

## Distance learning in 2010 and 2015 and remote learning after COVID-19

In 2010 and 2015, distance learning was a rapidly growing part of mathematics enrollment in two- and four-year colleges and universities. Four-year college distance learning enrollments grew by 80 percent from 2010 to 2015, representing 2 to 3 percent (2010 and 2015, respectively) of total enrollments (Figure 1). At two-year colleges, distance learning enrollments in mathematics grew by 12 percent, and represented 9 to 12 percent (for 2010 and 2015, respectively) of total mathematics enrollment.

In Spring 2020, the widespread closure of on-campus activities in response to the Covid-19 pandemic resulted in many mathematics courses pivoting to online courses. It is not yet clear what will happen in Fall 2020, but some colleges plan to resume in-person instruction, others plan to be entirely online, and others plan a hybrid approach (e.g., with some courses/sessions taught in-person and others taught online).

A more fundamental question is whether the pivot to online learning will result in long-lasting changes.

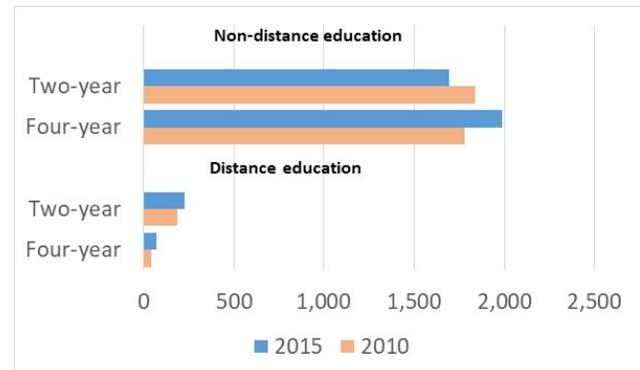
- Have students' and faculties' perceptions of distance learning changed, and if so have their perceptions become more favorable or less?
- Will the types of courses offered through distance learning change, perhaps increasing the course selection that is available?
- Will the lines between "regular" instruction and distance learning become less distinct, perhaps with the same course simultaneously being offered using multiple modalities and directed towards multiple audiences?

CBMS will be conducting a short survey in Fall 2020 about responses to the pandemic, and its normally quinquennial survey in Fall 2021, and will seek to address these questions.

Following is some information about distance learning from the CBMS 2015 survey:

Two-year colleges were the colleges most involved in distance learning, with 87 percent offering distance learning, and 58 percent giving credit for distance learning taught by faculty outside the institution (Table SP.8). Statistics departments at four-year colleges were the next

**FIGURE 1.** Enrollments (in thousands) in distance learning and non-distance learning in mathematics in 2010 and 2015

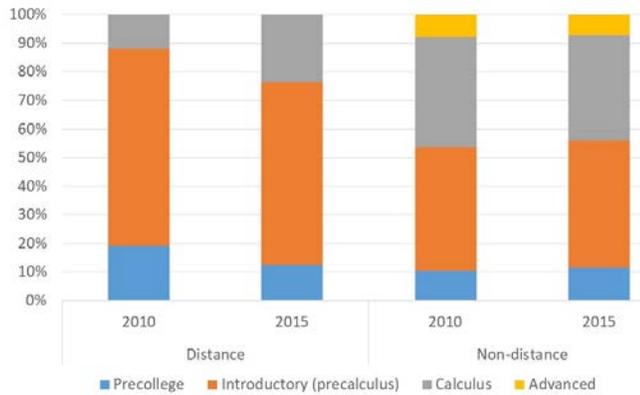


Source: 2015 CBMS Survey of Undergraduate Programs, Table TYE.12 and Appendix Table A.1.

most likely to offer distance learning (64 percent), followed by mathematics departments at four-year colleges (52 percent). However, mathematics departments at four-year colleges were more accepting of distance education than statistics departments in other ways, with 62 percent giving credit for distance learning taught by faculty outside the institution, compared with 50 percent at statistics departments. About a third of mathematics and statistics departments at four-year colleges set a limit on the number of credits that could be earned through distance learning, while only 1 percent of two-year colleges set such a limit. For mathematics departments at four-year colleges, distance learning was primarily focused on introductory (pre-calculus) courses, though there appears to have been a movement over time toward increased offerings in more advanced courses: in 2015 there was roughly a doubling in the percentage of distance learning courses that were calculus-level courses (24 percent) as compared with 2010 (12 percent) (Figure 2). Enrollment patterns in non-distance learning courses were very different; the largest enrollments were still in introductory courses, but enrollments in calculus-level courses were relatively close behind (e.g., 44 percent versus 37 percent in 2015). In 2015 no data were collected on distance learning enrollments in advanced mathematics courses, but they appear small. At least 14 different course topics were

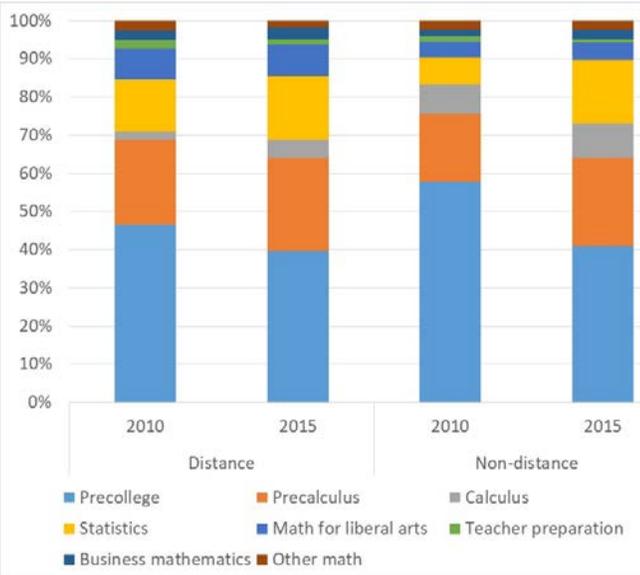
taught by at least one college using distance learning, but no course topic was taught by more than 2 percent of mathematics departments overall, and no more than 7 percent at any institutional level (Table SP.11A). The CBMS 2020 survey will again collect data on which courses are offered through distance learning and, in a change from 2015, it will also collect enrollments in distance learning for advanced courses.

**FIGURE 2.** percentage distribution of enrollments by course level and distance learning status in 2010 and 2015 in four year mathematics departments



Note: This graphic displays enrollments in advanced mathematics as non-distance learning; a small but unknown proportion actually fall within distance learning.  
Source: 2015 CBMS Survey of Undergraduate Programs, Appendix Table A.1.

**FIGURE 3.** percentage distribution of enrollments by course level and distance learning status in 2010 and 2015 in two-year mathematics departments



Source: 2015 CBMS Survey of Undergraduate Programs, Table TYE.12.

At two-year colleges, mathematics department distance learning enrollments most frequently were at the precollege level (40 percent) and next most often at the precalculus level (25 percent) (Figure 3). Like four-year colleges, two-year colleges showed some (but less) change from 2010 to 2015, with the proportion taking precollege courses decreasing from 47 percent to 40 percent, and the percentage taking precalculus increasing modestly from 22 percent to 25 percent. The distribution of non-distance learning enrollments in 2015 closely mirrored those of distance learning enrollments, except that the proportion taking calculus-level courses was somewhat higher in non-distance learning enrollments (9 percent versus 5 percent). Non-distance learning enrollments showed a much larger drop from 2010 to 2015 in the proportion taking precollege courses, from 58 percent to 41 percent.

Distance learning courses were typically used the same course outlines, had the same course projects, and evaluated instruction in the same way (Table SP.10). They also often made the same use of common exams. Roughly two-thirds of the departments offered a majority of their distance learning completely online, and about one-fourth offered a hybrid of face-to-face and online formats.

The monitoring of testing can be an issue for distance learning. Between 35–47 percent of mathematics and statistics departments conducted a majority of the testing at proctored testing sites, between 10–19 percent used online monitoring technology, and between 23–37 percent used a combination of both (Table SP.8). The remaining 11–22 percent said that a majority of their testing was not monitored.

**CBMS surveys: Tracking the mathematical and statistical sciences in higher education since 1965**

These national surveys, occurring every five years, examine course enrollments and programs at both two-year and four-year colleges and universities. The surveys are sponsored by the Conference Board of the Mathematical Sciences (CBMS), a consortium of eighteen professional associations in the mathematics sciences. The project is funded by the National Science Foundation. The survey reports can be downloaded from <http://www.ams.org/profession/data/cbms-survey/cbms-survey>. Table references in this brief refer to the CBMS 2015 report.

The 2015 CBMS survey was the eleventh report in this series of now fifty years of data. Three different instruments (two-year colleges, four-year college mathematics, and four-year college statistics) are sent to a stratified random sample of these three populations. The 2020 CBMS survey will be administered in fall 2020.