Chapter 6

Enrollment, Course Offerings, and Instructional Practices in Mathematics Programs at Two-Year Colleges

This chapter reports fall 2010 enrollment and instructional practices in mathematics and statistics courses at public two-year colleges in the United States. Also included are total enrollment for these two-year colleges, average mathematics class size, trends in availability of mathematics courses, enrollment in mathematics courses offered outside of the mathematics programs, and services available to mathematics students. Many tables contain data from previous CBMS surveys (1975, 1980, 1985, 1990, 1995, 2000 and 2005) and hence allow for historical comparisons. Further analysis of many of the items discussed in this chapter can be found in Chapter 1, where they are discussed from a comprehensive point of view in comparison to similar data for four-year colleges and universities.

In the 1990 and earlier CBMS surveys, computer courses taught outside the mathematics department, and the faculty who taught them, were considered part of the "mathematics program." By 1995, computer science and data processing programs at two-year colleges, for the most part, were organized separately from the mathematics program. Hence, in 1995, 2000, 2005, and again in this 2010 report, such outside computer science courses and their faculty are not included in mathematics program data. In 1995, enrollment data were collected about computer courses taught within the mathematics program and can be found in those reports. But because such courses had become rare, the 2005 and 2010 surveys contained no specific data about even these "inside mathematics program" computer courses, though some, no doubt, were reported by mathematics programs under the Other Courses category. Furthermore, the enrollment tables that follow have been adjusted to eliminate all specific computer science enrollments that appeared in previous CBMS reports. (For example, see Tables TYE.3 and TYE.4.) This adjustment allows for a more accurate comparison of mathematics program enrollments over time. There are also instances where "na" will be displayed in a table, indicating that similar data was not collected or was not available.

In contrast to previous surveys, CBMS2005 and CBMS2010 include only public two-year colleges. The two-year college data in this report were projected from a stratified random sample of 205 institutions chosen from a sample frame of 1,121 public two-year colleges. Survey forms were returned by 105 colleges (51% of the sample). The return rate for all two-year and four-year institutions in CBMS2010 was 65% (388 of 593). For comparison purposes, the survey return rate for two-year colleges for CBMS2005 was 54% (130 of 241 colleges), 60% (179 of 300 colleges) for CBMS2000, and 65% (163 of 250) for CBMS1995. The two-year rates continue to reflect the broadened professional involvement of two-year college mathematics faculty and the intense follow-up efforts exerted in collecting survey data. For more information on the sampling and projection procedures used in this survey, see Appendix II. A copy of the two-year college survey questionnaire for CBMS2010 may be found in Appendix V.

The Table display code in Chapter 6 is TYE, for "Two-Year Enrollment," since this chapter mostly addresses issues related to enrollment.

The term "permanent full-time" and "temporary full-time" faculty are occasionally used in this chapter. For a detailed explanation these terms, see the introductory notes in Chapter 7.

Highlights of Chapter 6

- The fall 2010 enrollment in mathematics and statistics courses in mathematics programs at public two-year colleges reached an historic high of 2,104,751 students. This total includes 80,805 dually enrolled students. See Table S.1 in Chapter 1, Table SP.18 in Chapter 2, and Table TYE.2 in this chapter.
- The growth in two-year college mathematics enrollment from 2005 to 2010 was 19% (21% when dual enrollment students are included). During the same period, four-year institutions had an enrollment increase in mathematics courses of 26%. The percent increase in total student enrollment in mathematics courses at two-year colleges was smaller than the enrollment increase from 2000 to 2005 (29% vs 34%). See Tables S.1 in Chapter 1, E.2 in Chapter 3, and TYE.1 and the discussion before Table TYE.2 in this chapter.
- From 2005 to 2010, the overall total enrollment increase at public two-year colleges was 11%, compared with an overall enrollment increase at four-year colleges of 13%. For details, see the

discussion before and after Table TYE.1 and Table S.1.

- Dual enrollment, defined in this survey as students enrolling in a course that earns credit in high school and a two-year college, increased 92% from 2005 to 2010 to a total of 80,805 students. See Tables SP.18 and SP.19 in Chapter 2.
- About 57% of the two-year college mathematics and statistics enrollment in fall 2010 was in Precollege (formerly called remedial) courses. This differed by less than one percent of Precollege enrollments in 2000 and 2005. See Table TYE.4.
- The number of students enrolled in Precollege mathematics courses (Arithmetic, Pre-algebra, Elementary and Intermediate Algebra, and Geometry) at two-year colleges increased to a total of 1,149,740 from 2005 to 2010. This represents a 19% increase from 2005 to 2010. The increase from 2000 to 2005 was 26%, and from 1995 to 2000, the increase was 5%. See Table TYE.4.
- The 19% increase in two-year college Precollege enrollments (see Table TYE.4) contrasts with four-year colleges (see Table E.2) in which Precollege enrollments increased 4% between 2005 and 2010.
- Within the cohort of Precollege courses, Arithmetic/ Basic Skills showed a 40% increase in enrollment from 2005 to 2010. This was a significant reverse of the decreasing enrollment trend in Arithmetic between 1990 and 2005. See Table TYE.3.
- The trend of an increasing enrollment in the Precalculus course group (College Algebra, Trigonometry, College Algebra and Trigonometry, Mathematical Modeling, Elementary Functions) continued in 2010. However, the enrollment growth grew only 15% between 2005 and 2010. This was slightly lower than the 17% growth in mathematics enrollment from 2000 to 2005. See Table TYE.4.
- Enrollment in all calculus-level courses showed a 29% increase between 2005 and 2010, compared to a 9% increase between 2000 and 2005. Enrollments in Non-mainstream Calculus I experienced a slight decrease in the same time period. See Table TYE.3.
- Enrollment was up in 2010 for every course type except Geometry, combined College Algebra/ Trigonometry, Non-mainstream Calculus I, Probability, Finite Mathematics, Mathematics for Elementary Teachers, and Business Mathematics. Notable decreases of 29% occurred in Business Mathematics (non-transferable) and 76% in Business Mathematics (transferable). See Table TYE.3.
- Among the usual college-level transferable mathematics and statistics courses, the largest enrollment increases in percentage order were as follows: Mathematics for Liberal Arts (55% increase), Elementary Statistics (21% increase), and College Algebra (12% increase). Enrollments in Mathematics for Elementary School Teachers remained constant. See Table TYE.3.
- From 2005 to 2010, Intermediate Algebra had a small increase of total students (2%) and showed a decrease in the percentage of students enrolled from 20% to 17%. Other courses that had similar decreases in percentage include College Algebra, Non-mainstream Calculus, Finite Mathematics, and Mathematics for Elementary Teachers. See Table TYE.3.
- Fall 2010 saw slight decreases in the percentage of two-year colleges offering selected mathematics courses required for baccalaureate degrees compared to fall 2005, even though enrollments increased. See Tables TYE.6 and TYE.3.
- The average size of classes taught on two-year campuses remained approximately the same in 2010 as it was in 2005 with 24 students, with the exception of Statistics, which increased to 28 students per section. The percentage of sections with a size greater than 30 increased from 21% in 2005 to 23% in 2010 for all mathematics courses. The class size recommended by the American Mathematical Association of Two-Year Colleges (AMATYC) and the Mathematical Association of America (MAA) is 30 or less. See Tables TYE.7 and TYE.8. For comparable four-year data, see Tables E.13 and E.14 in Chapter 3.
- For the first time, CBMS2010 collected information about the section size of distance learning courses. The average section size of distance learning courses ranged between 4-24 students, with the average section size of all courses consisting of 19 students. See Table TYE.8.1.
- Forty-six percent of mathematics class sections were taught by part-time faculty in 2010. This figure is up two points from 2005 and down four points from 2000. The percentage of sections taught by part-time faculty varied significantly by course type, with part-time faculty teaching 58% of Precollege courses and 11% of mainstream calculus courses. See Table TYE.9.
- Part-time faculty (including those paid by third parties such as school districts) numbered 25,776 and constituted about 70% of the total number of faculty in mathematics programs at public two-year colleges in 2010. Information on faculty size is given in Table TYF.1 in Chapter 7.
- The percent of total enrollment in distance learning courses at two-year colleges almost doubled from 2005 to 2010, increasing from 5% to 9% with a total of 187,523 students. The courses with the largest distance learning enrollment were Elementary

Algebra (37,371 students), College Algebra (31,964 students), Intermediate Algebra (24,544 students), and Elementary Statistics (23,363 students). See Table TYE.12.

- Distance learning courses with the largest percentage of students enrolled in distance learning sections compared to total enrollment in the course were: Mathematics for Elementary School Teachers I and II (17% and 22%, respectively), Elementary Statistics (17%), Math for Liberal Arts (17%), and Business Math (20%). Courses with enrollment in distance learning less than 2% were Geometry (0%), Mainstream Calculus II (1%), Mainstream Calculus III (0.3%), and Non-mainstream Calculus II (0%). See Table TYE.12.
- Precollege distance learning enrollments accounted for 46% of total distance-learning course enrollments. The number of students in Precollege distance learning courses increased 135% from 2005 to 2010, from 37,036 students to 87,073 students. Similar increases, more than doubling the numbers of distance learning students, were experienced in Precalculus courses (College Algebra, Trigonometry, College Algebra and Trigonometry, Mathematical Modeling, Elementary Functions) and Elementary Statistics. See Tables TYE.12 in this chapter and E.4 in Chapter 3. A discussion about the use of distance learning by mathematics departments is included in Chapter 2 before Table SP.10.
- More than ninety percent (90%) of two-year college mathematics programs offered diagnostic or placement testing, with 100% of those colleges requiring placement tests of first-time enrollees. See Table TYE.13.
- Opportunities offered to students included honors sections, mathematics clubs and contests, programs to encourage women and minorities in mathematical studies, undergraduate student research and independent studies in mathematics. These are described in Table TYE.13 in this chapter and in Table SP.14 in Chapter 2.
- The collection of Precollege (remedial) courses taught "outside" the mathematics program (e.g., in developmental studies divisions) showed a 24% decrease in 2010. These "outside" mathematics enrollments, offered at 29% of colleges, are not included in Table TYE. 2. See the discussion before Tables TYE.3 and TYE.5 and especially the discussion before Tables TYE.15, TYE.16, and TYE.17.

Enrollment, Class Size, and Course Offerings In Mathematics Programs

Number of two-year-college students

About 6,870,000 students were enrolled in public two-year colleges in fall 2010. This estimate is based on a mid-range overall 2010 enrollment projection for public two-year colleges by the National Center for Educational Statistics (NCES). Enrollment in two-year colleges in fall 2010 constituted about 42% of the total undergraduate enrollment in the United States, a two percent drop compared with 2005. See Table S.1 in Chapter 1.

Enrollment trends in mathematics programs

Enrollment in mathematics and statistics courses in mathematics programs at public two-year colleges was 2,104,751 students in 2010, an increase of 21% since 2005.

TABLE TYE.1 Total institutional enrollment (in thousands) and percentage of part-time enrollments in two-year colleges in fall for 1975 through 2005 and projected enrollments for fall 2010[1].

	1975	1980	1985	1990	1995	2000	2005	2010
Public + Private								
Number of students	3,970	4,526	4,531	5,240	5,493	5,948	6,488	7,201
Percentage part-time	56	61	63	64	64	63	59	59
Public only								
Number of students					5,278	5,697	6,184	6,870
Percentage part-time					65	65	61	61

[1]Data for 1995, 2000, and 2005, and projections for 2010 are derived from Tables 24, 26, and 27 of the NCES publication "*Projections of Educational Statistics to 2019*" at http://nces.ed.gov/programs/projections/projections2019/tables.asp.

This total includes dual-enrollment students, high school students who took courses taught either in high school or a two-year college campus and received course credit at both the high school and at the two-year college. In comparison to 2005, 2010 saw an increase of 21% in mathematics and science enrollment and represents steady increases during the last decade. The 2000 and earlier entries in Table TYE.2 include private two-year college enrollments. NCES data indicated over 95% of overall two-year college enrollment in 2010 was at public institutions. See Tables TYE.1 and TYE.2 in this chapter and Table SP.18 in Chapter 2.

The 21% enrollment increase in mathematics and statistics courses from 2005 to 2010 mentioned above was almost double the 11% overall enrollment increase at public two-year colleges in the same period. The percentage is based on a mid-range NCES overall enrollment projection of 6,870,000 full-time students at public two-year colleges in 2010. The overall enrollment increase is reported in Table S.1 in Chapter 1 and in Table TYE.1.

Dual-enrollment students in mathematics, numbering 80,805, were one reason for the mathematics program growth in 2010, accounting for about 21% of the growth. When these students are excluded, mathematics programs at public two-year colleges still had an historically high enrollment of 2,023,946. Without dual enrollments, the increase in mathematics enrollments from 2005 to 2010 was 19%. See Table TYE.2, Table S.1 in Chapter 1, and Table SP.18 in Chapter 2.

Two-year college mathematics growth from 2005 to 2010 can be contrasted with the pattern in the nation's four-year colleges and universities. Between 2005 and 2010, mathematics enrollments at two-year colleges increased 21%, while mathematics enrollments increased 27% at four-year colleges and universities. See Table S.1 in Chapter 1.

In addition to the tables that follow, the reader should consult Chapter 1 of the current report. Chapter 1 contains a detailed analysis of mathematics department enrollments at both two-year and four-year colleges over the time period 1995 to 2010 and also contains additional enrollment comparisons between two-year and four-year colleges.

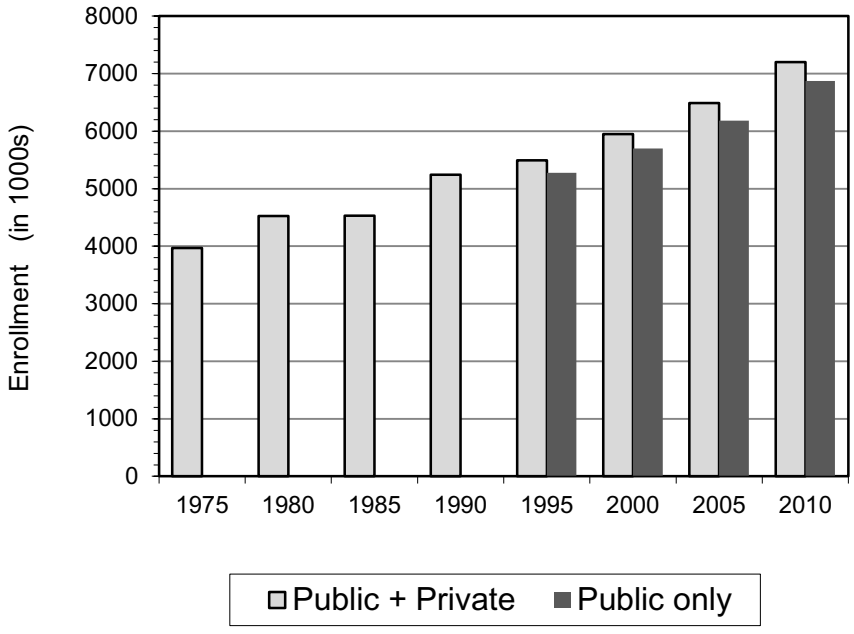

FIGURE TYE.1.1 Total enrollments (all disciplines) in public & private two-year colleges in fall 1975 through fall 2010 and in public-only two-year colleges in fall 1995 through fall 2010.

TABLE TYE.2 Enrollments in mathematics and statistics (no computer science) courses in mathematics programs at two-year colleges in fall 1980, 1985, 1990, 1995, 2000, 2005, and 2010.

	1980	1985	1990	1995	2000	2005 [1]	2010 [1]
Mathematics & Statistics enrollments in TYCs	953,000	936,000	1,295,000	1,456,000	1,347,000	1,739,000	2,105,000

[1] Data for 2005 and 2010 include only public two-year colleges and include 81,000 dual enrollments from Table SP.16.

Note: Data for 1990, 1995, and 2000 in Table TYE.2 differ from corresponding data in Table S.1 of Chapter 1 because the totals in TYE.2 do not include any computer science courses, while the totals in Table S.1 do.

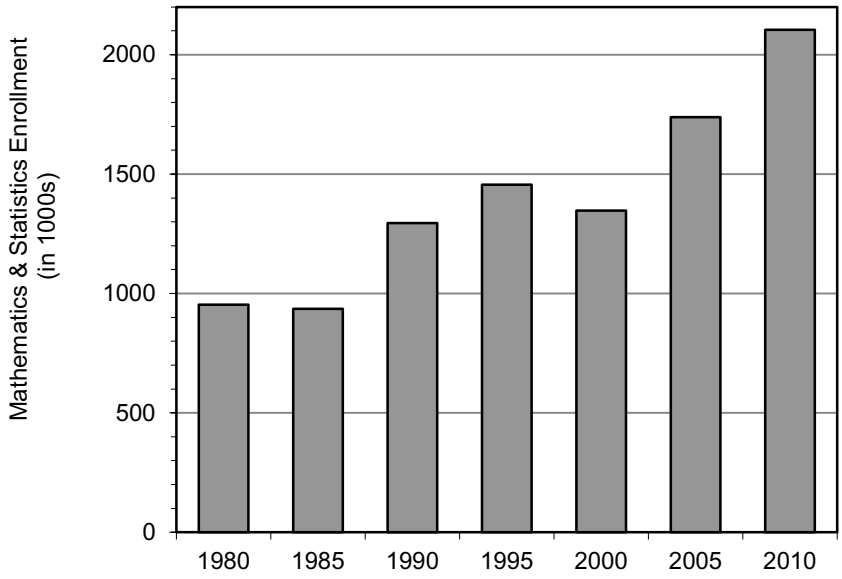

FIGURE TYE.2.1 Enrollments in mathematics and statistics courses (no computer science) in mathematics programs in two-year colleges in fall 1980, 1985, 1990, 1995, 2000, 2005, and 2010. (Data for 2005 and 2010 include only public two-year colleges and include dual enrollments from Table SP.16.)

Enrollment trends in course groups and in specific courses

Table TYE.3 lists enrollment in individual courses. Similar to the five-year period 2000-2005, 22 of the 28 courses surveyed remained level or increased in enrollment between 2005 and 2010. Course enrollment percentage increase of greater than the overall two-year college mathematics enrollment increase of 21% occurred in twelve courses from 2005 to 2010:

Course Number	Course	Percentage
1	Arithmetic and Basic Mathematics	40%
2	Pre-algebra	65%
7	Trigonometry	26%
9	Introduction to Mathematical Modeling	156%
11	Mainstream Calculus I	28%
12	Mainstream Calculus II	55%
13	Mainstream Calculus III	40%
15	Non-mainstream Calculus II	72%
16	Differential Equations	49%
17	Linear Algebra	60%
19	Statistics	21%
22	Mathematics for Liberal Arts	55%

In reviewing this list of percentage increases from 2005 to 2010, one also needs to take into consideration the actual number of students enrolled. Table TYE.3 lists actual enrollments in mathematics courses. For instance, a 156% increase in Mathematical Modeling represented an increase of 11,000 students from 2005-2010. A 65% increase in Pre-algebra enrollment represented an increase of 89,000 students from 2005-2010.

Course enrollment percentage increase less than the overall two-year college mathematics enrollment increase of 21% occurred in twelve courses from 2005 to 2010. Courses that experienced larger decreases in enrollment were:

Course Number	Course	Percentage
5	Geometry	-14%
8	Combined College Algebra/Trigonometry	-25%
20	Probability	-58%
26	Business Mathematics (not transferable)	-29%
27	Business Mathematics (Transferable)	-76%
29	Technical Mathematics (calculus-based)	-33%

Again, percentages can be misleading. A 58% decrease in Probability enrollment represented a change of 4,000 students. An 18% decrease for Finite Mathematics also represented a change of 4,000 students.

In fall 2010, over 1,150,000 students in Precollege courses (Arithmetic, Pre-algebra, Elementary and Intermediate Algebra, and Geometry) comprised over half (57%) of mathematics program enrollment. This percentage has been essentially stable at 57% since 1990. See Table TYE.4.

Precollege enrollment has varied over time as follows: down by 5% from 1995 to 2000, up 26% from 2000 to 2005, and up 19% from 2005 to 2010. These swings in the number of Precollege enrollments have paralleled the rises and falls in the total mathematics program enrollment at two-year colleges during these years: down 7% from 1995 to 2000, up 29% from 2000 to 2005, and up 16% from 2005 to 2010. These percentages are calculated from Table TYE.4, which does not include the 80,805 students in dual-enrollment courses.

Within the Precollege courses, special note is appropriate regarding the increases in Arithmetic and Basic Mathematics, up 40% from 2005, and Pre-algebra, up 65% from 2005. These are large increases in comparison with increases of 13% in Elementary Algebra and 2% in Intermediate Algebra. See Table TYE.3.

About one-third of two-year colleges responding to the survey conducted part of their Precollege (remedial) mathematics program outside of the mathematics program in an alternate structure like a developmental studies division or learning laboratory. This accounted for 152,000 students. These enrollments are not included in Tables TYE.3 and TYE.4. For more information on these "outside" Precollege courses, see the discussion for Tables TYE.15 and TYE.16 later in this chapter.

Precalculus level courses (College Algebra, Trigonometry, College Algebra & Trigonometry, Introduction to Mathematical Modeling, Precalculus) accounted for 18% of 2010 enrollment, one percentage point down from enrollment reported in 2005. Precalculus courses, together with Precollege courses, accounted for 75% of mathematics and statistics enrollment at public two-year colleges in fall 2010. See Table TYE.4.

Calculus-level courses slightly reversed a ten-year decline in which they progressively accounted for smaller proportions of the overall mathematics program enrollment. Table TYE.3 displays a 28% increase in Mainstream Calculus I enrollment, 55% in Calculus II, and 40% in Calculus III. This is contrasted with a decrease of 3% in Non-mainstream Calculus I.

In reading the enrollment tables, the reader is reminded that Mainstream Calculus consists of those calculus courses that lead to more advanced mathematics courses and usually is required of majors in mathematics, the physical sciences, and engineering. Non-mainstream Calculus includes the calculus courses most often taught for biology, behavioral science, and business majors. Additionally, refer to the comments at the start of this chapter about adjustments made in the tables that have not included computer science enrollments since CBMS2000. Additional enrollment data and analysis can also be found in Chapter 1.

It should be noted that the 7% calculus enrollment in TYE.4 for 2010 includes all Calculus listed in course numbers 11-16 in TYE.3 (mainstream and non-mainstream) and represents a one percentage point increase from 2005. The total enrollment in Non-mainstream Calculus I and II remained constant between 2005 and 2010 and represented 17% of all calculus enrollments.

Table TYE.3 reports enrollment in individual mathematics courses. Table TYE.4 reports enrollment for categories of courses. Table TYE.4 is constructed from Table TYE.3 and reports headcounts and percentages from 1990 through 2010 for the following course groupings: Precollege, Precalculus, Calculus, and Statistics. Each category consists of five or more specific courses from Table TYE.3. Percentages in Table TYE.4 will differ slightly from the corresponding percentages in the CBMS2000 report because of the

TABLE TYE.3 Enrollment in thousands in mathematics and statistics courses (not including dual enrollments) in mathematics programs at two-year colleges in fall 1990, 1995, 2000, 2005, and 2010.

Course Number	Type of course	1995	2000	2005	2010
	Precollege level				
1	Arithmetic & Basic Mathematics	134	122	104	146
2	Pre-algebra	91	87	137	226
3	Elementary Algebra (High School level)	304	292	380	428
4	Intermediate Algebra (High School level)	263	255	336	344
5	Geometry (High School level)	7	7	7	6
	Precalculus level				
6	College Algebra (above Intermediate Algebra)	186	173	206	230
7	Trigonometry	43	30	36	45
8	College Algebra & Trigonometry (combined)	17	16	14	11
9	Introduction to Mathematical Modeling	na	7	7	18
10	Precalculus/Elem Functions/Analytic Geometry	50	48	58	64
	Calculus level[1]				
11	Mainstream Calculus I	58	53	51	65
12	Mainstream Calculus II	23	20	19	29
13	Mainstream Calculus III	14	11	11	15
14	Non-mainstream Calculus I	26	16	21	20
15	Non-mainstream Calculus II	1	1	1	2
16	Differential Equations	6	5	4	6
	Other mathematics courses				
17	Linear Algebra	5	3	3	5
18	Discrete Mathematics	3	3	2	2
19	Elementary Statistics (with or w/o Probability)	69	71	111	134
20	Probability (with or w/o Statistics)	3	3	7	3
21	Finite Mathematics	24	19	22	18
22	Mathematics for Liberal Arts	38	43	59	91
23	Mathematics for Elementary School Teachers I [2]	16	18	29	21
24	Mathematics for Elementary School Teachers II [3]	na	na	na	8
25	Other Mathematics Courses for Teacher Preparation [3]	na	na	na	1
26	Business Mathematics (not transferable)	28	14	22	16
27	Business Mathematics (transferable)	11	19	17	4
28	Technical Math (non-calculus-based)	17	13	16	17
29	Technical Math (calculus-based)	2	2	1	1
30	Other Mathematics Courses (not transferable) [4]	0	14	28	33
31	Other Mathematics Courses (transferable) [3]	na	na	na	14
	Total all Two-year College math courses	1425	1347	1696	2024

Note: 0 means fewer than 500 enrollments and na means not available. Round-off may make column sums seem inaccurate.

[1] Mainstream calculus is for mathematics, physics, science & engineering. Non-mainstream calculus is for biological, social, and management sciences.

[2] In 2005 and earlier surveys there was a single course listed as *Mathematics for Elementary School Teachers*.

[3] This course was not listed in 2005 and earlier surveys.

[4] In 2005 and earlier surveys there was a single course listed as *Other Mathematics Courses*.

TABLE TYE.4 Enrollment in 1000s (not including dual enrollments) and percentages of total enrollment in mathematics and statistics courses by type of course in mathematics programs at two-year colleges in fall 1990, 1995, 2000, 2005, and 2010.

Course numbers [1]	Type of course	1990	1995	2000	2005	2010
1-5	Precollege Level	724	800	763	964	1150
		(57%)	(56%)	(57%)	(57%)	(57%)
6-10	Precalculus Level	245	295	274	321	368
		(19%)	(21%)	(20%)	(19%)	(18%)
11-16	Calculus Level	128	129	106	107	138
		(10%)	(9%)	(8%)	(6%)	(7%)
19-20	Statistics, Probability	54	72	74	118	137
		(4%)	(5%)	(5%)	(7%)	(7%)
17-18 & 21-31	Remaining Courses	121	130	130	186	231
		(10%)	(9%)	(10%)	(11%)	(11%)
1-31	Total, all courses	1272	1426	1347	1696	2024
		(100%)	(100%)	(100%)	(100%)	(100%)

[1] For names of specific courses see Table TYE.3.

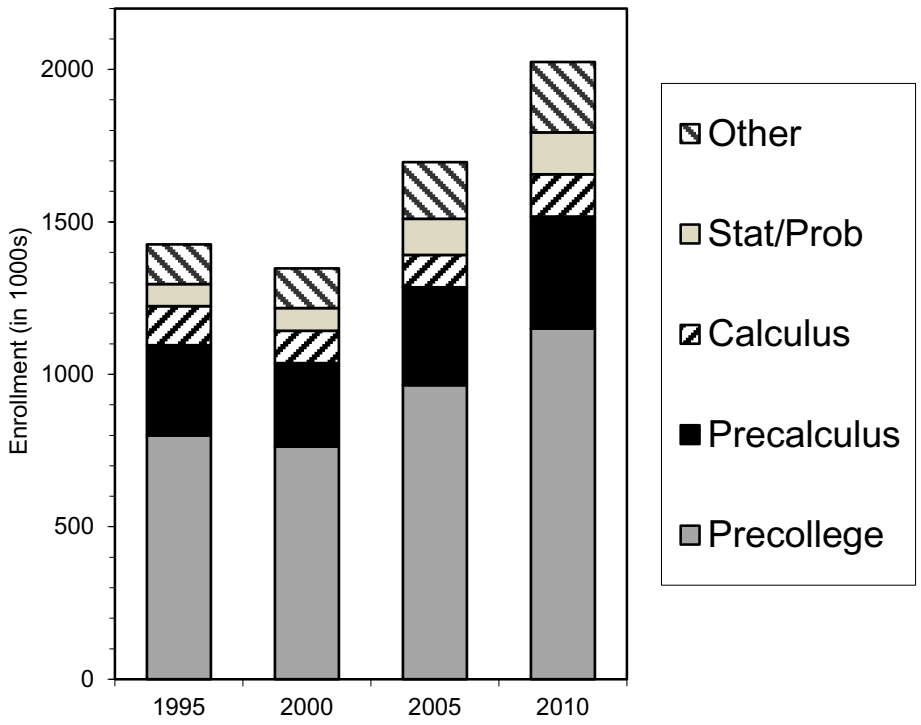

FIGURE TYE.4.1 Enrollment in 1000s (not including dual enrollments) in mathematics and statistics courses by type of course in mathematics programs at two-year colleges in fall 1995, 2000, 2005, and 2010.

computer science enrollment adjustment discussed in the introduction to this chapter.

Summarizing the enrollment trends in mathematics course categories (see Table TYE.4), the upward trend in actual enrollments from fall 2000 to fall 2005 continued from fall 2005 to fall 2010 with an increase in every category:

- Precollege courses enrolled 186,000 more students in 2010 than in 2005, representing a 19% change.
- Precalculus courses enrolled 47,000 more students in 2010 than in 2005, representing a 15% change.
- Mainstream and Non-mainstream Calculus enrolled 31,000 more students in 2010 than in 2005, representing a 29% change.
- Elementary Statistics and Probability enrolled 19,000 more students in 2010 than in 2005, representing a 16% change.
- Of special note is the 24% increase in the "Remaining" category of 45,000 students, which included Linear Algebra, Discrete Mathematics, Probability, Finite Mathematics, Mathematics for Elementary School Teachers, and Business and Technical Mathematics. Enrollment in the "Remaining" courses varied greatly, including a large increase of 55% in Mathematics for Liberal Arts.

Trends in availability of courses in mathematics programs

Tables TYE.5 and TYE.6 should be considered together; they represent the availability of fall 2005 and 2010 course offerings. Past CBMS surveys assessed the availability of courses throughout the academic year. CBMS2010 limited the questions to fall offerings and Tables TYE.5 and TYE.6 now reflect only fall offerings for both 2005 and 2010.

In considering the availability of courses, the reader should also note that 29% of two-year colleges in fall 2010 reported that some or all of the Precollege (Arithmetic, Elementary Algebra, and Intermediate Algebra) mathematics courses at the college were organized separately from the mathematics department. This was down slightly from the 31% reported in 2005 and the same as in 2000 and 1995. See Table TYE.16. These "outside" courses are not included below in Tables TYE.5 and TYE.6 in reporting the availability of particular courses. The "outside" enrollment headcount is estimated in Tables TYE.15 and TYE.16 and also includes Business Mathematics, Statistics and Probability, and Technical Mathematics. Also see the last highlight bullet at the start of this chapter.

Table TYE.5 reports that the percentage of two-year college mathematics programs offering a separately titled Arithmetic/Basic Mathematics course in 2010 was 50%, following a steep decline from 70% in 1995, 56% in 2000, and 48% in 2005. From 2005 to 2010, the percentage of mathematics programs offering a Pre-algebra course, which generally included arithmetic skills, rose three percentage points to 49%. Table TYE.3 reports that enrollment in Pre-algebra courses rose 65%. See Table TYE.3.

Intermediate Algebra, which is roughly equivalent to the second year of high school algebra, was offered in 79% of colleges in fall 2010, down slightly since 2005. Historically, Intermediate Algebra has been the bridge between a developmental studies division and a mathematics program. Within a mathematics program, Intermediate Algebra often is the preparatory course for transferable college-credit mathematics.

The availability of Elementary Algebra within mathematics programs increased slightly in 2010 to 82% from 80% in 2005. The discussion about mathematics courses taught "outside" the mathematics program is also relevant here. Table TYE.16 reported that almost one-third (29%) of two-year colleges offer precollege courses outside of the mathematics department with 13% of Elementary Algebra courses taught outside the mathematics program and (7%) of all Intermediate Algebra courses taught in other departments or divisions.

CBMS2010 reported a sharp decrease from 19% in fall 2005 to 7% in fall 2010 in the percentage of two-year colleges offering high school level Geometry courses (Table TYE.5), with the overall geometry enrollment decreasing by 1000 students (Table TYE.3).

Data for courses directly preparatory for calculus are also presented in Table TYE.5. In fall 2010, the percentage of colleges offering a separate College Algebra course decreased by two points to 76%. The percentage of colleges offering a separate Trigonometry course was up 4 points to 55%. The combined course College Algebra/Trigonometry experienced a 5-point drop to 12% of colleges offering the course. Precalculus/Elementary Functions experienced a one percentage point increase in availability from 2005 to 2010 to 53%.

Comparing fall 2005 to fall 2010, the percentage of colleges offering the first semester of Mainstream Calculus fell three points to 79%, although total enrollment increased 27% (Tables TYE.5 and TYE.3). The availability of Mainstream Calculus II was up four points to 61%.

Introductory Mathematical Modeling was first surveyed in 2000. In that year, 12% of colleges reported offering the course. In fall 2005, this percentage had dropped to 5%. In 2010, while 9% of colleges reported offering the course, the actual total enrollment of 18,000 represented a 157% enrollment increase.

The CBMS1995 survey noted that many students at two-year colleges could not complete lower-division mathematics requirements in certain majors because essential courses such as Linear Algebra,

Mathematics for Liberal Arts, and Mathematics for Elementary School Teachers were offered at fewer than half of two-year college mathematics programs, even over a two-year window. Using the two-year window, CBMS2000 noted an important increase in availability for all three of these baccalaureate-essential courses. In 2005, the availability of all three jumped again.

CBMS2010 reports offerings only in the fall term for 2005 and 2010. Comparing fall 2010 to fall 2005 course offerings, the percentage of colleges offering Linear Algebra remained constant, and Mathematics

TABLE TYE.5 Percentage of two-year college mathematics programs teaching selected mathematics courses in fall 2005 and in fall 2010.

Course number	Type of course	Fall 2005	Fall 2010
1	Arithmetic & Basic Mathematics	48	50
2	Pre-algebra	46	49
3	Elementary Algebra (High School level)	80	82
4	Intermediate Algebra (High School level)	88	79
5	Geometry (High School level)	19	7
6	College Algebra (above Intermediate Algebra)	78	76
7	Trigonometry	51	55
8	College Algebra & Trigonometry (combined)	17	12
9	Introduction to Mathematical Modeling	5	9
10	Precalculus/ Elementary Functions/ Analytic Geometry	52	53
11	Mainstream Calculus I	82	79
12	Mainstream Calculus II	57	61
13	Mainstream Calculus III	52	56
14	Non-mainstream Calculus I	36	25
15	Non-mainstream Calculus II	3	5
16	Differential Equations	25	21
17	Linear Algebra	19	19
18	Discrete Mathematics	12	11
19	Elementary Statistics (with or w/o Probability)	78	73
20	Probability (with or w/o Statistics)	7	5
21	Finite Mathematics	28	27
22	Mathematics for Liberal Arts	56	44
23	Mathematics for Elementary School Teachers I [1]	59	55
24	Mathematics for Elementary School Teachers II [2]	na	27
25	Other Mathematics Courses for Teacher Preparation [2]	na	2
26	Business Mathematics (not transferable)	19	20
27	Business Mathematics (transferable)	15	6
28	Technical Mathematics (non-calculus-based)	35	26
29	Technical Mathematics (calculus-based)	5	3
30	Other Mathematics Courses (not transferable) [3]	26	19
31	Other Mathematics Courses (transferable) [2]	na	18

[1] In 2005 there was a single course listed as *Mathematics for Elementary School Teachers;* the enrollment for that course is listed here.

[2] This course was not listed in 2005 survey.

[3] In 2005 there was a single course listed as *Other Mathematics Courses;* the enrollment for that course is listed here.

TABLE TYE.6 Percentage of two-year college mathematics programs teaching selected mathematics courses in the fall terms of 1995, 2000, 2005, and 2010.

		Percentage of two-year colleges teaching course			
Course number	Type of course	1995	2000	2005	2010
11	Mainstream Calculus I	83	94	82	79
16	Differential Equations	53	59	25	21
17	Linear Algebra	30	39	19	19
18	Discrete Mathematics	12	19	12	11
19	Elementary Statistics (with or w/o Probability)	80	83	78	73
21	Finite Mathematics	31	32	28	27
22	Mathematics for Liberal Arts	46	50	56	44
23	Mathematics for Elementary School Teachers I [1]	43	49	59	55
28	Technical Mathematics (non-calculus-based)	33	36	35	26
29	Technical Mathematics (calculus-based)	11	9	5	3

[1] In 2005 and earlier there was a single course listed as *Mathematics for Elementary School Teachers;* the enrollment for that course is listed here.

for Elementary School Teachers I decreased 4 percentage points. Mathematics for Liberal Arts shows a 12% decrease in departments offering the course in the fall semester while experiencing a 55% increase in student enrollment between 2005 and 2010. See Table TYE.5.

Availability of other courses important to baccalaureate degrees in science, technology, engineering, mathematics, and computer science—such as Differential Equations, Discrete Mathematics, Elementary Statistics, and Finite Mathematics—had small losses in 2010. See Table TYE.6.

The overall 2010 survey data reflect the continued significant role that two-year colleges play in the mathematics preparation of future teachers and majors in STEM courses and degrees in what the National Science Foundation calls STEM degrees (science, technology, engineering, and mathematics).

Trends in average section size

The downward trend in the average number of students per class section in two-year college mathematics courses exhibited in 1990 through 2005 shifted slightly upward in 2010. The average class size in fall 2010 was 24 students, compared with 23 in 2005 and 24.8 in 2000. The Precollege and Precalculus course categories had average class sizes of 24 and 26 students respectively in 2010. Calculus classes (Mainstream and Non-mainstream) were about 3 persons below the overall average (21), while Statistics and Probability averaged 4 students above the average (28). See Table TYE.7.

In 2005, the lower cut-off of 30 students per class was chosen to make data for two-year colleges directly comparable to that collected for four-year institutions and to coincide with the recommendation from the Mathematical Association of America (MAA) and endorsement by the American Mathematical Association of Two-Year Colleges (AMATYC) that undergraduate class size not exceed 30 students. In fall 2010, 77% of all class sections in two-year colleges met the goal of the two professional societies. At four-year colleges and universities, the average class size for freshman-/sophomore-level courses through calculus ranged from 20 - 31 students, depending on course type. At PhD-granting institutions, these numbers ranged from 35 - 43 students. See Table E.13 in Chapter 3 for four-year institutional data.

Table TYE.7 reports that 23% of all class sections in fall 2010 had size greater than 30, up two points from 21% in 2005. There is no comparable figure for 2000 since in CBMS2000 the comparison size for two-year colleges was 35 students per class section. In 2000, 10% of class sections were over 35 students.

For a closer examination of individual course average section sizes in 2010, see Table TYE.8. One example is the average class size in Mathematics for Elementary Teachers was 19 students, up 4 students from 2005 (see CBMS2005 for 2005 data). As one would expect, except for some specialized courses, the

TABLE TYE.7 Average on-campus section size by type of course in mathematics programs at two-year colleges in fall 2000, 2005, and 2010. Also percentage of sections with enrollment above 30 in fall 2005 and 2010.

			2005		2010	
Course numbers [1]	Type of course	2000 average section size	average section size	Percentage of sections with size > 30	average section size	Percentage of sections with size > 30
1-5	Precollege Level	24.5	23.9	21%	24.0	20%
6-10	Precalculus Level	24.8	23.6	23%	26.0	34%
11-16	Calculus Level	20.8	20.0	16%	21.0	25%
19-20	Elem. Statistics, Probability	25.2	25.9	33%	28.0	38%
1-31	Total, all courses	24.8 [2]	23.0	21%	24.0	23%

[1] For names of specific courses see Table TYE.3.

[2] The average section size of 23.7 reported in CBMS2000 included computer science courses taught in mathematics programs.

TABLE TYE.7.1 Average distance learning section size by type of course in mathematics programs at public two-year colleges in fall 2010. Also percentage of sections with enrollment above 30 in fall 2010.

Course number [1]	Type of course	2010 average section size	Percentage of 2010 sections with size > 30
1-5	Precollege Level	23.0	23%
6-10	Precalculus Level	22.0	12%
11-16	Calculus Level	15.0	0%
19-20	Statistics, Probability	24.0	15%
1-31	Total, all courses	22.0	10%

[1] For names of specific courses see Table TYE.3.

smallest class sizes were among advanced courses at the two-year college such as Mainstream Calculus III and Discrete Mathematics.

Given the increasing enrollments in distance learning courses, CBMS2010 collected data on the average section size of distance learning classes. As reported in Tables TYE 7.1 and 8.1, average section sizes for all distance learning courses ranged from 4 to 24 students. Section sizes in Precollege courses (course numbers 1-5) ranged from 22-24 students. Precalculus (course numbers 6-10) average section sizes ranged from 17-24 students. Mainstream Calculus and Non-mainstream Calculus section sizes ranged from 4-19 students. Comparing the section sizes of distance learning by course category to face-to-face section sizes, distance learning section size was less than the face-to-face in all categories (see Tables TYE 7.1 and TYE 8.1).

Trends in the use of part-time faculty

In fall 2010, there were more than twice as many part-time faculty as full-time faculty at two-year colleges (see Table TYF.1 in Chapter 7). However, this statement requires some explanation. The relevant issue, as the faculty data in Table TYF.1 reflected, is who is included in the various categories. When faculty of every sort are included, such as part-time faculty paid by third parties and also temporary full-time faculty, part-time faculty in fall 2010 made up about 70% of the total faculty. The comparable figure in 2005 was 68%. If the 2,323 third-party-payee part-time faculty members are excluded, 68% of the faculty

TABLE TYE.8 Average on-campus section size for public two-year college mathematics program courses in fall 2010.

Course number	Type of course	Average section size	Course number	Type of course	Average section size
1	Arithmetic & Basic Mathematics	24	17	Linear Algebra	20
2	Pre-algebra	21	18	Discrete Mathematics	18
3	Elementary Algebra (High School level)	24	19	Elementary Statistics (with or w/o Probability)	28
4	Intermediate Algebra (High School level)	25	20	Probability (with or w/o Statistics)	22
5	Geometry (High School level)	26	21	Finite Mathematics	23
6	College Algebra (above Intermediate Algebra)	26	22	Mathematics for Liberal Arts	27
7	Trigonometry	27	23	Mathematics for Elementary School Teachers I	19
8	College Algebra & Trigonometry (combined)	22	24	Mathematics for Elementary School Teachers II	17
9	Introduction to Mathematical Modeling	28	25	Other Mathematics Courses for Teacher Preparation	23
10	Precalculus/Elem Functions/Analytic Geometry	26	26	Business Math (not transferable)	22
11	Mainstream Calculus I	20	27	Business Math (transferable)	27
12	Mainstream Calculus II	24	28	Technical Math (non-calculus-based)	21
13	Mainstream Calculus III	20	29	Technical Math (calculus-based)	22
14	Non-mainstream Calculus I	21	30	Other Mathematics Courses (not transferable)	21
15	Non-mainstream Calculus II	27	31	Other Mathematics Courses (transferable)	23
16	Differential Equations	23			

had part-time status in fall 2010. The comparable figure for 2005 was 65%.

Though making up about 70% of total faculty by headcount, part-time faculty taught less than half (46%) of mathematics program class sections in fall 2010, up two percentage points from 2005. See Table TYE.9. For historical reference, in fall 2000, 46% of class sections were taught by part-time faculty. In fall 1995, this figure was 38%.

Concerning the important instructional issue of which types of courses are taught most often by part-time faculty, the pattern in fall 2010 continued from fall 2005. Once again in fall 2010, it was more likely that a part-time faculty member was teaching a course below calculus than a calculus course. In 2010, 58% of all Precollege courses were taught by part-time faculty, up two points compared with 2005, compared to 11% of Mainstream Calculus courses (down one point) and 27% of Non-mainstream Calculus (down one point). Table TYE.9 contains the relevant percentages.

Instructional Practices in Mathematics Programs

CBMS2005 presented the percentage of class sections in mathematics courses at public two-year colleges that employed the instructional practices of using graphic calculators, writing assignments, computer assignments, group projects, online resource systems, and standard lecture methods (Table TYE.10). At that time, the predominant instructional method was the standard lecture format, with percentage of use in an individual course ranging from 93% in Differential Equations and 81% in Mainstream Calculus I to 74% in each of College Algebra and Elementary Algebra to 64% in Arithmetic. Exceptions to the predominance of the lecture method were Mathematics for Elementary School Teachers and certain business mathematics

TABLE TYE.8.1 Average distance learning section size for public two-year college mathematics program courses in fall 2010.

Course number	Type of course	Average section size	Course number	Type of course	Average section size
1	Arithmetic & Basic Mathematics	22	17	Linear Algebra	20
2	Pre-algebra	23	18	Discrete Mathematics	15
3	Elementary Algebra (High School level)	24	19	Elementary Statistics (with or w/o Probability)	24
4	Intermediate Algebra (High School level)	22	20	Probability (with or w/o Statistics)	11
5	Geometry (High School level)	na	21	Finite Mathematics	20
6	College Algebra (above Intermed. Alg.)	23	22	Mathematics for Liberal Arts	24
7	Trigonometry	24	23	Mathematics for Elementary School Teachers I	19
8	College Algebra & Trigonometry (combined)	23	24	Mathematics for Elementary School Teachers II	18
9	Introduction to Mathematical Modeling	17	25	Other Mathematics Courses for Teacher Preparation	na
10	Precalculus/Elem Functions/Analytic Geometry	20	26	Business Math (not transferable)	24
11	Mainstream Calculus I	15	27	Business Math (transferable)	24
12	Mainstream Calculus II	8	28	Technical Math (non-calculus-based)	17
13	Mainstream Calculus III	4	29	Technical Math (calculus-based)	13
14	Non-mainstream Calculus I	19	30	Other Mathematics Courses (not transferable)	12
15	Non-mainstream Calculus II	na	31	Other Mathematics Courses (transferable)	22
16	Differential Equations	na			

courses. CBMS2000 reported that 78% of all class sections used the lecture method as the dominant instructional practice.

Reflecting the changes in mathematics instruction practices in the last five years, CBMS2010 responders were asked to report on faculty use of computer algebra systems, commercially produced electronic instructional packages, and the standard lecture method. In reviewing Table TYE.10, the reader will note the small number of percentages in some categories and with the number of sections taught in each modality totaling more than 100% for every course. Reasons for the incomplete data may be that the list of practices was not comprehensive enough to capture the different modalities used in 2010 classrooms, that department chairs (or persons completing the survey) did not always know which instructional practice is used by instructors, and/or that it was difficult to collect such data. In addition, it may have been that more than one instructional method was being used and hence the section was not reported in any one of the columns. In spite of the gaps, the writers of this summary felt that the data in the table should be presented as collected.

Regarding the 2010 data collected, the following observations can be made (see Table TYE.10):

- Computer algebra systems were used mainly in College Algebra & Trigonometry (combined), mainstream Calculus III, Differential Equations, and Probability.
- Commercially produced electronic instructional packages were used mainly at the Precollege level, and in College Algebra & Trigonometry (combined) and Probability.

TABLE TYE.9 Number of sections and number and percentage of sections taught by part-time faculty in mathematics programs at public two-year colleges by type of course in fall 2005 and 2010.

		2005			2010		
Course number [1]	Type of course	Number of sections	Number of sections taught by part-time faculty	Percentage of sections taught by part-time faculty	Number of sections	Number of sections taught by part-time faculty	Percentage of sections taught by part-time faculty
1-5	Precollege level	38814	21696	56%	45131	26069	58%
6-10	Precalculus level	12898	3914	30%	12588	3940	31%
11-13	Mainstream Calculus	3973	493	12%	5155	558	11%
14-15	Non-mainstream Calculus	923	254	28%	959	259	27%
16-18	Advanced level	617	58	9%	616	69	11%
19-20	Statistics, Probability	4142	1452	35%	4090	1573	38%
21-27	Service courses	6710	1913	29%	5673	2258	40%
28-29	Technical mathematics	927	339	37%	1533	264	17%
30-31	Other mathematics courses	1193	552	46%	2272	974	43%
1-31	Total, all courses	70197	30671	44%	78018	35965	46%

[1] For names of specific courses see Table TYE.3.

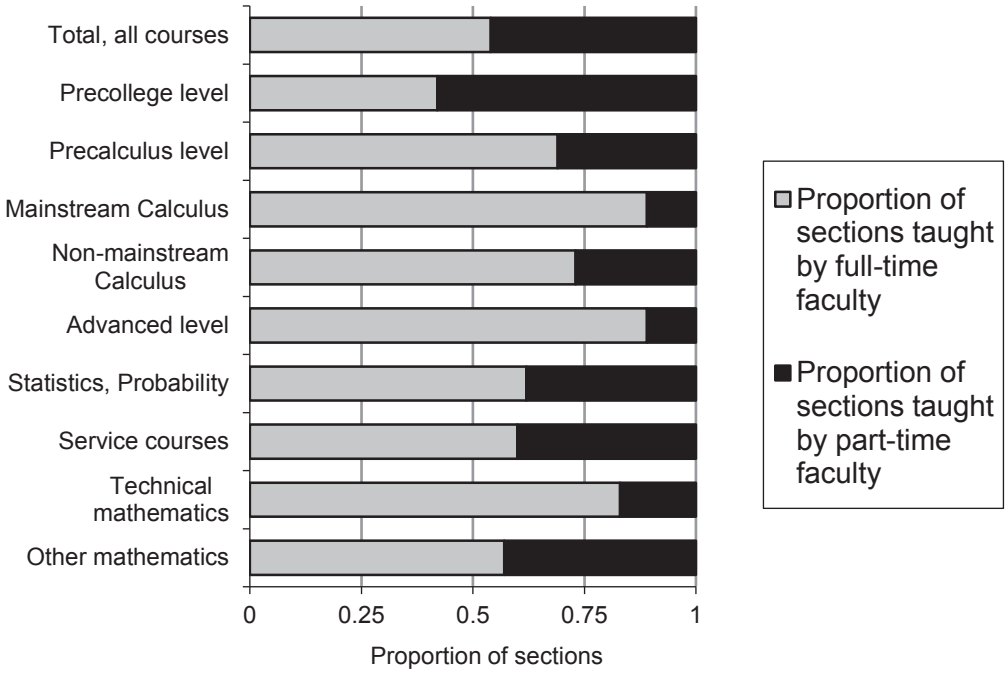

FIGURE TYE.9.1 Proportion of sections of mathematics and statistics courses taught by full-time and by part-time faculty in mathematics programs at public two-year colleges by type of course in fall 2010.

- Lecture method was used in all courses. The range of use by lecture method was:

Course #	Category	% range of use
1-5	Precollege level	31-40%
6-10	Precalculus level	11-34%
11-15	Calculus level	66-85%
19-20	Statistics/Prob	81-100%

Data and analysis on how first-year courses were taught at four-year institutions can be found in Chapter 5 of this report in Tables FY.2 through FY.10. For comparative data about four-year and two-year institutions, see Chapter 1, Tables S.11 through S.13.

Instructional methods in Precollege courses

In 2010, given the national attention on Precollege enrollments and redesigned curricula, survey respondents were asked specific questions about the use

TABLE TYE.10 Percentage of on-campus sections using different instructional methods by course in mathematics programs at public two-year colleges in fall 2010.

		Percentage of sections taught that			
Course Number	Type of course	Use computer algebra system %	Use commercially produced electronic instructional packages %	Are taught mostly by the standard lecture method %	Total number of on-campus sections in fall 2010
1	Arithmetic & Basic Mathematics	8	32	66	5652
2	Pre-algebra	9	40	54	10183
3	Elementary Algebra (High School level)	7	33	76	16236
4	Intermediate Algebra (High School level)	8	31	69	12843
5	Geometry (High School level)	0	0	77	217
6	College Algebra (above Intermed. Algebra)	6	34	79	7628
7	Trigonometry	4	23	91	1540
8	College Algebra & Trigonometry (combined)	12	20	89	413
9	Introduction to Mathematical Modeling	0	11	95	618
10	Precalculus/Elem Functions/Analytic Geometry	2	20	84	2389
11	Mainstream Calculus I	9	12	66	3166
12	Mainstream Calculus II	9	11	85	1223
13	Mainstream Calculus III	20	8	85	766
14	Non-mainstream Calculus I	0	22	72	895
15	Non-mainstream Calculus II	0	0	83	64
16	Differential Equations	14	6	81	266
17	Linear Algebra	8	8	87	239
18	Discrete Mathematics	0	0	77	111
19	Elementary Statistics (with or w/o Probability)	2	19	81	3965
20	Probability (with or w/o Statistics)	15	53	100	126
21	Finite Mathematics	4	26	82	703
22	Mathematics for Liberal Arts	1	12	88	2857
23	Mathematics for Elementary School Teachers I	7	4	71	973
24	Mathematics for Elementary School Teachers II	5	3	80	366
25	Other Mathematics Courses for Teacher Preparation	0	0	86	28
26	Business Math (not transferable)	3	4	68	602
27	Business Math (transferable)	0	20	91	143
28	Technical Math (non-calculus-based)	1	10	28	1203
29	Technical Math (calculus-based)	0	0	3	330
30	Other Mathematics Courses (not transferable)	0	46	87	1488
31	Other Mathematics Courses (transferable)	1	5	54	784

of accelerated and slower-paced Precollege course syllabi, the implementation of learning communities, and summer mathematics boot camps. Table TYE.11 shows a predominance of accelerated and slower-paced sections and summer boot camps in Beginning and Intermediate Algebra, with the percentage of departments using these strategies in these two courses ranging from 22% to 49%. Table TYE.11 also highlights the growth of learning communities where students work together and the Precollege skills of reading, writing, and mathematics are brought together in a unified curricular structure.

The use of both hand-held and computer technology in Precollege mathematics courses is presented in TYE.11.1. When this data is compared to TYE.10 in CBMS2005, the use of graphing calculators in Intermediate Algebra increased from 32% to

TABLE TYE.11 Percentage of mathematics programs at public two-year colleges whose institutions made various options available to students in developmental mathematics in fall 2010.

Course Number	Type of course	Accelerated Sections	Slower-Paced Sections	Learning Communities	Summer Boot Camp	Not applicable (course not offered)
1	Arithmetic & Basic Mathematics	22	23	17	13	34
2	Pre-algebra	35	22	15	8	30
3	Elementary Algebra (High School level)	49	29	16	15	15
4	Intermediate Algebra (High School level)	38	22	10	10	15

TABLE TYE.11.1 Percentage of mathematics programs at public two-year colleges reporting the use of various technologies in specific courses in fall 2010.

			Most sophisticated technology that is required or allowed:					
Course Number	**Type of course**	No Calculator Allowed	Four-Function Calculator	Scientific Calculator	Graphing Calculator	Computer-Based Tools	No Department Policy	Not applicable (course not offered)
1	Arithmetic & Basic Mathematics	43	7	12	1	3	8	26
2	Pre-Algebra	26	10	22	5	6	7	24
3	Elementary Algebra (High School level)	13	8	32	18	6	19	4
4	Intermediate Algebra (High School level)	4	3	23	42	7	17	4

TABLE TYE.11.2 Percentage of mathematics programs reporting status of "College Algebra" at public two-year colleges in fall 2010.

A. Percentage of all departments that offer College Algebra	84
B. Purpose of College Algebra programs is to	
a. Prepare students for Trigonometry, Engineering, or other Calculus	84
b. Prepare students for Business Calculus but not Engineering Calculus	55
c. Strengthen general quantitative literacy	73
d. Provide an option to students taking no further math	68
C. Course content primarily taught through modeling and problem solving	26
D. Department policy either requires or allows:	
a. Scientific calculator	59
b. Graphing calculator	65
c. Calculators with Algebra System	7
E. Use of technology	
a. Instructors and/or students use spreadsheets	20
b. Students use commercial programs	59
c. Students use computer algebra systems	24
d. Students are required to submit homework via an online platform	49
e. Offer web-based resources	47

42% in 2010. In 2010, calculators were not allowed in 43% of Arithmetic courses and 4% of Intermediate Algebra courses. For the first time, the question was asked whether the mathematics department had a departmental policy regarding the use of calculators in Precollege courses. The data suggests a split regarding the use of calculators in Arithmetic compared with Intermediate Algebra courses. There was no departmental policy on the use of technology in 7-8% of Arithmetic and Pre-algebra courses, suggesting policies do exist in 92% of departments, compared with 17-19% of departments with no department policy about the use of calculators in Beginning and Intermediate Algebra.

Instructional methods in College Algebra, Precalculus and Calculus courses

Prior to fall 2010, specific information about instructional practices used in Calculus had been collected. These questions were not repeated in the 2010 two-year college survey. In fall 2005, there were clear patterns among various types of courses regarding the four instructional techniques included in the survey (use of a graphing calculator, inclusion of a writing component, computer assignments, and the use of group projects). For all calculus courses (both mainstream and non-mainstream) and for Precalculus courses, the graphing calculator was used more frequently than any other technique. The percentage of sections using graphing calculators in calculus and Precalculus courses ranged from 74% to 81%, very similar to the range in 2000 of 69% to 83%. Only Non-mainstream Calculus II had a distinctly lower use (40%), and this may well be attributed to its extremely low reported enrollment.

Prior to 2005, use of the above methods was associated closely with adoption of "calculus reform" either by entire departments or by individual faculty members. In light of the somewhat general implementation of many calculus reform practices, the instructional teaching questions about calculus were not asked on the 2010 two-year college survey. Tables TYE.10 in this chapter and S.11 in Chapter 1 report that lecture was the primary instructional strategy in Calculus courses. Calculus data for two-year and four-year institutions can be found in Tables S.11 and S.12 in Chapter 1.

CBMS2010 focused on the national interest in the curricula and instructional practices of the courses titled "College Algebra." Initiatives of AMATYC and the MAA brought faculty together to discuss the broad role of College Algebra in preparing students for Calculus, but also preparing students for non-calculus academic paths. Table TYE.11.2 reports that 84% of responding colleges offer a college algebra course with 68% responding that the course was intended for students who will be taking no further mathematics and 84% responding that the course was intended to prepare students for trigonometry, engineering, or other calculus. Respondents were asked to check all categories that described the purpose of their College Algebra course. The percentages illustrated the overlapping purpose of College Algebra across the country, highlighting the challenges in teaching these courses and demonstrating the need for more national dialogue on the purpose of College Algebra and the structure and content of other courses traditionally preparing students for Calculus.

The use of calculators in College Algebra is prevalent, with up to 65% of departments requiring or allowing them. Of special note is the increasing use of spreadsheets, commercial technological programs, computer algebra systems, homework via an online platform, and other web-based resources.

Distance learning

In 2010, as in 2005, "distance learning" was defined as a course in which the majority of instruction occurs with the instructor and the students separated by time and/or place. The CBMS2005 survey inquired about the number of course sections taught via distance learning. Data about distance learning courses was collected differently in 2010, including information about both course enrollment and number of class sections. This change was motivated by the fact that distance-learning sections are not bound by room-size limits and can vary dramatically depending on local administrative practice. The comments that precede Table E.4 in Chapter 3 discuss the survey questions in CBMS2010 about "distance learning" for both four-year and two-year colleges. Additional discussion and tables about distance learning enrollments and instructional strategies for both two-year and four-year institutions are included in Chapter 2 (Tables SP.10-SP.13).

Looking back over fifteen years, less than 1% of mathematics class sections at two-year colleges were offered via television in 1995 and only 2.5% of sections in 2000 were described as using distance learning. Among high enrollment courses in 2000, College Algebra had 6.7% of sections offered via distance learning and Elementary Statistics had 5.8%.

Using enrollment data, not section counts, the fall 2010 data for two-year colleges (Tables TYE.12 in this chapter and E.4 in Chapter 3) reported that over 9% of all mathematics students enrolled via distance (187,573 students of the total 2,023,946 students), an increase of 4 points from 2005. Comparing 2010 to 2005, two-year colleges had increases in students enrolled in courses via distance learning in most courses.

As stated earlier, given the increasing enrollments in distance-learning courses, CBMS2010 collected data on the average section size of distance-learning

classes. As reported in Tables TYE 7.1 and 8.1, average section sizes for all distance-learning courses ranged from 4 to 24 students. Sections sizes in Precollege courses (course numbers 1-5) ranged from 22-24 students. Precalculus (course numbers 6-10) average section sizes ranged from 17-24 students. Mainstream Calculus and Non-mainstream Calculus section sizes ranged from 4-19 students. Comparing the section sizes of distance learning by course category to face-to-face section sizes, distance learning section size was less than the face-to-face in all categories. (Tables TYE.7.1 and TYE.8.1)

CBMS2010 also collected data on characteristics of distance learning courses and programs in two-year colleges (see Table TYE.12.1 and Tables SP.10-SP.13 in Chapter 2). Eighty-eight percent (88%) of mathematics departments reported that the goals of distance learning courses were the same as face-to-face courses, with 96% using the same course outlines for distance learning as face-to-face classes. Instructional materials were a combination of materials created by faculty and commercially produced products, used in 78% of the departments. Twenty-one percent (21%) of the departments require faculty to meet with students a specified number of office hours per week. Exams in distant learning courses were the same as face-to-face courses at 47% of the colleges reporting.

A more detailed discussion about trends in distance learning can be found in Table E.4 in Chapter 3 and in the Chapter 2 discussion preceding Tables SP.10-SP.13. At four-year institutions in fall 2005, there was only one of the course groupings in Table E.4 showing more than 2% of total enrollment in a distance format. In 2010, while the use of distance learning in four-year institutions was less than at two-year colleges, the data showed that almost 4% of Precollege level courses and over 5% of Elementary Statistics enrollments were in distance-learning courses at four-year institutions.

Services Available to Students

Chapter 2 of this report contains a comparison of academic services and other resources available to both four-year college students and to two-year college students in fall 2010. See Tables SP.14 and SP.15 in that chapter.

Placement testing

Table TYE.13 reported that diagnostic or placement/diagnostic testing was available in 90% of two-year colleges. One hundred percent of these colleges made such testing mandatory for first-time students, 98% used this score as part of a mandatory course placement program, and 75% of the colleges responding periodically assess the effectiveness of their placement tests.

Math Clubs, independent study, honors programs, programs for minorities, programs for women, and outreach projects in K-12 schools

Tables TYE.13, SP.14, and SP.15 report specific outside-of-class opportunities for two-year college mathematics students. Notable increases in participation occurred in opportunities for students to participate in various activities: mathematics clubs (31% in 2010 compared to 22% in 2005), lectures/colloquia not part of mathematics clubs (16% in 2010 compared to 6% in 2005), and undergraduate research activities (14% in 2010 compared to 9% in 2005). Participation in mathematics contests was up two points to 41% of colleges. Independent studies in mathematics decreased three points to 36%. Over ten years, honors sections in mathematics programs have gone up and down, from 17% in 1995 to 20% in 2000 to 24% in 2005 and back down to 20% in 2010. Special programs to encourage minorities in mathematics were reported in 15% of two-year colleges in 2005; this percentage dropped to 11% in 2010, matching the 11% reported in 1995.

In 2010, K-12 outreach opportunities increased again, up 7 points from 2005 to 32%. Similarly, opportunities for involvement with K-12 schools increased in four-year colleges, up to 49% from 34% in 2005. Additional discussion about teacher training in two-year colleges appears at the end of this chapter and in Chapter 2 (Tables SP.14, SP.2, and SP.4).

Mathematics labs and tutoring centers faculty advisors and advising, student-faculty interaction

In fall 2005, as noted above, 95% of mathematics programs at two-year colleges reported making available a mathematics lab or tutorial center to students.

The period from 1995 to 2000 witnessed a 50% drop (down 32 percentage points from 65% to 33%) in colleges where mathematics advising to students was provided by members of the mathematics faculty. In 2005 and 2010, this pattern had partly reversed itself with 40% and 42%, respectively, of colleges reporting that students were advised by mathematics faculty (Table TYE.13).

CBMS2010 did not attempt to survey comprehensively the habits of mathematics students related to academic services or the amount of time spent by faculty in these areas. Data of this kind have been collected by other entities. One resource is the Community College Survey of Student Engagement (CCSSE), conducted under the auspices of the Community College Leadership Program at The University of Texas at Austin since 2004. The 2011 CCSSE Survey collected data from 444,000 students at 699 colleges in 48 states and Washington, DC. The survey is not specific to mathematics students, but the items below relate to the CBMS survey questions.

TABLE TYE.12 Percentage of distance-learning enrollments (= distance-learning courses are courses in which the majority of instruction occurs with the instructor and the students separated by time and/or place) among all enrollments (excluding dual enrollments) at public two-year colleges in fall 2005 and 2010, and total enrollments (in 1000s) in those courses.

		2005	2005	2010	2010	2010
Course Number	Type of course	Total Enrollments [4] (1000s)	Percentage Distance Enrollments	Total Enrollments [4] (1000s)	Distance Enrollments (1000s)	Percentage Distance Enrollments
1	Arithmetic & Basic Mathematics	104	4	146	11	7
2	Pre-algebra	137	3	226	14	6
3	Elementary Algebra (High School level)	380	4	428	37	9
4	Intermediate Algebra (High School level)	336	5	344	25	7
5	Geometry (High School level)	7	12	6	0	0
6	College Algebra (above Intermed. Algebra)	206	6	230	32	14
7	Trigonometry	36	4	45	4	10
8	College Algebra & Trigonometry (combined)	14	1	11	1	12
9	Introduction to Mathematical Modeling	7	11	18	1	4
10	Precalculus/ Elementary Functions/ Analytic Geometry	58	4	64	3	5
11	Mainstream Calculus I	51	5	65	2	3
12	Mainstream Calculus II	19	1	29	0	1
13	Mainstream Calculus III	11	2	15	0	0
14	Non-mainstream Calculus I	21	5	20	2	8
15	Non-mainstream Calculus II	1	0	2	0	0
16	Differential Equations	4	0	6	0	2
17	Linear Algebra	3	2	5	0	4
18	Discrete Mathematics	2	2	2	0	12
19	Elementary Statistics (with or w/o Probability)	111	9	134	23	17
20	Probability (with or w/o Statistics)	7	7	3	0	7
21	Finite Mathematics	22	5	18	2	11
22	Math for Liberal Arts	59	8	91	15	17
23	Mathematics for Elementary School Teachers I [1]	29	10	21	2	11
24	Mathematics for Elementary School Teachers II [2]	na	na	8	2	20
25	Other Mathematics Courses for Teacher Preparation [2]	na	na	1	0	0
26	Business Math (not transferable)	13	9	16	3	19
27	Business Math (transferable)	14	11	4	0	7
28	Technical Math (non-calculus)	16	1	17	1	7
29	Technical Math (calculus)	1	0	1	0	37
30	Other Math Courses (not transfer-able) [3]	na	na	33	2	7
31	Other Math Courses (transferable) [2]	na	na	14	3	19
	Total Enrollments	1696		2024	188	

Note: 0% means less than one-half of one percent.

[1] In 2005 there was a single course listed as *Mathematics for Elementary School Teachers;* the enrollment for that course is listed here.

[2] This course was not listed in 2005.

[3] In 2005 there was a single course listed as *Other Mathematics Courses;* the enrollment for that course is listed here.

[4] Does not include dual enrollments.

TABLE TYE.12.1 Percentage of mathematics programs reporting use of distance learning in public two-year colleges.

A. Goals of distance learning generally the same as face-to-face courses	
a. Yes	88
b. No	0
c. Do not have distance learning	12
B. Instructional materials created by:	
a. Faculty	10
b. Commercially produced materials	12
c. Combination of both	78
C. Format of majority of distance learning	
a. Complete online	73
b. Hybrid	22
c. Other	5
D. Requirements of distance learning faculty to meet with students	
a. Never	8
b. For scheduled meetings	6
c. Specified office hours per week	21
d. Not applicable	65
E. How distance learning students take majority of tests	
a. Complete online and unproctored	11
b. At proctored testing site	42
c. Combination of both	47
F. Exams when there are multiple instructors	
a. No common departmental exams	39
b. Common departmental exams for some courses	20
c. Common departmental exams for all courses	23
G. Are some courses in both non-distance and distance learning formats	
a. Yes	97
b. No	3
H. Distance learning practices	
a. Same exams as in face-to-face	47
b. Same outlines as in face-to-face	96
c. Same course projects	49
I. Distance learning instructors evaluated in same way	
a. Yes	78
b. No	22

Related highlights of the 2011 CCSSE Student Survey are listed below:

- Fifty-eight percent (58%) of students use academic advising services *sometimes* or *often*, and 34% *rarely* or *never* use them.
- Fifty-eight percent (58%) of students have used e-mail to communicate with an instructor *often* or *very often*, compared with 10% of students that have *never* done so.
- Forty-eight percent (48%) have discussed grades or assignments with an instructor *often* or *very often*, compared with 9% of students that have *never* done so.
- Twenty-six percent (26%) have talked about their career plans with an instructor or advisor *often* or *very often*, but 29% have *never* done so.
- Seventy percent (70%) have *never* worked with instructors on activities other than coursework.
- Fifty-one percent (51%) of students say they *rarely* or *never* use career counseling services.
- Forty-six percent (46%) *rarely* or *never* use peer or other tutoring resources.
- Four in 10 (40%) *sometimes* or *often* use a skills lab.
- Sixty-three percent (63%) use a computer lab *sometimes* or *often*, with 32% using one *often*.

The CCSSE surveys can be found at:

Center for Community College Student Engagement. Community College Survey of Student Engagement: Key Findings, http://www.ccsse.org/survey/survey.cfm. Austin, TX, 2011.

Mathematics Courses Taught Outside of the Mathematics Program

Two-year colleges have a long history of offering mathematics courses in instructional units outside of the mathematics program. Tables TYE.14, TYE.14.1, TYE.15, and TYE.16 give the enrollment in mathematics courses offered outside of mathematics programs. These enrollments were estimated by mathematics program department chairs. Thus, they may not be as accurate as the numbers given for enrollment within mathematics programs.

In fall 2010, the total enrollment in mathematics courses outside the department was reported to be 152,000 students, a 19% decrease from 2005. Seventy-seven percent of those enrollments involved Precollege courses (Arithmetic/Pre-algebra, Elementary and

TABLE TYE.13 Percentage of two-year colleges offering various opportunities and services to mathematics students in fall 2000, 2005, and 2010.

Opportunity/Service	2000	2005	2010
A. Diagnostic or placement testing	98	97	90
a. Colleges that usually require placement tests of first-time enrollees	98	97	100
b. Colleges that use placement tests as part of mandatory placement	na	88	98
c. Colleges that periodically assess the effectiveness of their placement tests	85	81	75
B. Mathematics lab or tutorial center	98	95	*
C. Advising by a member of the mathematics faculty	33	40	42
D. Opportunities to compete in mathematics contests	28	37	41
E. Honors sections	20	24	20
F. Mathematics club	14	22	31
G. Special mathematics programs to encourage minorities	4	15	11
H. Lectures/colloquia for students, not part of math club	9	6	16
I. Special mathematics programs to encourage women	4	7	6
J. K-12 outreach opportunities	20	25	32
K. Undergraduate research opportunities	4	9	14
L. Independent mathematics studies	25	38	36
M. Other	4	4	13

* Did not collect.

TABLE TYE.14 Estimated enrollment (in 1000s) in mathematics and statistics courses taught outside of mathematics programs at two-year colleges in fall 1995, 2000, 2005, and 2010.

		Enrollment (in 1000s)			
Course Number	Type of course	1995	2000	2005	2010
1-2	Arithmetic & Basic Math, Pre-algebra	54	43	60	48
3	Elementary Algebra (High School level)	41	27	65	38
4	Intermediate Algebra (High School level)	10	10	26	29
19-20	Elementary Statistics, Probability	9	7	12	12
26-27	Business Mathematics	26	18	15	19
28-29	Technical Mathematics	8	5	10	7
	Total	148	110	188	152

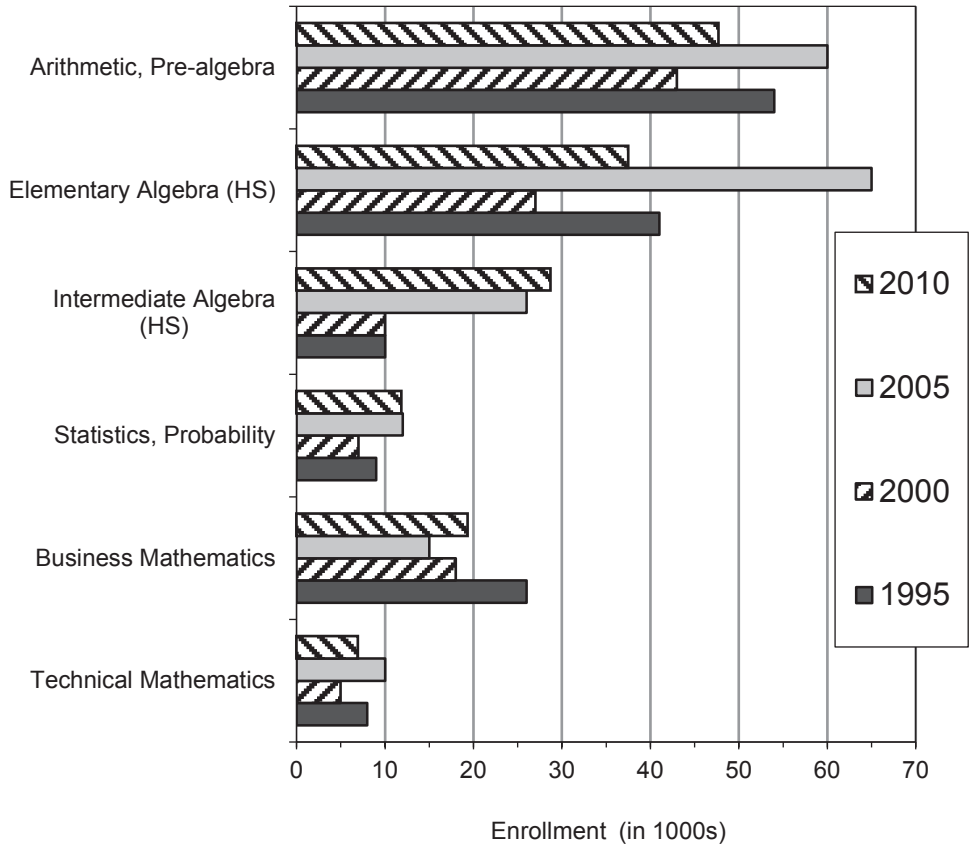

FIGURE TYE.14.1 Estimated enrollment (in 1000s) in mathematics and statistics courses taught outside of mathematics programs at two-year colleges in fall 1995, 2000, 2005, and 2010.

Intermediate Algebra), down three points from 2005. Almost all of these courses were taught in a developmental education department or division. The other 23% (Business Mathematics, Statistics and Probability, and Technical Mathematics) were courses taught in a business or engineering division, occupational training programs, or other divisions. (See Tables TYE.14 and TYE.15.)

Precollege mathematics taught outside the mathematics program

The largest component of this "outside" mathematics enrollment was in Precollege developmental courses. The structure of Precollege course offerings within a particular college is determined by the institution's philosophy concerning developmental education. Two views predominate. Either a student took all developmental courses (mathematics, reading, and writing) in a self-contained unit devoted to developmental studies or developmental courses were offered as part of the disciplinary curriculum.

The earliest CBMS survey for which "outside" Precollege mathematics enrollment data are available on a course-by-course basis was in 1990. The following percentages are obtained by using Tables TYE.3 and TYE.15. They trace the pattern of enrollment outside the mathematics program from 1990 to 2010 in Arithmetic, Elementary Algebra and Intermediate Algebra as a percentage of the total enrollment in the course.

	1990	1995	2000	2005	2010
Arithmetic/Pre-algebra	18%	19%	17%	20%	33%
Elementary Algebra	13%	12%	12%	15%	9%
Intermediate Algebra	9%	4%	4%	7%	8%

Looking only at percentages of total enrollment does not tell the whole story. The reported enrollment in "outside of mathematics program" Precollege-level courses had a 42% drop in enrollment from 1995 to 2000, an 89% enrollment increase from 2000 to 2005, and a 24% drop in 2010. The percentage change in the above courses of enrollment from 2005 to 2010 was Arithmetic/Pre-algebra, down 20%, Elementary Algebra, down 42%, and Intermediate Algebra, up 12%. Fluctuation in these values may be influenced by the fact that the mathematics department chairs, who do not manage these outside programs, were responsible for estimating the numbers.

Table TYE.16 shows that 29% of colleges reported some part of their developmental mathematics program was administered separately from the mathematics program, down from 31% in 2005, but the same in 2010 as both 2000 and 1995.

TABLE TYE.15 Estimated enrollment (in 1000s) in mathematics courses taught outside of mathematics programs at public two-year colleges, by division where taught, in fall 2010.

		Mathematics Enrollment (in 1000s) in Other Programs			
Course Number	Type of course	Developmental Education Dept/Division	Occupational Programs	Business	Other Depts/ Divisions
1-2	Arithmetic & Basic Math, Pre-algebra	47	1	0	0
3	Elementary Algebra (High School level)	36	0	1	0
4	Intermediate Algebra (High School level)	29	0	0	0
19-20	Elementary Statistics, Probability	0	0	9	3
26-27	Business Mathematics	0	1	18	0
28-29	Technical Mathematics	0	4	1	2
	Total	112	5	29	6

Note: 0 means less than 500 enrollments and this may cause column sums to seem inaccurate.

Special Instructional Activities in Mathematics Programs

Teacher training

Enrollment data in CBMS2005 Tables TYE.3 and TYE.5 give a partial perspective on the involvement of mathematics programs at two-year colleges in teacher education, especially in the preparation of future K-8 teachers. The expansion of two-year-college activity in this area in the last decade has been significant. Hence, the topic was one of the survey's Special Projects in CBMS2000, CBMS2005, and CBMS2010. The reader should refer to Tables SP.2 and SP.4 in Chapter 2 for a comprehensive perspective on the mathematics education of future teachers at two-year and four-year institutions. Of special note are increases in almost all categories. Forty-one percent (41%) of colleges reported organized programs in which students can complete their entire mathematics course or licensure requirements at two-year colleges. An increase was noted in "career-switchers" aiming for elementary, middle school, and secondary teaching. (See Table SP.2.)

Dual-enrollment courses

Since at least the year 2000, enrollment in dual courses had been a growing phenomenon in two-year college mathematics programs. These dual-enrollment courses earned credit both for high school graduation and at the two-year institution. In 2010, information was again collected about these courses. A discussion of the 2010 survey results, including dual-enrollment data and comparisons to what is happening in the same regard at four-year institutions, can be found with the Special Projects analysis in Chapter 2, Tables SP.18 and SP.19. Additional commentary on dual enrollment also can be found in Chapter 7 with emphasis on the credentials and the supervision of those who teach such courses.

The increase in the numbers of students involved in dual-enrollment courses in two-year colleges is notable. In 2005, 50% of all two-year college mathematics departments enrolled a total of 41,836 students. In 2010, 80,805 students received credit for the same course in high school and two-year colleges in 61% of the nation's public two-year colleges, a 92% increase from 2005. Comparing dual enrollments in fall 2010 to fall 2005, there was almost a tripling of enrollment in College Algebra, a 66% increase in Precalculus, and a 2% decrease in Calculus. See Table SP.18.

In most cases, dual courses were not "outside" the mathematics program in the sense of the CBMS survey. They had some level of supervision from the mathematics program on college campuses, and most mathematics programs counted them among the courses offered by the program. In 2010, 22% of colleges reported that they assigned their own full-time or part-time faculty members to teach courses in a high school that awards both high school and college credit. See Tables SP.18 and SP.19.

TABLE TYE.16 Percentage of two-year colleges in which some of the precollege (remedial) mathematics course offerings are administered separately from, and not supervised by, the mathematics program – e.g. in a developmental studies department or program – by type of course in fall 1995, 2000, 2005, and 2010.

Mathematics Outside of the Mathematics Department		1995	2000	2005	2010
Percentage of Two-year Colleges with some precollege mathematics courses outside of mathematics department control		29	29	31	29
Course number	Type of Course				
1-2	Arithmetic & Basic Math, Pre-algebra	19	17	20	24
3	Elementary Algebra (High School level)	12	12	15	13
4	Intermediate Algebra (High School level)	4	4	7	7