Chapter 5

First-Year Calculus and Statistics Courses in Four-Year Colleges and Universities

Data Highlights

The eight tables in this chapter present details concerning first-year courses in calculus and statistics taught in four-year colleges and universities. Mainstream and non-mainstream calculus are studied separately, as are elementary statistics courses taught in mathematics departments and in statistics departments. ("Mainstream calculus" refers to those calculus courses that lead to the usual upper division mathematical sciences courses; all others are called "non-mainstream calculus.") In each case, the tables present data answering the two broad questions "Who teaches these courses?" and "How are these courses taught?" Sections of Chapter 6 study the same questions in the two-year college environment.

A. Who Teaches First-Year Courses?

Between fall 1995 and fall 2000, there was a substantial decline in the percentage of mainstream Calculus I enrollments taught by tenured and tenure-eligible faculty. Even though other full-time faculty (i.e., full-time faculty who are not tenured and not tenure-eligible) took up part of the slack, it is still true to say that the percentage of Calculus I enrollments taught by full-time faculty of all kinds dropped in every type of department, with the percentage dropping by about seven percentage points in masters and doctoral mathematics departments and by four percentage points in bachelors level departments. The percentage of mainstream Calculus I enrollments taught by part-time faculty in masters and doctoral departments rose between 1995 and 2000, and the percentage taught by graduate teaching assistants was essentially unchanged. Similar percentage shifts occurred in the teaching of mainstream Calculus II.

During the same five year period, there was a ten point increase in the percentage of enrollment in elementary statistics courses taught by tenured and tenure-eligible faculty in doctoral mathematics departments, while in masters and bachelors mathematics departments and in doctoral statistics departments the percentage dropped substantially. Looking at the percentages of enrollment taught by full-time faculty of all types, one sees a nine point rise in doctoral mathematics departments, a nine point drop in doctoral statistics departments, and double digit declines in masters and bachelors mathematics departments between 1995 and 2000. At the same time, the percentage of elementary statistics courses taught by graduate teaching assistants dropped substantially in masters and doctoral mathematics departments, and in doctoral statistics departments.

B. How Are First-Year Courses Taught?

To determine how a given course is taught, the CBMS2000 survey asked departments to report on the number of sections taught:

1) using graphing calculators,
2) with writing components such as reports or projects,
3) using required computer assignments,
4) with assigned group projects,
5) at least once per week in a setting that requires student computer use, e.g., in a computer lab.

The first four items appeared on the CBMS1995 survey, along with another option "taught using a reform text" that was defined as "the primary text or set of notes generally reflect the pedagogical principles of the calculus reform movement." In 1995, the term "reform text" was relatively well-defined, but by fall 2000 the distinction between reformed and non-reformed texts was no longer clear, with textbook publishers advertising almost all of their books as containing various components of the calculus reform movement. Consequently the reform-text question was dropped and replaced by the fifth question above.

One goal of the five questions above was to track the spread of the pedagogical reforms that were advocated by the calculus reform movement. At the suggestion of several professional society committees, the CBMS2000 survey asked the same five questions about how first-year calculus and elementary statistics were taught in two-year colleges, and the results are studied in Chapter 6.

In fall 2000, distance learning was another relatively new method for teaching undergraduate mathematics, and CBMS2000 was the first CBMS survey to ask about courses taught in that way. Data on distance learning appear in Chapter 2.

By fall 2000, every type of mathematics department used both graphing calculators and required computer assignments to a greater degree in calculus teaching than in 1995. The use of writing assignments and group projects also continued to expand in masters and bachelors departments, while in doctoral mathematics departments the use of the latter two reform pedagogies actually declined.

Calculus reform pedagogies were used in elementary statistics courses as well as in calculus courses. In fall 2000, graphing calculator use was lower in statistics courses than in calculus courses, while writing assignments, computer assignments, and weekly computer labs were more common in elementary statistics than in calculus courses. Statistics departments seemed to place less emphasis on graphing calculator use, and considerably more emphasis on computer assignments and weekly computer labs than did mathematics departments.

Notes on the Tables

Intuition suggests that who teaches a given course or section, and how it is taught, may be influenced by the size of the section. To minimize variation based on section size, CBMS2000 divided sections of first-year courses into three types, namely: sections taught as lectures with separately scheduled recitation or problem sessions; other sections of size 35 or less, and other sections with size above 35. To determine who teaches first-year courses in calculus and statistics, we divided instructors into four types: tenured and tenure-eligible, other full-time faculty, part-time faculty, and graduate teaching assistants. As in previous CBMS surveys, departments were asked to count a lecture section along with all of its recitations as a single class and to record a section as having been taught by a graduate teaching assistant if and only if the graduate teaching assistant taught the section independently.

Unfortunately, respondents to the CBMS2000 survey did not always report the instructors for all of their sections, and as a result we created an "Unknown Instructor" category in tables that report data on who teaches first-year courses. Part of the unknown instructor problem can be explained by the fact that "distance learning" sections (see Chapter 2) were included in the section count, but not categorized by type of instructor. However, the percentage of first-year courses taught by distance learning was not nearly large enough to account for the unknown instructor percentages found in this chapter's tables. In some cases, the unknown instructor percentage is so high that it makes comparisons with 1995 data suspect. The most extreme cases of this problem occur in situations where the total national enrollment in a type of course (e.g., lecture/recitation sections taught in bachelors level mathematics departments) is quite small.

The tables in this chapter follow the pattern established in the CBMS 1995 report, giving percentages of enrollment rather than percentages of sections. Estimating enrollment percentages presented special problems and we followed the methodology introduced in the 1995 survey. See Appendix II of this report for a discussion of the statistical methodology involved. Tables E.12 through E.18 in Chapter 3 report on numbers and percentages of sections, have smaller unknowns, and generally corroborate the data in this chapter's tables.

TABLE FY.1: WHO TEACHES MAINSTREAM CALCULUS?

This table presents data on the question "Who teaches mainstream Calculus I and II?" It gives estimates of the percentage of enrollments taught by various types of instructors in different types of sections in departments with the Ph.D., MA, or BA as their highest offered degree. The percentages sum to 100% (except for round-off errors) in a complicated pattern. For example, consider lecture/recitation sections taught in doctoral departments. Table FY.1 shows that 58% of such sections were taught by tenured and tenure-eligible faculty, 23% by other full-time faculty, 10% by part-time faculty, 8% by graduate teaching assistants, and 1% by unknown instructors.

A. Mainstream Calculus I

Comparison with the corresponding table in CBMS1995 shows that between 1995 and 2000, there was a change in who taught mainstream Calculus I. The percentage of mainstream calculus enrollment taught by tenured and tenure-eligible faculty dropped in doctoral, masters, and bachelors departments. In fall 1995 the percentages of mainstream Calculus I enrollments taught by tenured and tenure-eligible faculty were 62%, 77%, and 84% respectively, and the corresponding percentages in fall 2000 were 50%, 64%, and 73%, a decline of about 12 percentage points in each type of school. If one combines the percentages of mainstream Calculus I students taught by tenured, tenure-eligible, and other full-time faculty, one sees a decline in each type of department over the past five years. In fall 1995, the percentages of mainstream Calculus I students taught by full-time faculty of all types were 78%, 89%, and 90% in doctoral, masters, and bachelors departments respectively. By fall 2000 the corresponding percentages had dropped to 71%, 81%, and 86%. The percentage of enrollment taught by part-time faculty rose by about 5 points in doctoral and in masters departments and fell by about 3 points in bachelors level departments. The fall 2000 percentages of enrollment taught by graduate teaching assistants were essentially unchanged from the levels of fall 1995.

There was essentially no change between 1995 and 2000 in the number of students enrolled in fall sections of mainstream Calculus I. In that five year period, overall fall enrollment in mainstream Calculus I rose slightly in doctoral departments, was unchanged in masters departments, and fell off by about 7,000 students (about 11%) in bachelors departments.

Overall average section sizes in mainstream Calculus I declined slightly between 1995 and 2000. However, when one looks at average section sizes in courses taught using lecture/recitation format, one sees some substantial decreases. The average section size in lecture/recitation courses in doctoral departments dropped from 100 in 1995 to 60 in fall 2000, and the average section size of lecture/recitation sections in masters level departments dropped from 84 in fall 1995 to 31 in fall 2000. Another change is worth noting: in fall 1995, bachelors level departments reported teaching no students in lecture/recitation format, but in fall 2000 there were about 9,000 students enrolled in lecture/recitation sections of mainstream Calculus I in bachelors-only departments, with an average section size of 25.

B. Mainstream Calculus II

As in mainstream Calculus I, between 1995 and 2000 there was a shift away from the use of tenured and tenure-eligible faculty to teach mainstream Calculus II. In doctoral departments, the percentage of enrollment taught by tenured and tenure-eligible faculty dropped from 59% in fall 1995 to 56% in fall 2000. The drop off in masters level departments was more pronounced, going from 84% to 71%. The decline in bachelors level departments was from 88% in fall 1995 to 81% in fall 2000.

If one combines the percentages of mainstream Calculus II students taught by tenured, tenure-eligible, and other full-time faculty, one finds that the fall 2000 percentage in doctoral departments was essentially unchanged from 1995 levels while the percentages in bachelors and masters departments dropped by at least ten percentage points. There were increases in the percentages of students taught by part-time faculty.

In contrast with the fact that the overall enrollment in mainstream Calculus I was unchanged between fall 1995 and fall 2000, during that five year period there was a 6% rise in mainstream Calculus II fall enrollments (from 83,000 to 88,000). This might represent a shift in students' initial college calculus course due to the spread of Calculus I courses in high school.

Overall average section sizes in mainstream Calculus II did not change much between 1995 and 2000. However, as with Calculus I, there was a marked decline in average section size of lecture/recitation format courses in doctoral departments — a decline from 84 in fall 1995 to 66 in fall 2000. Also as in Calculus I, bachelors level departments began reporting the use of lecture/recitation format in mainstream Calculus II, something they had not done in 1995. Nationally, in fall 2000 about 3,000 students were enrolled in lecture/recitation sections of mainstream Calculus II in bachelors level departments, with average section size 20, while in fall 1995 there were none. As was the case with mainstream Calculus I, the small size of lecture/recitation sections in bachelors level departments suggests that they were of quite a different type than lecture/recitation sections in doctoral departments.

C. Enrollment Increases in Later Mainstream Calculus Courses

Although this chapter deals only with first-year courses, it may be important to note that enrollment in later calculus courses (Calculus III and IV) rose from 62,000 in fall 1995 to 73,000 in fall 2000 (see Appendix I). That is an increase of almost 18% and may predict future increases in advanced-level mathematics and statistics enrollments.

TABLE FY.1 Percentage of enrollment in Mainstream Calculus I and Mainstream Calculus II taught by tenured/tenure-eligible, other full-time, part-time faculty, graduate teaching assistants, and unknown instructors in Mathematics Departments by size of sections and type of school: Fall 2000, and historical data. Also total enrollments (in 1000s) and average section sizes.

	Percentage of enrollment taught by															Enrollment in 1000s			Average section size		
	Tenured/ tenure-eligible %			Other full- time %			Part-time %			Graduate teaching assistants %			Unknown %								
Course	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA
Mainstream Calculus I																					
Lecture/ recitation	58	67	78	23	3	2	10	16	4	8	13	0	1	1	16	53	6	9	60	31	25
Regular section <36	38	67	71	19	16	15	14	13	9	22	2	0	7	2	5	20	26	45	27	27	22
Regular section >35	39	53	76	20	26	18	19	14	4	21	0	0	1	7	2	16	10	5	43	38	37
Total Mainstream Calculus I	**50**	**64**	**73**	**21**	**17**	**13**	**12**	**14**	**7**	**14**	**3**	**0**	**3**	**2**	**7**	**89**	**42**	**59**	**44**	**29**	**23**
1995 data	62	77	84	16	12	6	7	9	10	15	2	0				84	42	66	47	30	25
Mainstream Calculus II																					
Lecture/ recitation	62	76	60	21	0	0	6	24	8	6	0	0	5	0	32	23	2	3	66	24	20
Regular section <36	48	68	84	15	9	8	14	21	5	19	0	0	4	2	3	15	12	19	27	26	23
Regular section >35	53	78	0	11	16	0	12	0	0	23	0	0	1	6	0	9	4	0	46	34	0
Total Mainstream Calculus II	**56**	**71**	**81**	**17**	**10**	**7**	**10**	**16**	**6**	**13**	**0**	**0**	**4**	**3**	**5**	**48**	**18**	**22**	**43**	**27**	**22**
1995 data	59	84	88	13	11	10	7	5	2	20	0	0				42	16	25	43	28	20
Total Mainstream Calculus I & II	**52**	**66**	**75**	**20**	**14**	**12**	**11**	**14**	**7**	**14**	**2**	**0**	**5**	**4**	**6**	**136**	**60**	**82**	**44**	**29**	**23**
1995 data	61	79	85	15	12	7	7	8	8	17	0	0				126	58	91	46	29	23

Note: 0 means less than one half of 1% in columns 1 through 5, and less than 500 enrollment in column 6.

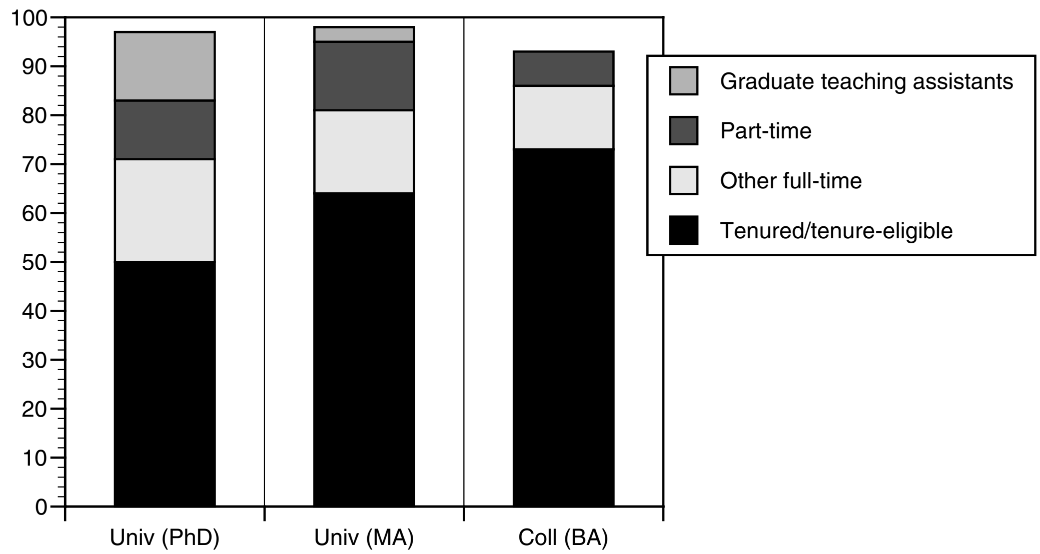

FIGURE FY.1.1 Percentage of enrollment in Mainstream Calculus I in Mathematics Departments by type of instructor and type of school: Fall 2000. (Deficits from 100% represent unknown instructors.)

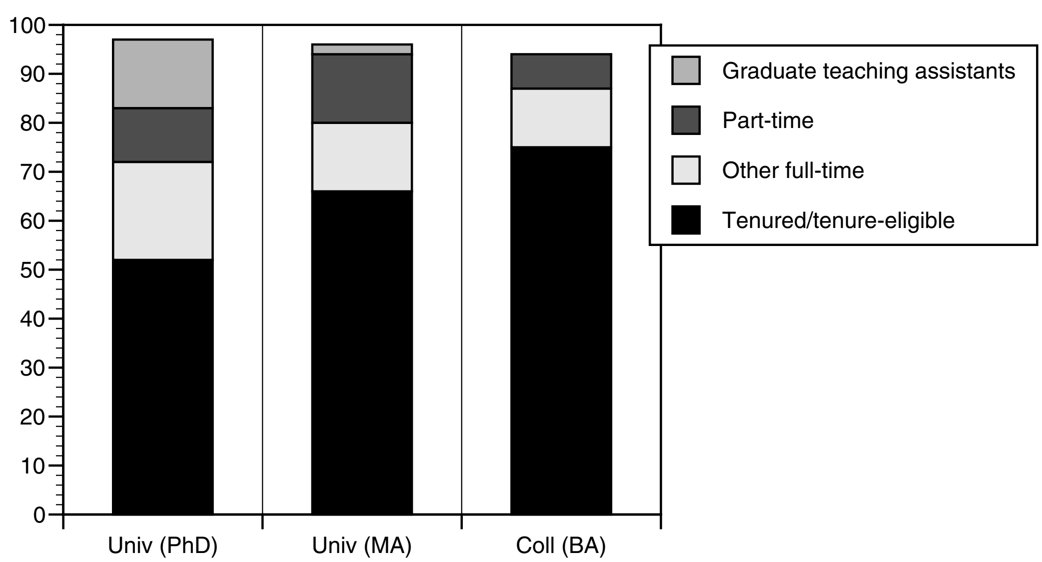

FIGURE FY.1.2 Percentage of enrollment in Mainstream Calculus II in Mathematics Departments by type of instructor and type of school: Fall 2000. (Deficits from 100% total represent unknown instructors.)

TABLE FY.2: HOW IS MAINSTREAM CALCULUS TAUGHT?

This table shows the percentage of enrollment in mainstream Calculus I and II taught using five reform pedagogies:

a) graphing calculators

b) writing assignments

c) computer assignments

d) group projects

e) meeting at least once each week in a setting that requires student computer use.

TABLE FY.2 Percentage of enrollment in Mainstream Calculus I & II taught using various reform methods in Mathematics Departments by type of section and type of school: Fall 2000, plus historical data. Also total enrollments (in 1000s) and average section size.

	Percentage of Mainstream Calculus I & II enrollment taught using															Enrollment in 1000s			Average section size		
	Graphing calculators %			Writing assignments %			Computer assignments %			Group projects %			Weekly computer lab %								
	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA
Mainstream Calculus I																					
Lecture/recitation	35	43	65	16	40	55	17	0	46	5	40	49	14	0	44	53	6	9	60	31	25
Regular section <36	46	64	66	16	22	39	27	35	38	11	20	27	9	11	25	20	26	45	27	27	22
Regular section >35	47	38	81	34	5	72	36	56	58	25	2	61	20	0	20	16	10	5	43	38	37
Total Mainstream Calculus I	**40**	**55**	**67**	**19**	**20**	**45**	**23**	**35**	**41**	**10**	**18**	**33**	**14**	**7**	**27**	**89**	**42**	**59**	**44**	**29**	**23**
1995 data	33	44	39	21	16	27	15	21	20	21	16	28	na	na	na	84	42	66	47	30	25
1990 data	3	3	2	2	2	21	5	8	14	1	2	5	na	na	na	na	na	na	na	na	na
Mainstream Calculus II																					
Lecture/recitation	41	95	51	5	95	69	18	0	64	2	95	64	14	0	64	23	2	3	66	24	20
Regular section <36	52	60	50	13	10	26	17	26	31	10	10	26	8	7	18	15	12	19	27	26	23
Regular section >35	28	45	0	29	0	0	43	35	0	16	0	0	17	3	0	9	4	0	46	34	0
Total Mainstream Calculus II	**42**	**59**	**50**	**12**	**15**	**32**	**23**	**26**	**35**	**8**	**15**	**31**	**13**	**5**	**23**	**48**	**18**	**22**	**43**	**27**	**22**
1995 data	27	32	32	17	11	42	15	18	20	15	12	31	na	na	na	42	16	25	43	28	20
1990 data	3	1	2	2	1	23	3	7	10	1	1	3	na	na	na	na	na	na	na	na	na
Total Mainstream Calculus I&II	**40**	**56**	**62**	**17**	**19**	**41**	**23**	**33**	**39**	**9**	**18**	**33**	**14**	**6**	**26**	**136**	**60**	**82**	**44**	**29**	**23**

Note: 0 means less than one half of 1% in columns 1 through 5, and less than 500 enrollments in column 6.

As in Table FY.1, sections are divided into those taught in lecture/recitation mode, those taught in regular sections of size 35 or less, and those taught in regular sections of size greater than 35.

Certain patterns are evident in Table FY.2. In Calculus I, bachelors level departments reported higher use of each of the five reform pedagogies than did departments having graduate programs, and doctoral departments reported the lowest use. In Calculus II, there appeared to be less use of reform pedagogies than in Calculus I. As in Calculus I, bachelors departments reported more use of four of the five reform pedagogies than departments with graduate programs.

Comparison of CBMS2000 findings with historical data from 1990 and 1995 shows a steady rise in the use of graphing calculators and computer assignments in every type of department, often with double digit increases over five years. The use of writing assignments and group projects did not grow as quickly, and in doctoral departments actually declined during the last five years of the 1990s. In mainstream Calculus II, the use of writing assignments was down, even in bachelors level departments.

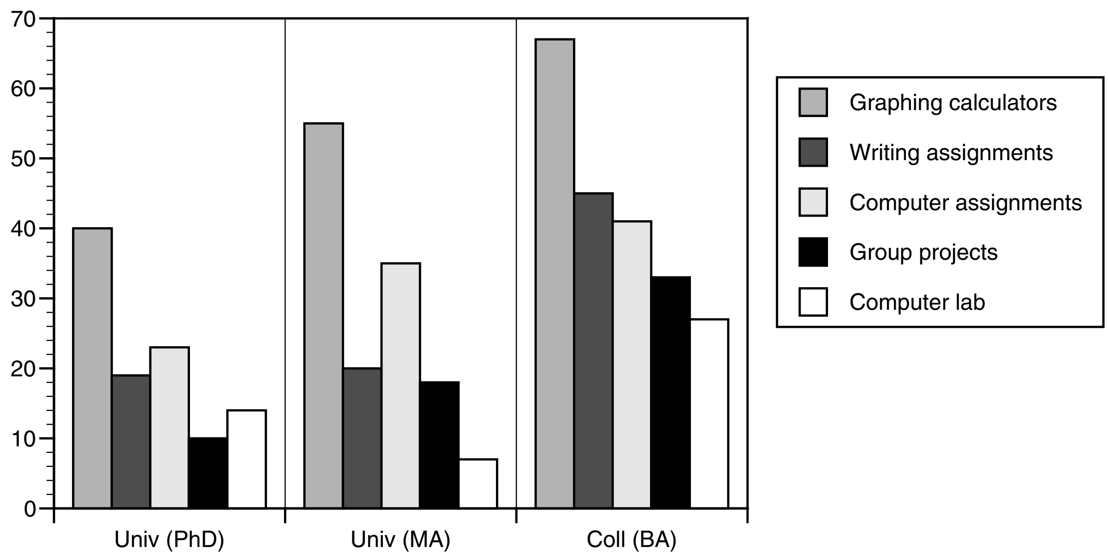

FIGURE FY.2.1 Percentage of enrollment in Mainstream Calculus I taught using various reform methods in Mathematics Departments by type of school: Fall 2000.

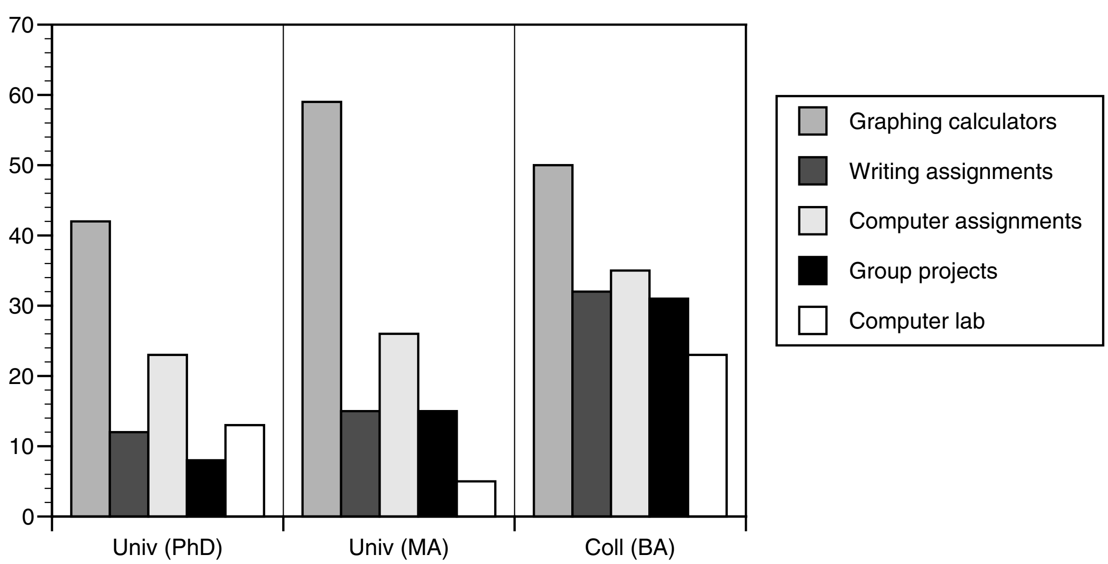

FIGURE FY.2.2 Percentage of enrollment in Mainstream Calculus II taught using various reform methods in Mathematics Departments by type of school: Fall 2000.

TABLES FY.3 AND FY.4: NON-MAINSTREAM CALCULUS COURSES

These tables are an elaboration of Tables SFY.20 and SFY.21 of Chapter 1. Table FY.3 studies the question "Who teaches non-mainstream Calculus I and II?" and Table FY.4 studies the use of reform pedagogies in non-mainstream Calculus I. (Recall that a calculus course is "non-mainstream" if it does not lead to upper division mathematical science courses.)

A. Enrollments

Enrollments in non-mainstream Calculus I rose from 97,000 in fall 1995 to 105,000 in fall 2000, an increase of about 8%. Average section sizes in doctoral and masters departments increased slightly, and decreased slightly in bachelors level departments. Enrollment in non-mainstream Calculus II decreased slightly from fall 1995 to fall 2000, and average section sizes in that second course rose in doctoral and bachelors level departments.

B. Staffing

As was the case with mainstream Calculus I, the period from 1995 to 2000 saw a decrease in the percentage of non-mainstream Calculus I students taught by tenured and tenure-eligible faculty. In each type of department, the decline was about 12 percentage points. If one combines the percentages of enrollment taught by tenured, tenure-eligible, and other full-time faculty, one sees a small decrease—about three points—in the percentage of students taught by full-time faculty of all types in non-mainstream Calculus I in departments with graduate programs, and an increase of about five points in bachelors-only departments. There was an increase in the percentage of students taught by part-time faculty in doctoral departments, and a decline in other departments. Between 1995 and 2000, there was a decrease in the percentage of non-mainstream Calculus I students taught by graduate teaching assistants: in 1995, doctoral departments taught 30% of these students using graduate teaching assistants, and in 2000 the percentage was 22%. In masters level departments, the percentage of non-mainstream Calculus I enrollments taught by graduate students declined from 5% in 1995 to less than one half of one percent in fall 2000.

C. Use of Reform Pedagogies

Table FY.4 shows that the use of graphing calculators in non-mainstream Calculus I increased between 1995 and 2000 in all types of departments and by fall 2000 was comparable to the use of graphing calculators in mainstream Calculus I. Unlike the situation in mainstream Calculus I, it was the masters level departments that seemed to be taking the lead in using reform pedagogies in non-mainstream Calculus I, although the fall 2000 percentages of enrollment taught using some of the new methods (e.g., weekly computer lab format) were low in every type of department.

The use in fall 2000 of other reform pedagogies for which 1995 data is available increased in doctoral and masters departments, and decreased in bachelors level departments. Comparison with Table FY.4 shows that the use of writing assignments, required computer assignments, and group projects was considerably lower in non-mainstream Calculus I than in mainstream Calculus I courses. It is safe to say that by fall 2000, calculus reform had produced greater changes in mainstream calculus than in non-mainstream sections.

TABLE FY.3 Percentage of enrollment in Non-Mainstream Calculus I and II taught by tenured/tenure-eligible, other full-time, part-time faculty, graduate teaching assistants, and unknown instructors in Mathematics Departments by size of sections and type of school: Fall 2000. Also total enrollments (in 1000s) and average section size.

	Percentage of enrollment taught by																				
	Tenured/ tenure-eligible %			Other full-time %			Part-time %			Graduate teaching assistants %			Unknown %			Enrollment in 1000s			Average section size		
Course	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA
Non-Mainstream Calculus I																					
Lecture/ recitation	59	86	22	17	0	0	9	14	22	15	0	0	0	0	56	19	2	1	93	55	29
Reg. section <36	14	44	60	16	22	18	22	25	21	45	1	0	3	8	1	14	18	12	30	29	22
Reg. section >35	42	29	52	24	34	33	20	22	10	13	0	0	1	15	5	23	12	4	77	41	38
Total Non-Mnstrm Calculus I	**41**	**41**	**56**	**19**	**25**	**21**	**17**	**23**	**18**	**22**	**0**	**0**	**1**	**11**	**5**	**56**	**32**	**17**	**58**	**34**	**25**
Total Non-Mnstrm Calculus II	43	82	100	11	0	0	26	14	0	20	0	0	0	4	0	8	2	0.5	50	24	26
Total Non-Mnstrm Calculus I & II	**41**	**44**	**58**	**18**	**24**	**20**	**18**	**23**	**17**	**21**	**0**	**0**	**2**	**9**	**5**	**64**	**34**	**17**	**57**	**33**	**25**
1995 data	50	53	67	10	16	4	8	26	30	32	5	0	0	0	0	60	29	22	52	32	25

Note: 0 means less than one half of 1% in columns 1 through 5 and less than 500 enrollment in column 6.

TABLE FY.4 Percentage of enrollment in Non-mainstream Calculus I taught using various reform methods in Mathematics Departments by type of section and type of school: Fall 2000, plus historical data. Also total enrollments (in 1000s) and average section size.

	Percentage of Mainstream Calculus I enrollment taught using																				
	Graphing calculators %			Writing assignments %			Computer assignments %			Group projects %			Weekly computer lab %			Enrollment in 1000s			Average section size		
	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA
Non-mainstream Calculus I																					
Lecture/recitation	19	100	0	7	50	0	2	47	0	0	50	0	2	0	0	19	2	1	92	55	29
Regular section <36	19	73	61	1	22	10	1	16	8	0	4	5	0	13	3	14	18	12	30	29	22
Regular section >35	39	50	81	22	9	15	22	29	0	22	4	20	0	0	0	23	12	4	77	41	38
Total Non-mainstream Calculus I	**27**	**66**	**63**	**12**	**19**	**11**	**10**	**23**	**5**	**9**	**8**	**8**	**1**	**7**	**2**	**56**	**33**	**17**	**58**	**34**	**25**
1995 data	25	20	34	6	4	14	3	7	11	5	3	15	na	na	na	50	27	20	54	33	26

Note: 0 means less than one half of 1% in columns 1 through 5, and less than 500 enrollments in column 6.

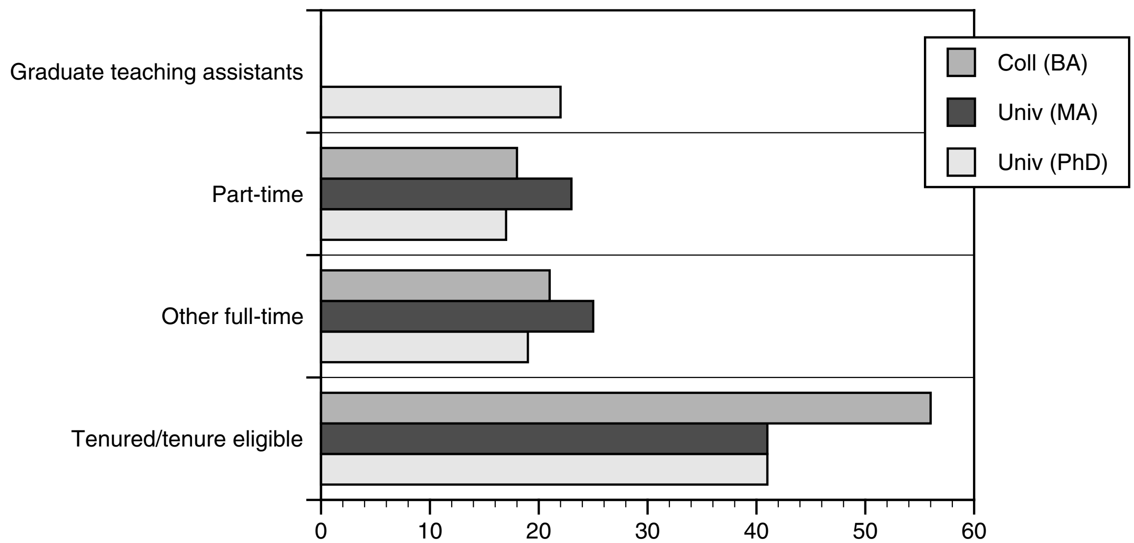

FIGURE FY.3.1 Percentage of enrollment in Non-mainstream Calculus I in Mathematics Departments taught by various types of instructor and type of school: Fall 2000.

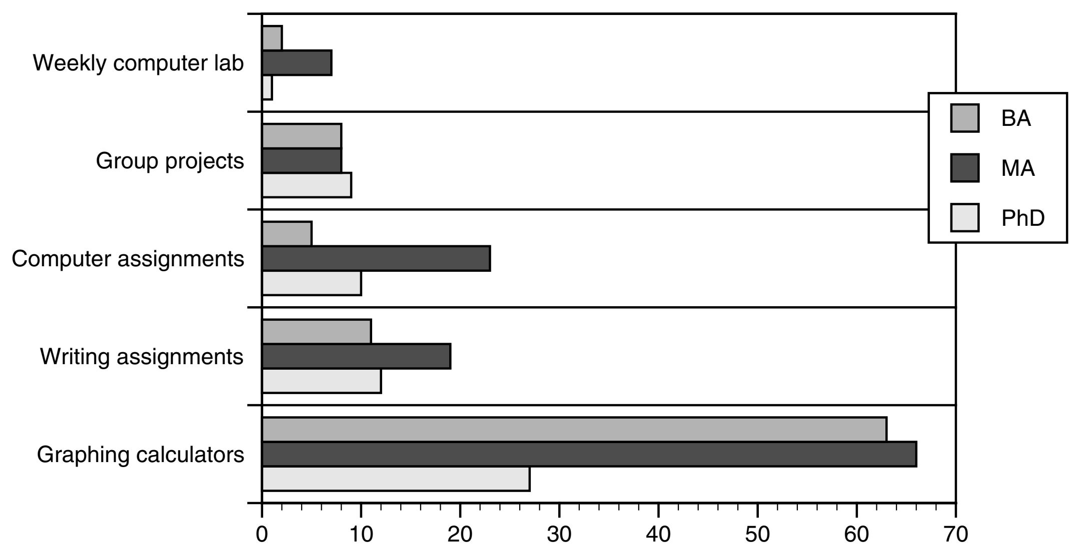

FIGURE FY.4.1 Percentage of enrollment in Non-mainstream Calculus I taught using various reform methods in Mathematics Departments by type of school: Fall 2000.

TABLES FY.5, FY.6, FY.7, AND FY.8: FIRST-YEAR STATISTICS COURSES

These tables are an elaboration of Tables SFY.22 and SFY.23 of Chapter 1. Tables FY.5 and FY.6 present data on a pair of first-year elementary level statistics courses (i.e., having no calculus prerequisite) that are offered in mathematics departments, while Tables FY.7 and FY.8 present data on the same courses, plus three others, that are offered in statistics departments. Tables FY.5 and FY.7 study the question "Who taught elementary level statistics courses?" while Tables FY.6 and FY.8 present data on how the courses were taught.

There is an unfortunate but unavoidable confusion in the terminology used in these tables. The category "elementary level statistics" includes all statistics courses that do not have a calculus prerequisite. In

TABLE FY.5 Percentage of enrollment in Elementary Statistics (non-Calculus) and Probability and Statistics (non-Calculus) taught by tenured/tenure-eligible, other full-time, part-time faculty, graduate teaching assistants, and unknown instructors, in Mathematics Departments by size of sections and type of school: Fall 2000, with historical data. Also total enrollments (in 1000s) and average section size.

	Percentage of enrollment taught by																				
	Tenured/ tenure-eligible %			Other full-time %			Part-time %			Graduate teaching assistants %			Unknown %			Enrollment in 1000s			Average section size		
Mathematics Departments	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA
Elementary Statistics (non-Calculus)																					
Lecture/ recitation	38	68	45	3	28	5	25	4	15	30	0	0	4	0	35	12	5	8	54	45	29
Regular section <36	41	58	41	24	10	17	11	19	36	24	3	0	0	10	6	4	20	39	26	29	26
Regular section >35	39	43	40	13	12	35	23	4	25	20	0	0	5	41	0	13	6	7	53	47	40
Total Elementary Statistics	**39**	**57**	**42**	**9**	**9**	**17**	**22**	**14**	**31**	**24**	**2**	**0**	**6**	**18**	**10**	**29**	**31**	**54**	**54**	**45**	**29**
1995 data	29	69	73	10	11	5	16	15	22	46	6	0				17	29	51	45	35	30
Probability & Statistics (non-Calculus)																					
Total Probability & Statistics	**63**	**18**	**55**	**28**	**69**	**15**	**9**	**12**	**30**	**0**	**1**	**0**	**0**	**0**	**0**	**3**	**2**	**8**	**35**	**30**	**22**
1995 data	36	75	69	1	12	0	12	10	31	51	3	0				6	6	6	34	31	27
Total both courses	**41**	**54**	**43**	**11**	**13**	**17**	**21**	**14**	**31**	**22**	**2**	**0**	**5**	**17**	**9**	**32**	**33**	**62**	**45**	**33**	**27**

Note: 0 means less than one half of 1% in columns 1 through 5, and less than 500 enrollment in column 6.

the questionnaire sent to mathematics departments, three courses were studied within that category: Elementary Statistics, Probability and Statistics, and "Other elementary level statistics courses." Tables FY.5 and FY.6 study the first and second courses in the list, namely the Elementary Statistics course and the Probability and Statistics course. As a result, the enrollment figures given in FY.5 for the single Elementary Statistics course do not match the total enrollment figures given in Table E.2 of Chapter 3 for all elementary level statistics courses.

The questionnaire sent to statistics departments included a wider array of courses in the elementary statistics level, namely Elementary Statistics, Probability and Statistics, Statistical Literacy, Statistics for Pre-service Elementary School Teachers, Statistics for Pre-service High-School Teachers, and "Other elementary level statistics courses." The courses studied in Tables FY.7 and FY.8 are the first four of those courses and consequently the enrollment figures given in FY.7 and FY.8 do not match the category total given for all elementary level statistics courses taught in statistics departments that appears in Table E.2 of Chapter 3.

In fall 2000, the Elementary Statistics course accounted for the vast majority of all elementary level statistics enrollments shown in Table E.2 of Chapter 3—about five sixths in mathematics departments, and about three quarters in statistics departments. Consequently we focus most of the rest of this discussion on that one course.

A. Staffing the Elementary Statistics Course

Table FY.5 focuses on who teaches two elementary level statistics courses in mathematics departments, namely Elementary Statistics, and Probability and Statistics. As was the case with calculus courses, the period between fall 1995 and fall 2000 saw a decrease in the percentage of enrollment taught by tenured and tenure-eligible faculty in masters and bachelors mathematics departments. During the same period, the percentage of students in the Elementary Statistics course who were taught by tenured and tenure-eligible faculty in doctoral mathematics departments rose. If one combines the percentages of students taught by all types of full-time faculty, one sees an almost ten point increase in doctoral mathematics departments and double digit decreases in masters and bachelors departments between fall 1995 and fall 2000. Because three quarters of all elementary statistics enrollments in mathematics departments were in bachelors and masters level departments, it is safe to say that there was an overall shift away from the use of full-time faculty to teach these courses. The use of part-time faculty to teach the Elementary Statistics course rose in doctoral and bachelors departments and declined slightly in masters level departments. The percentage of elementary statistics enrollments taught by graduate teaching assistants in mathematics departments dropped markedly between fall 1995 and fall 2000.

Table FY.7 presents data on who teaches the Elementary Statistics course in statistics departments. In doctoral statistics departments, there was a decline in the percentage of enrollments in Elementary

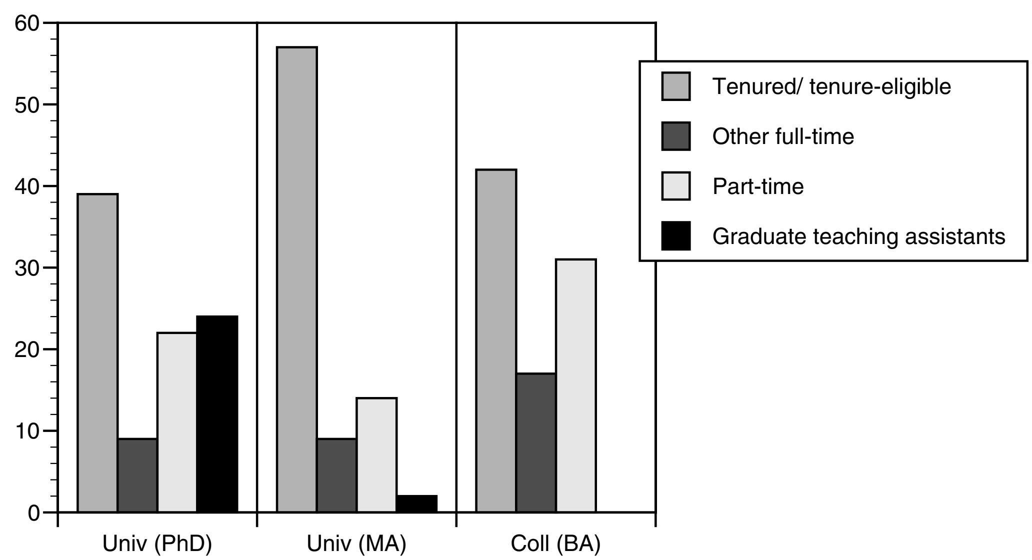

FIGURE FY.5.1 Percentage of enrollment in Elementary Statistics (non-Calculus) in Mathematics Departments by type of instructor and type of school: Fall 2000.

Statistics (no calculus prerequisite) taught by tenured and tenure-eligible faculty from 46% in fall 1995 to 34% in fall 2000. If one combines the percentages of enrollments taught by tenured, tenure-eligible, and other full-time faculty, one sees a decrease from 60% in 1995 to 51% in fall 2000. At the same time, there was a substantial increase in the percentage of enrollment taught by part-time faculty, coupled with a marked decrease in the percentage taught by graduate students.

TABLE FY.6 Percentage of enrollment in Elementary Statistics (non-Calculus) and Probability & Statistics (non-Calculus) taught using various reform methods in Mathematics Departments by type of section and type of school: Fall 2000, plus historical data. Also total enrollments (in 1000s) and average section size.

	Percentage of Statistics & Probability (non-Calculus) enrollment taught using															Enrollment in 1000s			Average section size		
	Graphing calculators %			Writing assignments %			Computer assignments %			Group projects %			Weekly computer lab %								
Mathematics Departments	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA	PhD	MA	BA
Elementary Statistics (non-Calculus)																					
Lecture/recitation	46	40	31	33	67	56	76	60	38	30	33	20	50	32	38	12	5	8	54	45	29
Regular section <36	32	50	49	28	27	52	50	65	48	5	6	37	19	22	19	4	20	39	26	29	26
Regular section >35	34	55	81	10	23	43	23	15	29	2	13	23	0	11	37	13	6	7	53	47	40
Total Elementary Statistics	**38**	**49**	**51**	**22**	**33**	**52**	**48**	**55**	**44**	**14**	**12**	**32**	**23**	**22**	**24**	**29**	**31**	**54**	**54**	**45**	**29**
1995 data	na	na	na	na	na	na	42	30	64	na	na	na	na	na	na	17	29	51	45	35	30
Probability & Statistics (non-Calculus)																					
Total Probability & Statistics	0	10	55	14	88	40	0	88	43	14	10	20	14	5	13	3	2	8	35	30	22
1995 data	na	na	na	na	na	na	31	53	34	na	na	na	na	na	na	6	6	6	34	31	27
Total both courses	**35**	**46**	**51**	**21**	**37**	**50**	**44**	**57**	**44**	**14**	**12**	**31**	**22**	**21**	**23**	**32**	**33**	**62**	**45**	**33**	**27**

Note: 0 means less than one half of 1% in columns 1 through 5, and less than 500 enrollment in column 6.

B. Pedagogical Changes in the Elementary Statistics Course

Table FY.6 investigates the extent to which pedagogical methods promoted by the calculus reform movement had been adopted in the teaching of elementary level statistics in mathematics departments by fall 2000, and Table FY.8 presents data on the same issue in statistics departments. The only comparisons with 1995 data that are available concern the use of required computer assignments. Between fall 1995 and fall 2000, the use of computer assignments in elementary statistics courses increased in doctoral and masters mathematics departments and decreased substantially in bachelors departments. In doctoral statistics departments, the use of computer assignments in the Elementary Statistics course did not change between fall 1995 and fall 2000, remaining at 61%, a figure that is somewhat higher than the corresponding figure in the same courses in mathematics departments.

Tables FY.2 and FY.6 allow us to compare the percentage of enrollments taught using reform pedagogies (graphing calculators, writing assignments, etc.) in mainstream Calculus I and in the Elementary Statistics course as taught in mathematics departments. In fall 2000, graphing calculator use was lower in Elementary Statistics than in mainstream Calculus I and the use of group projects was about the same in the two courses. The percentages of enrollments in elementary statistics that used writing assignments, computer assignments, and weekly computer labs exceeded the corresponding percentages in mainstream Calculus I.

Tables FY.6 and FY.8 allow us to compare the use of reform pedagogies in the Elementary Statistics course as taught in mathematics departments and in statistics departments. In fall 2000, a smaller percentage of Elementary Statistics students in statistics departments used graphing calculators than in the same course taught in mathematics departments. In the use of writing assignments and group projects, mathematics doctoral departments and statistics doctoral departments were roughly comparable, while in the use of required computer assignments and weekly computer labs, doctoral statistics departments were substantially ahead of doctoral mathematics departments.

C. Enrollments and Section Sizes for the Elementary Statistics Course

The total combined enrollment for the Elementary Statistics course considered in Tables FY.6 and FY.8 grew from 132,000 in fall 1995 to 154,000 in fall 2000, an increase of almost 17%. (Note that this figure is not the same as the total appearing in Table E.2 for all elementary level statistics courses.) In mathematics departments, enrollment in the Elementary Statistics course rose by almost 18% overall and increased in every type of department, with doctoral departments seeing the largest increases. Overall enrollment in the Elementary Statistics course taught in statistics departments increased by about 14%. As was the case in 1995, about three quarters of all enrollments in the Elementary Statistics course were in mathematics departments.

Between fall 1995 and fall 2000, average section sizes in the Elementary Statistics course rose by about

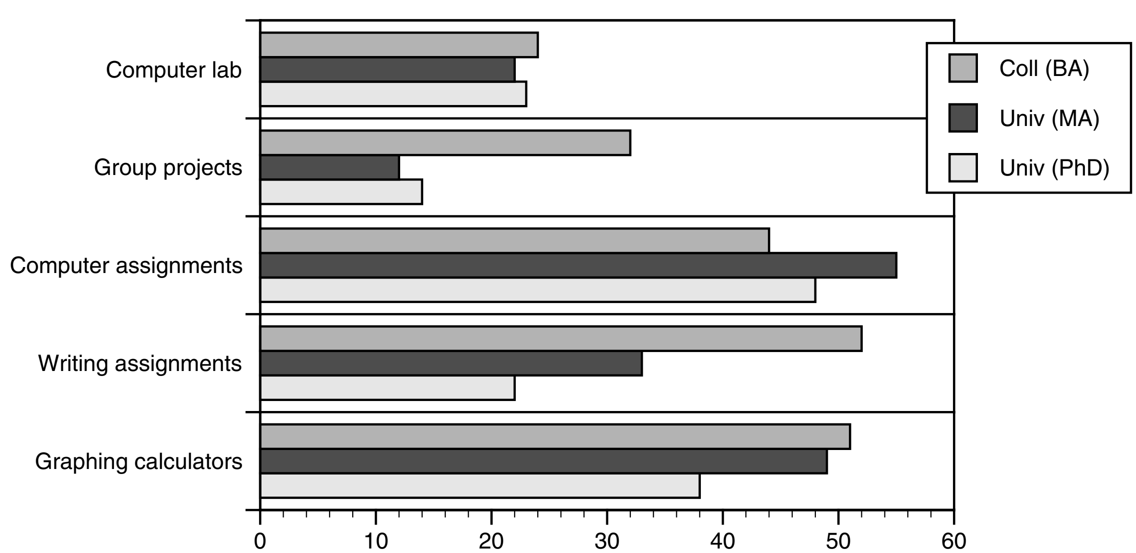

FIGURE FY.6.1 Percentage of enrollment in Elementary Statistics (non-Calculus) taught using various reform methods in Mathematics Departments by type of school: Fall 2000.

20% in doctoral mathematics departments (from 45 students per section to 54) and there was an even larger rise in masters level mathematics departments. Average section size in bachelors mathematics departments dropped slightly. Average section size in the Elementary Statistics course in doctoral statistics departments also rose, and remained higher than in doctoral mathematics departments (57 students per section, compared to 54).

TABLE FY.7 Percentage of enrollment in Elementary Statistics (non-Calculus) and Probability and Statistics (non-Calculus) taught by tenured/tenure-eligible, other full-time, part-time faculty, graduate teaching assistants, and unknown, in Statistics Departments by size of sections and type of school: Fall 2000, with historical data. Also total enrollments (in 1000s) and average section size.

	Percentage of enrollment taught by													
	Tenured/ tenure-eligible %		Other full-time %		Part-time %		Graduate teaching assistants %		Unknown %		Enrollment in 1000s		Average section size	
Statistics Departments	PhD	MA	PhD	MA	PhD	MA	PhD	MA	PhD	MA	PhD	MA	PhD	MA
Elementary Statistics (non-Calculus)														
Lecture/recitation	36	51	19	21	26	7	16	5	3	16	27	4	63	79
Regular section <36	34	89	8	0	8	11	43	0	7	0	1	0.4	26	33
Regular section >35	23	25	7	50	16	25	38	0	16	0	7	0.3	48	45
Total Elementary Statistics, 2000	**34**	**53**	**17**	**21**	**24**	**8**	**21**	**4**	**4**	**14**	**35**	**5**	**63**	**79**
1995 data	46	50	14	25	9	25	31	0			33	2	52	45
Probability & Statistics (non-Calculus)														
Total Probability & Statistics	**15**	**18**	**7**	**25**	**19**	**0**	**39**	**17**	**20**	**40**	**3**	**1**	**51**	**68**
1995 data	19	86	2	14	4	0	75	0			7	1	52	30
Statistics literacy	13	68	30	17	2	15	53	0	2	0	4	0.5	79	33
Statistics for pre-service teachers	100	0	0	63	0	0	0	0	0	37	0.04	0.08	39	54
All courses in Table FY.7	**31**	**48**	**17**	**22**	**21**	**7**	**25**	**6**	**6**	**17**	**42**	**6**	**58**	**61**

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

TABLE FY.8 Percentage of enrollment in Elementary Statistics (non-Calculus) and Probability & Statistics (non-Calculus) taught using various reform methods in Statistics Departments by type of section and type of school: Fall 2000, plus historical data. Also total enrollments (in 1000s) and average section size.

	Percentage of Statistics & Probability (non-Calculus) enrollment taught using													
	Graphing calculators %		Writing assignments %		Computer assignments %		Group projects %		Weekly computer lab %		Enrollment in 1000s		Average section size	
Statistics Departments	PhD	MA	PhD	MA	PhD	MA	PhD	MA	PhD	MA	PhD	MA	PhD	MA
Elementary Statistics (non-Calculus)														
Lecture/recitation	16	0	25	3	58	85	16	19	40	100	27	4	63	79
Regular section <36	1	0	10	56	35	100	10	23	23	10	1	0.4	26	33
Regular section >35	12	0	26	50	74	50	17	0	33	0	7	0.3	48	45
Total Elementary Statistics	**15**	**0**	**25**	**11**	**61**	**85**	**16**	**18**	**38**	**85**	**35**	**5**	**57**	**67**
1995 data	na	na	na	na	61	25	na	na	na	na	33	2	52	45
Probability & Statistics (non-Calculus)														
Total Probability & Statistics	5	0	46	0	52	0	12	0	10	0	3	1	51	68
1995 data	na	na	na	na	60	39	na	na	na	na	7	1	52	30
Statistics literacy	28	23	15	77	32	60	15	69	28	31	4	0.5	79	33
Statistics for pre-service teachers	0	0	0	63	0	63	0	63	0	63	0.04	0.08	39	54
All courses in Table FY.8	**15**	**2**	**25**	**15**	**58**	**65**	**15**	**20**	**35**	**64**	**42**	**6**	**58**	**61**

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

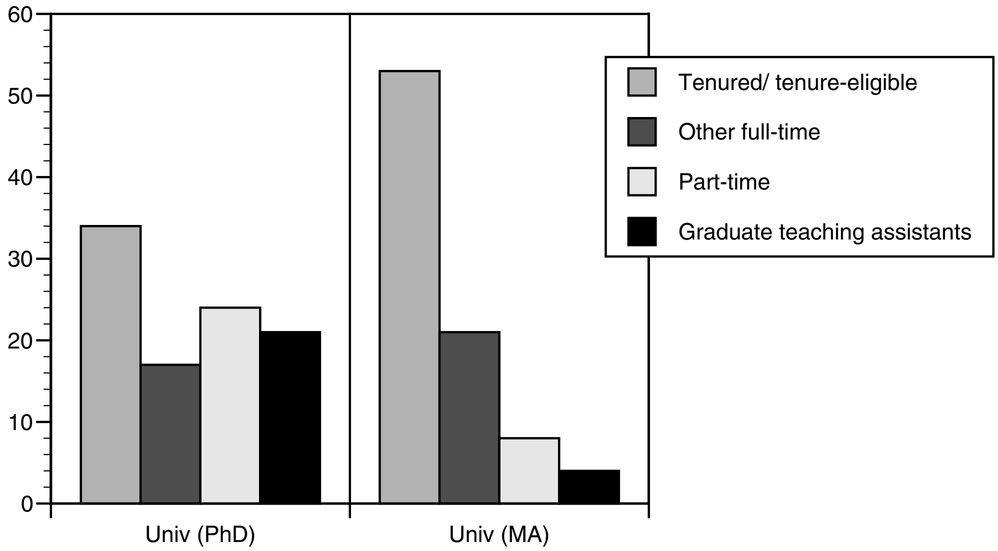

FIGURE FY.7.1 Percentage of enrollment in Elementary Statistics (non-Calculus) in Statistics Departments by type of instructor and type of school: Fall 2000.

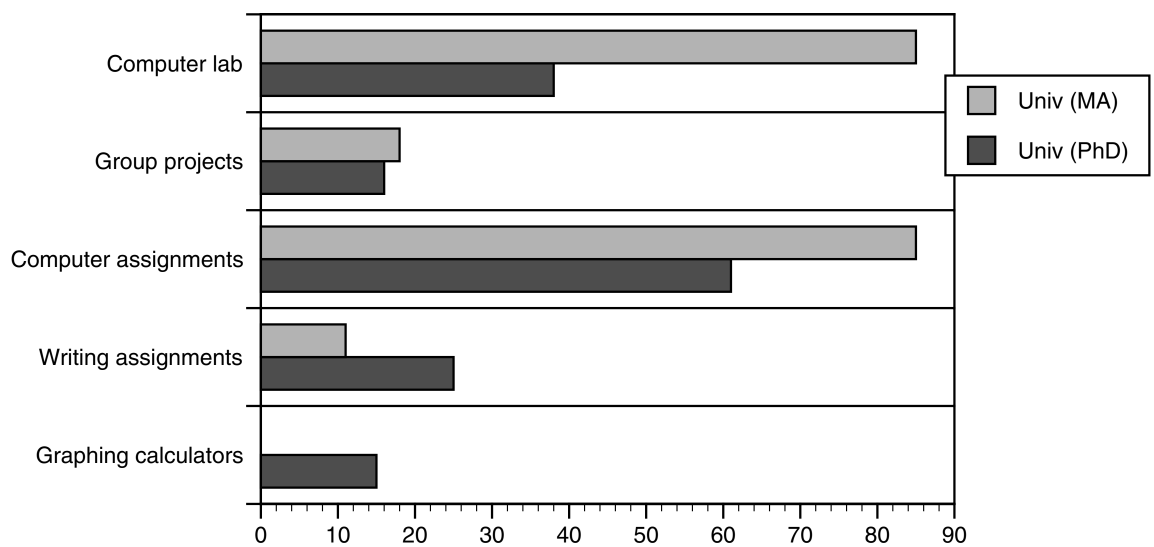

FIGURE FY.8.1 Percentage of enrollment in Elementary Statistics (non-Calculus) taught using various reform methods in Statistics Departments by type of school: Fall 2000.