempts allowed a higher percentage of students to reach

mastery in each unit (Figure 1). A greater proportion of students earned an A or B in these courses.



► **Figure 1.** Multiple exam attempts resulted in more students with an A or B exam average. BIO111 = General College Biology I; BIO112 = General College Biology II; CHE111 = General College Chemistry I.

A majority of students reported on end-of-semester surveys that the opportunity to retake each exam reduced their anxiety about succeeding in the class. Students' perceptions of how much they learned also increased. Ninety percent of students agree or strongly agree that retaking exams helped them learn the material better (Figure 2). A typical survey response was, "I'm learning, not just passing."



► **Figure 2.** Students felt that repeated exams helped them learn the material better. Survey results are from 175 students on the last day of class.

We are continuing to expand and improve the CBE program to include more faculty, more sections, and more courses. Our students are leaving our courses confident in their understanding of course content and equipped with effective study skills for future courses. We have every expectation that this will translate into increased retention in our STEM courses and long-term gains in overall completion rates.

Cheryl Hoke is Faculty, Chemistry; Maggie Richards is Faculty, Science; Ann Riedl is Faculty, Biology; and Tina Burke is Director, Pharmacy Technician Program, Front Range Community College.