Ten years ago, analytical chemist William LaCourse took a hard look at the status of teaching within his department at the University of Maryland, Baltimore County (UMBC). He didn’t like what he saw. “We were losing ground,” says LaCourse. Students were doing worse on tests, and more were failing or dropping courses. Attendance was spotty, and only the best students were showing up for extra help. The number of chemistry majors was also declining.

A big part of the problem, LaCourse and others decided, was Chemistry 101. It’s the gateway course for prospective chemistry majors and a requirement for those in many other fields. “The student newspaper called it a weed-out course,” he recalls. “And I thought, ‘That doesn’t make any sense. Rather than always looking for new customers, why can’t we do a better job with the ones we already have?’”

A new report from the National Academies offers advice to universities trying to answer that question. It says that improving introductory courses is one of many steps needed to increase the number of students obtaining degrees in the fields of science, technology, engineering, and mathematics (STEM) and, in particular, the percentage of minorities who aspire to a STEM degree. Only 33% of whites and 42% of Asian-Americans complete their STEM degrees in 5 years, the UCLA study finds. “It’s really an American issue,” says Hrabowski, a mathematician and longtime UMBC president. “It’s simply unacceptable for such a large majority of students not to achieve their goal [of a STEM degree]. We must find ways for larger numbers of American students to excel in science.”

The new report says that retaining STEM minorities who aspire to a STEM degree actually earn one within 5 years, according to a longitudinal study cited in the NRC report by researchers at the University of California, Los Angeles (see graphic). And it’s not just minorities who are falling out of the science pipeline. Only 33% of whites and 42% of Asian-Americans complete their STEM degrees in 5 years, the UCLA study finds. “It’s really an American issue,” says Hrabowski, a mathematician and longtime UMBC president. “It’s simply unacceptable for such a large majority of students not to achieve their goal [of a STEM degree]. We must find ways for larger numbers of American students to excel in science.”

The new report says that retaining STEM majors will require better academic, social, and financial support for students. Some of those steps are relatively inexpensive, says Hrabowski, although the report does recommend that the government launch a scholarship program to boost the number of needy minority students that could eventually cost $600 million a year.

Under Hrabowski, UMBC has implemented enough of those ideas to become one of the nation’s top feeder schools for minorities going on to receive a Ph.D. degree. (Some 22% of UMBC students are underrepresented minorities, and they comprise 20% of all STEM majors.) One especially promising intervention, notes the report, is the university’s Meyerhoff Scholars Program, which offers a summer bridge program, scholarships, tutoring and networking, research experiences, and study abroad.

UMBC has also overhauled its introductory courses. The chemistry department, which LaCourse now chairs, has converted Chem 101 and Chem 102 into “Discovery Learning” courses. Students who had once sat passively during a weekly 2-hour recitation section while a graduate student solved problems on the whiteboard are now part of four-person teams responsible for finding the right answer. Teaching assistants act as “Sherpas,” says LaCourse, “guiding students up the mountain.” Laptops and cell phones have been banned from the sections so that students can focus on the assignment. Attendance is mandatory, and unexcused absences result in lower grades. There are still lectures, but they are delivered by someone “who lives and breathes Chem 101,” says LaCourse.

The changes have produced immediate—and dramatic—results. Pass rates for the introductory courses shot up the first year from 70% to 85%—even though the department also raised the minimum score—and have inched up from there. Attendance has improved, and fewer students drop the course. The number of chemistry majors has nearly doubled since 2003, and the outflow from chemistry to other majors has stopped, reversing a chronic leakage of up to a dozen students a year. As a bonus, a once-moribund student chapter of the American Chemical Society is now thriving.

LaCourse freely acknowledges that UMBC’s approach draws heavily on a national movement to replace the didactic style of undergraduate teaching with more active, hands-on learning (Science, 31 July 2009, p. 527). And although the results are impressive, LaCourse says the transformation is not complete. The person with the primary responsibility for teaching the two intro courses, for example, is not a tenured faculty member. “I’d like that situation to change,” he says frankly. “And I think it’s only a matter of time before [teaching] becomes a legitimate pathway. But I’m not that powerful.”

—JEFFREY MERVIS