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Lectures Still Dominate Science and Math Teaching, Sometimes Hampering Student Success

By Dan Berrett

Lecturing remains the most common method for teaching undergraduates in science, technology, engineering, and mathematics, known as the STEM disciplines. Although other forms of instruction have made inroads, the continuing reliance on this pedagogical tool may be stymieing efforts to increase the number of graduates in those programs.

"We have a really good idea about what doesn't work: lecturing students without engaging them, having labs not linked with lectures," says James S. Fairweather, a professor of educational administration at Michigan State University and a co-principal investigator of an Association of American Universities project that seeks to improve STEM education.

A [recent faculty survey](#) shows that more instructors in STEM fields than those in other disciplines rely on this method: 63 percent of STEM professors said they used "extensive lecturing" in all or most of their classes, according to the Higher Education Research Institute at the University of California at Los Angeles. About 37 percent of faculty in other fields said they did so.

The latest results of the survey were released on Wednesday. The survey, which is conducted every three years, was administered during the 2010-11 academic year to 23,824 full-time and 3,547 part-time faculty who teach undergraduates at four-year institutions.

Increasing the number of graduates from STEM programs has been a national priority for years, and it has only grown in urgency. President Obama and other policy makers have recently touted it as an economic, civic, and national-security imperative.

High Rate of Attrition

Students continue to wash out of those programs at a high rate, though. Less than 40 percent of those who enter college intending to be STEM majors complete a degree in one of those fields,

according to a report issued this year by the President's Council of Advisors on Science and Technology. The traditional view among some faculty members has been that students leave those majors because they are poorly prepared or cannot handle the intellectual rigor.

That view irritates Elaine Seymour, whose 1997 book, *Talking About Leaving: Why Undergraduates Leave the Sciences*, marked a watershed in understanding the dynamics that cause STEM majors to quit their disciplines. Ms. Seymour, director emerita of ethnography and evaluation research at the University of Colorado at Boulder, and her co-author, Nancy M. Hewitt, surveyed seven institutions, conducting hundreds of hours of in-depth interviews with 335 students, including those who had left STEM majors and those who had persisted. Ms. Seymour and a team of researchers will start revisiting the same institutions next year to update the original study.

"Poor teaching," a term the researchers used to describe a litany of student complaints, emerged as the most common concern among both STEM graduates and those who had left those majors, according to the 1997 book.

And STEM teaching in the 1990s, Ms. Seymour says in an interview, invariably took the form of lecturing. "This was all a critique of that method," she says.

The researchers heard that professors often grew frustrated with students when they failed to learn from the faculty's explanation of the material, instead of giving the students opportunities to work with the subject matter themselves. Some professors, says Ms. Seymour, seemed especially concerned with covering as much of the curriculum as possible, which could make the instructional pace overwhelming.

The UCLA data about the use of lectures are actually a hopeful sign, Ms. Seymour says. If 63 percent of STEM faculty are lecturing, it means that nearly 40 percent are not. "It's a good marker of change," she says.