Chapter 2

Summary of CBMS2000 Special Topics

In addition to continuing the longitudinal studies of the mathematical sciences curriculum and faculty that started in 1965, each CBMS survey selects several special topics for investigation. The choice of special topics for the CBMS2000 survey began in 1999 when the CBMS2000 Steering Committee asked numerous professional society committees to suggest topics that were particularly timely.

One of the special topics chosen was to continue the CBMS1995 study of the spread of calculus reform. Those results are discussed in Chapters 1 and 5 of this report. Other special topics chosen by the CBMS2000 Steering Committee were:

a) pre-service education of K–8 teachers in mathematics and statistics;

b) academic resources for students: placement tests, tutoring centers, and special opportunities for mathematics students;

c) distance learning in the mathematical sciences;

d) dual-enrollment courses;

e) the educational background of faculty who teach statistics courses in four-year colleges and universities, and the impact of the statistics Advanced Placement examination.

This chapter presents twenty tables that summarize the findings of the CBMS2000 survey on those topics.

A. Pre-service Education of K–8 Teachers in the Mathematical Sciences

A recent CBMS-sponsored study [The Mathematical Education of Teachers, Vol. 11 in the *CBMS Issues In Mathematics Education Series*, Amer. Math. Soc., Providence, RI, 2001] made recommendations about appropriate mathematical education of pre-service K–8 teachers, i.e., undergraduates who are preparing to be teachers in one or more of the grades between kindergarten and eighth grades. The study recommended increased cooperation between mathematical sciences departments and schools of education in the design of courses for these students. The study also recommended that students preparing for early grades teaching take at least 9 semester hours of mathematics courses, and that students preparing for later grades teaching have at least 21 semester hours of mathematics courses. In addition, the report gave specific recommendations about the mathematical content of the 9–21 hours.

At the request of various professional society committees, the CBMS2000 survey included a study of the mathematical sciences education of pre-service K–8 teachers, and the next six tables summarize CBMS2000 findings. These findings can be seen as partial benchmarks against which future progress toward the recommendations of the above-cited report can be compared.

Typically there were at least two kinds of K–8 teacher preparation tracks in fall 2000, corresponding to the different kinds of teaching certificates issued by a given state. In almost all cases, one track dealt with early grades and included grades K–3, while another prepared teachers for later grades. Depending upon the system in a given state, the later grades might be 5 through 8, or 4 through 6, or 5 through 7. However, in almost all states, the later grades certification includes at least grades 5 and 6. Consequently, CBMS2000 asked surveyed departments to respond separately concerning students preparing to teach in the early grades (including K–3) and in later grades, which were defined as the block of grades including grades 5 and 6.

Table PSE.1 shows that in fall 2000, not all mathematics departments and statistics departments resided in institutions that offered teacher certification for some or all of grades K–8. For example, less than three quarters of the universities that contain doctoral mathematics or doctoral statistics departments were reported as offering K–8 certification.

TABLE PSE.1 Percentage of Mathematics Departments and Statistics Departments whose institutions offer a certification program for some or all of grades K–8, by type of school: Fall 2000.

	Percentage whose institutions have a K-8 teacher certification program
Mathematics Departments	
Univ (PhD)	72
Univ (MA)	87
Coll (BA)	85
Total Math Depts	84
Statistics Departments	
Univ (PhD)	58
Univ (MA)	63
Total Stat Depts	58

One way to assess the level of cooperation between mathematics departments and schools of education in pre-service teacher education is to consider the extent to which mathematics departments share in the governance of teacher certification programs. If one considers only mathematics departments whose universities had K–8 teacher certification programs in fall 2000, one finds that sixty to seventy-five percent of mathematics departments had a department member serving on the committee or in the office in charge of the program.

The *Mathematical Education of Teachers* report cited above argues that all K–8 teachers need special insight into K–8 mathematics, and mentions topics that are not found in most standard college mathematics courses except possibly for a special course or course sequence for pre-service teachers. CBMS2000 found that more than seventy percent of mathematics departments offered a special course or course sequence designed for some or all pre-service K–8 teachers, and we estimate that there were about 68,000 students enrolled in such courses at four-year colleges and universities in fall 2000, up 15% from the corresponding enrollment in fall 1995 (see Appendix I). In addition to courses designed exclusively for pre-service K–8 teachers, we found that a few mathematics departments also designated special sections of other courses as being especially for K-8 teachers. CBMS2000 data show that statistics departments were far less likely to be involved in K–8 teacher preparation in these ways. Details appear in Table PSE.2.

TABLE PSE.2 Percentage of departments in universities and colleges offering K-8 certification programs that are involved in K–8 teacher certification in various ways, by type of school: Fall 2000.

	Percentage of departments in schools offering K–8 certification programs that		
	Have a department member on the certification program's control committee	Offer a special course or course sequence for K-8 teachers	Designate special sections of regular courses for K-8 teachers
Mathematics Departments			
Univ (PhD)	63	79	11
Univ (MA)	74	92	13
Coll (BA)	68	73	4
Total Math Depts	69	77	7
Statistics Departments			
Univ (PhD)	0	4	0
Univ (MA)	0	0	0
Total Stat Depts	0	4	0

Note: 0 means less than one-half of 1%.

Although they do not offer teacher certification credentials, two-year colleges do offer courses that are part of the pre-service education of K–8 teachers. About half of all two-year colleges offered a course for pre-service K–8 teachers at some point during the 1999–2000 or 2000–2001 academic years, and we estimate that total enrollment in these courses in the fall of 2000 was about 16,900 students.

TABLE PSE.3 Percentage of two-year colleges that are involved with K–8 teacher preparation in various ways: Fall 2000.

Percentage of two-year colleges that	
Assign a faculty member to coordinate K–8 teacher education	22
Offered a course for preservice K–8 teachers in 1999–2000 or 2000–01	49
Designate special sections of other courses as especially for teachers	15

In order to be certified as a teacher in some or all of grades K–8 in fall 2000, how many mathematics courses, including general education courses, were pre-service K–8 teachers required to take? CBMS2000 data show that in those colleges and universities that offered K–8 certification programs, prospective K–3 teachers were required to take an average of 2.4 mathematics department courses during their undergraduate studies (including required general education courses, if any). Students preparing for later grades teaching were required to take an average of 3.0 mathematics department courses. There was some variation between the mathematical education of pre-service K–8 teachers based on the highest degree offered by the mathematics department. For example, in universities with masters level mathematics departments, the average number of courses required for early grades certification was 3.3 courses, while the

average number required for later grades was 4.1. In universities with doctoral mathematics departments, the average number of mathematics courses required for K–3 certification was 2.2 and the average number required for the later grades was 2.5. By way of contrast, the national average of the number of statistics department courses required for pre-service K–8 teachers was so low that it rounded to zero.

Table PSE.4 also shows that in fall 2000 there was considerable variation among colleges and universities in terms of the number of mathematics department courses required for K–8 certification. For example, 8% required no mathematics department courses for K–3 certification, and 6% required five or more courses. For later grades certification, 7% required no mathematics department courses, while 18% required five or more courses in the mathematics department.

TABLE PSE.4 Percentage of four-year colleges and universities that require various numbers of Mathematics Department courses for early grades (K–3) certification and for later grades (including 5 and 6) certification, among colleges and universities offering certification programs. Also the average number of Mathematics Department courses required for various teacher certifications in those colleges and universities offering K–8 certification programs, by certification level and type of school: Fall 2000.

	Percentage requiring various numbers of Mathematics Department courses for	
Number of Mathematics courses required for certification	Early grades certification	Later grades certification
0 required courses	8%	7%
1 required course	17%	12%
2 required courses	45%	42%
3 required courses	14%	12%
4 required courses	11%	10%
5 or more required	6%	18%
Type of Mathematics Department	Average number of Mathematics courses required	Average number of Mathematics courses
Univ (PhD)	2.2	2.5
Univ (MA)	3.3	4.1
Coll (BA)	2.3	2.8
Overall Mathematics Depts	2.4	3

Which mathematics department courses were most likely to be taken by pre-service K–8 teachers? CBMS2000 asked mathematics departments to identify the three courses (from a list of eleven possibilities) that were most likely to be taken by pre-service teachers preparing for the K–3 classroom, and the three courses most likely to be taken by students preparing for teaching in later grades. For prospective K–3 teachers, the four courses most frequently mentioned were a multi-term course designed for elementary education majors (48%), followed by College Algebra (42%), Mathematics for Liberal Arts (39%) and a single-term course designed for elementary education students (32%). For students seeking

certification in later grades, there was a wider variety of responses. Most frequently chosen were a multi-term course designed for elementary education students (46%), followed by College Algebra (34%), Liberal Arts Mathematics (33%) and a calculus course (29%). Because counting pre-service teachers enrolled in various courses is difficult, it is likely that these figures represent opinions of survey respondents rather than actual enrollment counts of pre-service teachers' curricular choices.

TABLE PSE.5 Percentages of Mathematics Departments identifying a given course as one of the three Mathematics courses most likely to be taken by pre-service teachers preparing for K–3 teaching or for later grades teaching (including 5 and 6), by type of department: Fall 2000.

	Most likely for K–3 certification				Most likely for later grades certification			
Mathematics Departments	Univ (PhD) Math	Univ (MA) Math	Coll (BA) Math	Total Math Depts	Univ (PhD) Math	Univ (MA) Math	Coll (BA) Math	Total Math Depts
Multi-term course for elementary education majors	48	36	51	48	49	41	47	46
Single term course for elementary education majors	39	53	26	32	31	39	23	27
College algebra	49	56	38	42	42	37	32	34
Pre-calculus	14	9	15	14	13	16	23	21
Intro to mathematical modeling	4	2	4	4	7	2	6	5
Mathematics for liberal arts	23	42	41	39	23	23	36	33
Finite mathematics	13	13	23	20	16	12	22	20
Mathematics history	8	7	4	5	13	25	5	9
Calculus	10	9	20	17	24	14	34	29
Geometry	10	18	6	8	18	23	15	17
Elementary Statistics	30	10	32	28	30	14	31	28

The extent to which statistics department courses were part of pre-service K–8 education in fall 2000 was less clear: recall that almost no statistics department courses were required for pre-service K–8 teachers. However, when asked which three statistics department courses were most likely to be taken by pre-service K–8 teachers, departments responded that the Elementary Statistics course with no calculus prerequisite was by far the most likely. A distant second was the department's Statistical Literacy course, followed by a single term statistics course designed for elementary education students. This data is confirmed by Appendix I which shows that total enrollment in the latter two courses is very small nationally.

TABLE PSE.6 Percentages of Statistics Departments identifying a given course as being one of the three Statistics courses most likely to be taken by pre-service teachers preparing for K–3 teaching or for later grades teaching (including 5 and 6), by type of department: Fall 2000.

	Most likely for K–3 certification			Most likely for later grades certification		
Statistics Departments	Univ (PhD) Stat	Univ (MA) Stat	Total Stat Depts	Univ (PhD) Stat	Univ (MA) Stat	Total Stat Depts
Multi-term course for elementary education majors	6	0	5	6	0	5
Single term course for elementary education majors	28	20	26	21	20	21
Elementary Statistics	69	40	63	75	40	68
Probability & Statistics	20	0	16	10	0	8
Statistics literacy	36	20	33	31	20	29

Note: 0 means less than one-half of 1%.

B. Academic Resources for Students: Placement Tests, Tutoring Labs, and Special Opportunities for Mathematics Students

This section of Chapter 2 continues the study of academic resources available to students in the mathematics and statistics departments and programs of two- and four-year colleges and universities that was initiated in CBMS1995.

Placement testing is somewhat different in two-year and four-year institutions. In four-year colleges and universities, it is relatively easy to identify the incoming students for whom placement or diagnostic testing may be important: they are each fall's entering freshmen class. In the two-year college world, identifying students who should take placement tests, and administering the tests, are more challenging. Many students enter a given two-year college already having considerable academic credit from another institution, and many enroll at the very last minute. As a result, the CBMS2000 survey asked slightly different questions of two- and four-year departments and programs. Both were asked whether they offered mathematics (or statistics) placement tests for entering students. Two-year programs were then asked whether the tests were usually required for first-time enrollees, while four-year departments were asked whether their placement test was required for entering freshmen.

Table AR.7 makes it clear that in fall 2000, placement testing was almost universally available in two-year colleges, and that it was usually required for first-time enrollees in almost all two-year colleges. Mathematics departments in four-year colleges and universities used mathematics placement testing to a somewhat lesser extent, with bachelors level departments offering (and requiring) it least of all. Nine out of ten statistics departments were not involved in placement testing.

What happened after the placement tests? Among the two-year colleges that offer placement testing, more than three quarters required entering students to meet with an advisor to discuss the results. In four-year mathematics departments, about three-fifths required students to discuss results with an advisor, and in the few statistics departments that offer placement testing, the corresponding percentage was about 50%. In about two thirds of two-year colleges, placement testing led to mandatory placement in the entering student's first mathematics course. The corresponding percentage in four-year departments was noticeably lower.

TABLE AR.7 Percentage of Mathematics Programs in two-year colleges, Mathematics Departments, and Statistics Departments that offer or require Mathematics or Statistics placement tests for first-time enrollees, by type of school: Fall 2000.

	Percentage of programs/departments that offer placement tests	Percentage of programs/departments that require placement tests of first-time enrollees
Two-Year College Mathematics Programs	98	98
Mathematics Departments		
Univ (PhD)	81	56
Univ (MA)	83	58
Coll (BA)	66	45
Overall Mathematics Depts	70	49
Statistics Departments		
Univ (PhD)	11	2
Univ (MA)	0	0
Overall Statistics Depts	9	2

TABLE AR.8 Percentage of Mathematics Programs in two-year colleges, Mathematics Departments, and Statistics Departments offering placement tests for first-time enrollees that require advising or mandate placement, and that periodically assess the effectiveness of their tests, by type of school: Fall 2000.

	Of Departments and Programs that offer placement tests		
	Percentage in which students must discuss results with advisor	Percentage in which placement tests lead to mandatory placement	Percentage that periodically assess the effectiveness of the tests
Two-Year College Mathematics Programs	79	67	85
Mathematics Departments			
Univ (PhD)	54	43	91
Univ (MA)	60	57	98
Coll (BA)	62	46	83
Overall Mathematics Depts	60	47	87
Statistics Departments			
Univ (PhD)	53	34	0
Univ (MA)	0	0	0
Overall Statistics Depts	53	34	0

Note: 0 means less than one-half of 1%.

Among two-year college mathematics programs, and among four-year mathematics departments that offered placement tests, the vast majority reported that they periodically assess the effectiveness of their tests.

Where do departments get the placement tests that they use? Table AR.9 shows that in fall 2000, two-year college programs obtained placement test materials from many different sources, with locally written tests being used almost everywhere, frequently combined with materials from outside vendors. In four-year mathematics departments, locally written tests were also used almost everywhere, but four-year departments relied on Mathematical Association of America (MAA) materials to a greater degree than did the mathematics programs of two-year colleges. (Percentages in columns of this table add to more than 100% because departments were asked to "check all sources used.")

TABLE AR.9 Among Mathematics Programs in two-year colleges and Mathematics Departments in four-year colleges and universities that offer placement tests, the percentage of departments that obtain their placement tests from various sources: Fall 2000.

	Percentage of institutions using placement tests from various sources				
	Two-Year	Four-Year Mathematics			
Source of placement tests	Colleges	Univ (PhD)	Univ (MA)	Coll (BA)	Total
Written by department	99	100	100	100	100
Provided by ETS	30	6	5	2	3
Provided by ACT	34	14	21	12	14
Provided by MAA	3	21	39	18	23
Provided by other outside vendor	26	13	18	5	9

Note: In the CBMS2000 survey, departments were asked to "check all that apply" in a list of five potential sources of placement tests, and many checked several sources. Hence, the columns of AR.9 will not add to 100%.

Table AR.10 below describes the percentage of programs in two-year colleges, and in four-year mathematics departments and statistics departments, that operated a mathematics or statistics lab or tutoring center in fall 2000. In the two-year world, such academic support facilities were almost universally available. In four-year colleges and universities, nearly 90% of all four-year mathematics departments, and about 60% of statistics departments, offered such academic resources to students.

TABLE AR.10 Percentage of Mathematics Departments, Statistics Departments, and Mathematics Programs in two-year colleges that operate a lab or tutoring center in their discipline: Fall 2000.

Highest degree offered	Mathematics Departments	Statistics Departments	Two-Year College Mathematics Programs
Univ (PhD)	90	61	--
Univ (MA)	95	50	--
Coll (BA)	88	--	--
All departments	89	59	98
1995 data	na	na	93

What kinds of services are offered in mathematics and statistics labs and tutoring centers? Table AR.11 shows that in terms of the kinds of services offered in labs and tutoring centers, there was not much difference between four-year mathematics and statistics departments in fall 2000. Both emphasized computer software and tutoring by students in their tutoring centers, while other services were offered in a third or fewer of the departments. As Table AR.11 shows, there was a marked difference between the four-year and two-year worlds in terms of services available in labs and tutoring centers: except in the category "tutoring by students," labs and tutoring centers in two-year colleges were more elaborate than their counterparts in the four-year world.

TABLE AR.11 Percentage of Mathematics Departments, Statistics Departments, and Mathematics Programs in two-year colleges operating labs or tutoring centers that offer various services, by type of school: Fall 2000.

Services in labs & tutoring centers	Computer-aided instruction	Computer software	Media such as video tapes	Tutoring by students	Tutoring by para-professional staff	Tutoring by part-time faculty	Tutoring by full-time faculty	Internet resources
Mathematics Departments								
Univ (PhD)	37	59	23	97	39	30	31	42
Univ (MA)	40	70	33	98	28	21	15	39
Coll (BA)	39	60	22	100	36	16	13	30
Total Mathematics Departments	38	62	24	99	35	18	16	33
Statistics Departments								
Univ (PhD)	43	70	20	96	44	13	3	22
Univ (MA)	0	25	0	75	0	0	0	25
Total Statistics Departments	36	63	17	93	37	11	3	23
Two-Year College Mathematics Programs	68	69	74	96	68	48	42	53

Note: 0 means less than one-half of 1%.

Besides labs and tutoring centers, there are many other out-of-class academic support services and opportunities that departments can offer to their undergraduates. For examples, see Table AR.12 below. Among four-year mathematics departments in fall 2000, those offering doctoral degrees appeared to offer the widest, and bachelors level departments the smallest, range of academic opportunities for their majors. Two-year colleges offered a more restricted set of options for their mathematics students.

The entry for two-year colleges in the column "Assigned advisors in department" seems anomalous. First, it is not consistent with anecdotal evidence about advising practices in two-year colleges, and second, it represents a major decline from the percentage (65%) of two-year colleges that reported assigning advisors in the CBMS1995 survey ([CBMS1995, p. 100]). However, the data has been carefully checked, and CBMS2000 estimates that only 33% of two-year colleges assigned advisors in fall 2000. For further discussion, see the "Faculty

TABLE AR.12 Percentage of Mathematics Programs in two-year colleges, Mathematics Departments, and Statistics Departments that offer various kinds of special opportunities for undergraduates, by type of school: Fall 2000.

Special opportunities for undergraduates	Honors sections of courses for majors	Math or Stat club	Special programs for women	Special programs for minorities	Math or Stat contests	Special Math or Stat colloquia for undergrads	Outreach, e.g., K–12 schools	Undergrad. research opps	Indep. studies opps	Assigned advisors in dept.
Two-Year College Mathematics Programs	20	14	4	4	28	9	20	4	25	33
Mathematics Departments										
Univ (PhD)	74	84	26	27	96	73	46	84	97	90
Univ (MA)	49	87	24	11	76	74	49	67	75	93
Coll (BA)	16	51	3	2	55	46	46	52	79	78
Total Math Depts	29	61	9	7	63	54	47	59	80	82
Statistics Departments										
Univ (PhD)	43	26	3	3	29	39	6	59	68	73
Univ (MA)	63	25	0	0	25	50	13	50	63	63
Total Stat Depts	46	25	2	2	28	41	7	58	67	71

Advisors" section of Chapter 6, associated with Table TYR.12.

C. Distance Learning in the Mathematical Sciences

Previous CBMS reports have investigated the extent to which mathematics programs in two-year colleges used computer-aided instruction and television to teach their courses. The CBMS2000 survey broadened that study, asking all departments about the extent to which they were using "distance learning" to teach sections of their courses. Distance learning was defined as follows: a section is taught by distance learning provided "at least half of the students in the section receive the majority of their instruction via Internet, TV, or other method where the instructor is NOT physically present." The tables in this section show the percentage of sections in various courses that were reported as taught using distance learning in two-year and four-year programs and departments in fall 2000. In almost all cases, the percentages were quite low. In the few cases where the percentage exceeded 10%, the course enrollment was a relatively small one (e.g., non-mainstream Calculus II in two-year colleges or Database Management Systems taught in bachelors-level mathematics departments) and the standard errors were large.

Mathematics programs at two-year colleges had well-developed distance learning activities in many parts of their mathematical sciences programs, as can be seen from Table DL.13 below. In two-year college mathematics programs, the mathematical sciences courses most frequently taught using distance learning were College Algebra (almost 7% of sections), non-mainstream Calculus II (19%), Mathematics for Liberal Arts (5%), and the Elementary Statistics course (almost 6%). Among computer science courses taught by two-year college mathematics programs, distance learning was used in about

TABLE DL.13 Percentage of sections in Mathematics Programs of two-year colleges taught via distance learning: Fall 2000.

Percentage of sections taught via distance learning methods in two-year colleges							
% of sections		% of sections		% of sections		% of sections	
Remedial level		**Calculus level**		**Other mathematics**		**Computing**	
Arithmetic/ Basic mathematics	0.7	Mainstream Calculus I	1.5	Linear algebra	3.7	Computers and society	0
Pre-algebra	1.5	Mainstream Calculus II	2.4	Discrete Mathematics	0	Introduction to software	6.5
Elementary algebra (HS level)	1.3	Mainstream Calculus III	1.1	Elementary Statistics	5.8	Issues in CS	0
Intermediate algebra (HS level)	1.8	Non-mnstrm Calculus I	3.1	Probability	2	Computer programming I	0
Geometry (HS level)	4.9	Non-mnstrm Calculus II	19.4	Finite mathematics	0.4	Computer programming II	3.3
Precalculus level		Differential equations	1.5	Math for liberal arts	5.5	Adv prog & data structures	0
College algebra (above Intermediate)	6.7			Math for elem school teachers	1.4	Database mgmt systems	6.3
Trigonometry	0.8			Business math[1]	4.9	Discrete math for CS	0
College algebra & trig (combined)	2.8			Business math[2]	0	Other CS	3.1
Intro mathematical modeling	0.9			Technical math[3]	0		
Precalculus/Elem functions	1.6			Other mathematics courses	4.7		

Note: 0 means less than one tenth of 1%.

[1] Not transferrable for credit toward Bachelors degree.
[2] Transferrable for credit toward Bachelors degree.
[3] A combination of courses C26 and C27 in the Two-Year Questionnaire. See Appendix V or Table TYR.3 in Chapter 6.

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6% of sections in Introduction to Software Packages and in Database Systems.

Table DL.14 gives data on the percentage of sections of various courses in four-year colleges and universities that were taught using distance learning methods in fall 2000. In almost all mathematics courses, the percentage of sections taught by distance learning was below 2%, with Finite Mathematics (2.4%) and Trigonometry (3.2%) being exceptions. Among mathematics departments, doctoral departments were the most active in distance learning in fall 2000, teaching almost 5% of their Elementary Algebra sections and of their Intermediate Algebra sections via distance learning, and over 8% of their Trigonometry sections. In lower level computer science courses taught in mathematics departments, there was a greater proportion of courses in which at least 5% of sections were taught using distance learning methods. Over 6% of sections in Data Structures and in Database Management used distance learning, as did almost 5% of sections in Introduction to Software Packages. As noted earlier, the majority of computer science taught in mathematics departments is taught by bachelors and masters level departments, and it is masters level mathematics departments that teach the highest proportion of their computer science courses via distance learning. Bachelors level mathematics departments teach an exceptionally large percentage of their Database Management sections (almost a quarter) using distance learning methods.

TABLE DL.14 Percentage of sections of various courses taught via distance learning (= any method where at least half of the students receive the majority of their instruction in situations where the instructor is not physically present) in four-year college and university Mathematics Departments, by type of department: Fall 2000.

	Percentage of sections taught via distance learning in			
Courses	Univ (PhD)	Univ (MA)	Coll (BA)	All Math Depts
Remedial level				
Arithmetic	0	0	0	0
General mathematics (Basic skills)	0	0	0	0
Elementary algebra (HS level)	5.5	0	0	0.9
Intermediate algebra (HS level)	4.7	0.4	1.5	2
Other remedial level	0	0	1.9	1.4
Introductory level (incl. pre-Calculus)				
College algebra	1.9	1.6	0.5	1.3
Trigonometry	8.1	0	0	3.2
College algebra & trigonometry	0.5	0	0	0.1
Elementary functions & pre-calculus	1.6	0	0	0.4
Intro to mathematical modeling	0	0	0	0
Mathematics for liberal arts	2.9	0	1.7	1.2
Finite mathematics	2.3	0	3.4	2.4
Business mathematics	0	0	0	0
Math for elementary school teachers	5.8	0	0	1
Other introductory level courses	4	0	0	0.6

Note: 0 means less than one tenth of 1%.

TABLE DL.14, Continued.

	Percentage of sections taught via distance learning in			
Courses	Univ (PhD)	Univ (MA)	Coll (BA)	All Math Depts
Calculus level				
Mainstream Calculus I	0.9	0	0	0.3
Mainstream Calculus II	1.1	0	0	0.5
Mainstream Calculus III,IV	2	1.1	0	1.1
Non-mainstrm Calculus I	0.5	1.4	0	0.8
Non-mainstrm Calculus II	0	0	0	0
Differential equations	0.7	0	0	0.3
Discrete mathematics	0	0	0	0
Linear/Matrix algebra	0	0	0	0
Other Calculus level courses	0	0	0	0
Statistics courses				
Elementary statistics (no Calculus prerequisite)	4.3	2.1	0.5	1.6
Probability & Statistics (no Calculus prerequisite)	0	0	0	0
Other elementary level statistics	0	0	0	0
Computer Science courses				
Lower level				
Computers & society	0	0	0	0
Introduction to software packages	0	9.2	0	4.5
Issues in Computer Science	0	0	0	0
Computer programming I	0	2	0	0.6
Computer programming II	0	3.9	0	1.7
Advanced programming & data structures	0	15	7	6.6
Database management systems	0	0	23.8	17.2
Discrete mathematics for CS	0	0	0	0
Other lower level CS courses	0	10.1	0	4.7

Note: 0 means less than one tenth of 1%.

Statistics departments offered very few of their courses by distance learning, the most frequently offered being Statistics Literacy.

TABLE DL.15 Percentage of sections taught via distance learning methods (= where at least half of the students receive the majority of their instruction in situations where the instructor is not physically present) in Statistics Departments by type of department: Fall 2000.

	Percentage of sections taught via distance learning in		
Statistics Departments	Univ (PhD)	Univ (MA)	All Stat depts
Elementary statistics (no Calculus prerequisite)	0.3	0	0.3
Probability & Statistics (no Calculus prerequisite)	0	0	0
Statistics literacy	4.5	0	3.3
Statistics for pre-service teachers	0	0	0
Other elementary level statistics	0	0	0

Note: 0 means less than one tenth of 1%.

While it is easy to estimate the numbers and percentages of sections taught using distance learning, it is more difficult to estimate the number of students taught in these courses. (For a discussion of the statistical methodology used in making enrollment estimates, see Appendix II.) There is no reason, for example, to assume that the size of sections taught by distance learning was the same as the section size in courses taught on campus. Indeed, it is conceivable that a department might have assigned all distance-learning students in a given course to a single section, or that a department might have kept distance learning sections artificially small, because of the experimental nature of the program. To investigate distance learning more completely, future studies will need to separate total enrollment in distance learning sections from the enrollment in other sections of each course.

D. Dual Enrollment in Mathematical Science Courses

For many years, mathematically talented high school students have had options for obtaining college mathematics credit during their high school years. Performing well on national AP examinations was one option, and many well-prepared high school seniors were also able to enroll at local colleges and universities to take mathematics courses not offered in their high schools.

In the 1990s, new options for obtaining college credit during high school became increasingly available. Because many courses were taught in both high school and college, some colleges began offering credit for courses taught in high schools, often by high school teachers rather than by college faculty, and usually taught for simultaneous high school and college credit. Such courses came to be called "dual enrollment courses."

In many states in the late 1990s, both the high school offering a dual enrollment course and the college granting college credit to students in that course received some degree of credit for enrollments in the course. Sometimes the credit received was in terms of increases in enrollment-generated budgets, and sometimes it was in terms of citations for local educational quality. Anecdotal evidence suggests that some students saw receiving college credit for high school courses as a way to enhance college admissions prospects, or to have more time for elective courses in college, or perhaps as a way to shorten the time spent in college. Finally, anecdotal evidence suggests that it may be easier to pass a high school course and thereby receive dual enrollment credit than to get a score of 3, 4, or 5 on the corresponding national AP exam. The combination of all these factors would seem to make the movement toward dual enrollment credit almost irresistible.

In fall 2000, two-year colleges were typically the post-secondary institutions that awarded dual enrollment credit. However, in many states, college credit awarded by any of the state's public two-year colleges

was, by law, transferable to four-year colleges within that state, so that dual enrollment programs also affected four-year colleges and universities. Some four-year institutions found that dual enrollment credit was beginning to compete with traditional Advanced Placement credit among entering freshmen.

Table DEN.16 shows that in fall 2000, nearly 15% of all College Algebra, Pre-calculus, and Calculus I sections offered by two-year colleges, and about 7% of the Elementary Statistics sections, were taught via dual enrollment.

TABLE DEN. 16 Number of sections of various courses offered by two-year colleges via dual enrollment in Spring and Fall, 2000, plus total number of sections of those courses: Fall 2000.

	Number of dual enrollment sections		
	Spring 2000	Fall 2000	Total Fall sections
College algebra	522	924	6619
Precalculus/Elementary functions	510	362	1991
Intro to Mathematical modeling	10	0	329
Calculus I	347	440	3026[1]
Elementary Statistics	179	190	2794

Note: 0 means less than 5 sections.
[1] Combination of mainstream and non-mainstream calculus sections offered Fall 2000.

To what extent did mathematics programs at two-year colleges control the dual enrollment courses for which they awarded credit? Table DEN.17 shows the percentages of two-year mathematics programs that reported different levels of control of various aspects of dual enrollment courses.

TABLE DEN.17 Percentages of two-year college Mathematics Programs that controlled various aspects of dual enrollment courses for which they award credit: Fall 2000.

Percentages of two-year Mathematics Programs that controlled the following aspects of dual enrollment courses			
	Never	Sometimes	Always
Choice of textbook	10	12	79
Design of syllabus	8	11	82
Design of final exam	15	28	57
Choice of instructor	19	20	61

To what extent were the instructors in dual enrollment courses expected to meet the same standards as other part-time faculty in two-year college mathematics programs? Table DEN.18 shows the percentage of mathematics programs in which dual enrollment instructors were required to have the same educational qualifications and to participate in the same teaching evaluation program as other part-time faculty.

TABLE DEN.18 Percentages of two-year college Mathematics Programs in which dual-credit instructors must meet the same credit hour and degree requirements as regular part-time faculty, and participate in the college's regular teaching evaluation program: Fall 2000.

Percentage of two-year colleges in which instructors of dual credit courses	
Must meet the same degree requirements as regular part-time faculty	92
Are included in the college's regular teaching evaluation program	67

What is the reaction of two-year college mathematics programs to the new wave of dual enrollment courses? The CBMS2000 survey included "dual enrollment courses" in a list of eighteen potential concerns for two-year college mathematics programs and asked respondents to rate the degree to which each was a problem. Table TYR.46 in Chapter 7 shows that only 8% of mathematics program heads cited dual enrollment as a major problem, while 77% saw it as a minor problem or no problem at all. Thus, in the eyes of mathematics program directors in two-year colleges, dual enrollment was not a pressing problem in fall 2000.

E. Special Statistical Topics in CBMS2000

Officers of the American Statistical Association proposed that CBMS2000 investigate two special statistics topics — the educational background of faculty members teaching statistics courses in fall 2000, and the impact of the new Statistics Advanced Placement (AP) program in university statistics departments. This subsection presents the findings.

Who Teaches Statistics in Four-Year Colleges and Universities?

Table ST.19 shows that in doctoral mathematics departments, almost 60% of statistics course instructors had at least a masters degree in statistics. In masters level mathematics departments, the corresponding percentage was over 40%, while in bachelors level departments, about one fifth of statistics course instructors had at least a masters degree in statistics. In statistics departments, the percentages were understandably higher.

TABLE ST.19 Percentage of instructors in Statistics courses who had doctoral degrees in Statistics or Biostatistics, or masters degrees but not doctoral degrees in Statistics or Biostatistics, by type of department: Fall 2000.

	Percentage of Fall 2000 Statistics instuctors who had the following degrees in Statistics		
	Statistics or Biostatistics PhD	Statistics or Biostatistics Masters only	Other degree or Unknown
Mathematics Departments			
Univ (PhD)	52	6	42
Univ (MA)	38	6	56
Coll (BA)	11	8	81
Statistics Departments			
Univ (PhD)	83	6	11
Univ (MA)	62	17	21

Another way to understand the educational backgrounds of faculty teaching statistics courses is to ask about the major fields of study for their highest earned degree. CBMS2000 phrased the question in those terms to take into account that a person might receive a doctoral degree from a mathematics department even though the person's dissertation was in statistics. Table ST.20 presents survey results on that question. As expected, the vast majority of statistics instructors held graduate degrees in either statistics or mathematics.

Tables E.3 to E.9 in Chapter 3 present data on the academic status (tenured or tenure-eligible, other full-time, part-time faculty, and graduate teaching assistants) of instructors in statistics courses. Tables FY.5 and FY.7 present more detailed information about who teaches first year statistics courses.

TABLE ST.20 Percentages of faculty teaching statistics courses and having various major fields for their highest earned degree, by type of department: Fall 2000.

	Percentages of Statistics instructors in Fall 2000 with various major fields for their highest earned degree				
Field of highest degree	Math Dept (PhD)	Math Dept (MA)	Math Dept (BA)	Stat Dept (PhD)	Stat Dept (MA)
Statistics PhD	50	36	11	82	56
Statistics MA only	6	6	7	5	15
Biostatistics PhD	2	2	0	1	6
Biostatistics MA only	0	0	1	1	2
Mathematics PhD	22	28	31	6	10
Mathematics MA only	6	12	18	0	2
Mathematics Education PhD	1	3	11	0	0
Mathematics Education MA only	1	1	8	0	0
Computer Science PhD	0	0	1	0	0
Computer Science MA only	0	1	0	0	0
Social Science PhD	0	0	2	1	2
Social Science MA only	0	0	0	0	0
Education PhD	0	0	0	0	0
Education MA only	0	0	1	0	0
Other PhD	6	7	2	1	2
Other MA only	2	1	2	0	2
Unknown	4	3	5	3	3

Note: 0 means less than half of 1%.

Impact of the Statistics Advanced Placement Examination in Statistics Departments

The CBMS2000 statistics questionnaire asked about changes in enrollments, curriculum, and the number of statistics majors in statistics departments that might grow out of the Statistics Advanced Placement (AP) program. Because the Statistics AP examination was not started until 1997, it might have been premature to ask such questions in fall 2000, but the resulting data can serve as a baseline for future studies.

CBMS2000 estimates that in fall 2000, 1,012 (SE = 230) students nationally received statistics department credit for an elementary level statistics course based on their Statistics AP examination performance. As can be seen from Table SE.3 in Chapter 1, that figure was slightly less than 2% of the total of all fall 2000 elementary level statistics enrollments in statistics departments. (To understand why that figure (1,012) is low compared to the almost 18,000 students who received grades of 3, 4, or 5 on the Statistics AP exam during 2000, recall that in fall 2000 there were fewer than 100 statistics departments in the U.S., and almost 1,400 mathematics departments. Consequently the numbers reported by statistics departments would not include the students from the vast majority of colleges.)

Concerning curricular changes, the CBMS2000 survey found that in fall 2000 no statistics department reported creating new courses because of the Statistics AP Program.

Given that the Statistics AP examination allows students to earn credit for the non-calculus, elementary statistics course, why would one ask about the relation between the Statistics AP program and the number of majors in statistics departments? Admittedly the linkage, if there is one, is indirect: the hoped-for linkage might grow out of enthusiasm for statistics generated by students' early exposure to the subject in AP classes.

Some statistics departments reported an increase in statistics majors since the 1997 inception of the Statistics AP program. In fall 2000, about 80% (SE 3.7) of statistics departments offered a bachelors degree in statistics (as well as teaching undergraduate statistics courses). Of statistics departments offering a bachelors degree, about 32% (SE 5.7) reported an increase in the number of their majors between 1997 and 2000, with 36% of doctoral statistics departments, and 17% of masters level statistics departments, reporting such growth. Reports of such increases may be particularly noteworthy given what appears to be a general decline in the number of statistics majors (in both statistics and mathematics departments) between 1995 and 2000. See the discussion of Table E.1 in Chapter 3 for more details.