Chapter VI

THE TWO-YEAR COLLEGE MATHEMATICS FACULTY

In this chapter we will examine the characteristics of the mathematical sciences faculty of two-year colleges. In summary, we are able to report that the number of faculty assigned to mathematics teaching has increased in the last four years somewhat more rapidly than has the student course load assigned to them. At the same time, the qualifications which the faculty bring to the teaching of mathematics have increased quite markedly, as measured by several different yardsticks of qualification.

The study of junior college faculties in the mathematical sciences as of 1966-67 which was reported in 1967 in our Volume I was the first such which provided data related in detail to the subject field. Subsequently, the National Science Foundation has issued (1969) a study [P] of the entire junior college science faculty, also as of 1966-67, which includes considerable data on teachers of mathematical subjects. Although the analysis has quite a different statistical base--using courses taught rather than faculty as individuals, for reasons more pertinent to science fields than to mathematics--the data that are comparable are quite consistent with the CBMS data for the same year. For example, the NSF study showed that 3 percent of the courses in mathematics (counting several sections taught by one individual as a "course") were taught by holders of a doctorate degree; the CBMS report showed that 3.7 percent of the full-time mathematics faculty, and 1.3 percent of the part-time faculty, held a doctorate: these estimates are quite consonant. For those especially interested in faculty characteristics, the NSF study is a useful source.

Our current survey shows that the two-year college faculty in mathematics (i.e., the mathematical sciences) in 1970-71 consisted of 4,879 full-time and 2,213 part-time individuals. Using the conventional estimate of one-third as the equivalent load for part-time faculty, this gives a total of 5,616 for the full-time

Table 6.1

TWO-YEAR COLLEGE MATHEMATICS FACULTY, 1970-71

	Full-Time Faculty	Part-Time Faculty	Average FTE Faculty Per Institution
41 Large Public Colleges	723	457	21.3
330 Medium Public Colleges	2,680	1,056	9.2
405 Small Public Colleges	1,055	495	3.0
24 Large Private Colleges	134	79	6.7
203 Small Private Colleges	287	126	1.6
Total	4,879	2,213	5.6

equivalent (FTE) faculty in the mathematical sciences. The spread of these among the different types of colleges is shown in Table 6.1. The actual range of department size varied from 45 full-time faculty in the largest junior college, and 31 full-time and 69 part-time (54 FTE) in another very large institution, to only one part-time individual, as reported by several very small colleges.

Faculty Qualifications

The formal educational qualifications which these faculty members brought to their tasks are exhibited in Tables 6.2 and 6.3. The details shown in these tables are based, as is the rest of our survey, upon an extrapolation from sample studies, and clearly the accuracy which is implied by the exhibited data is not warranted at this fine structure level except as raw material for the succeeding tables which recapitulate this same data in larger cells which therefore have greater probable accuracy.

How does one measure the quality of a faculty group? There are obviously many aspects of quality which cannot be measured, not the least of which is teaching effectivess. But from information provided by the faculty themselves, the best we can do

Table 6.2

EDUCATIONAL QUALIFICATIONS OF FULL-TIME TWO-YEAR COLLEGE MATHEMATICS FACULTY, 1970-71

	Doctorates in			Master's + 1 yr. in			Master's in			Bachelor's in			TOTAL
	Math Sci.	Math Ed.	Other Field	Math Sci.	Math Ed.	Other Field	Math Sci.	Math Ed.	Other Field	Math Sci.	Math Ed.	Other Field	
Public Junior Colleges	95	53	51	1,496	437	151	1,222	522	138	151	83	59	4,458
Private Junior Colleges	14	3	11	84	8	15	178	42	32	20	1	13	421
Total	109	56	62	1,580	445	166	1,400	564	170	171	84	72	4,879

Table 6.3

EDUCATIONAL QUALIFICATIONS OF PART-TIME TWO-YEAR COLLEGE MATHEMATICS FACULTY, 1970-71

	Doctorates in			Master's + 1 yr. in			Master's in			Bachelor's in			TOTAL
	Math Sci.	Math Ed.	Other Field	Math Sci.	Math Ed.	Other Field	Math Sci.	Math Ed.	Other Field	Math Sci.	Math Ed.	Other Field	
Public Junior Colleges	110	16	64	384	71	168	573	173	168	186	34	61	2,008
Private Junior Colleges	8	0	8	25	8	8	49	10	43	24	1	21	205
Total	118	16	72	409	79	176	622	183	211	210	35	82	2,213

Table 6.4

HIGHEST DEGREES HELD BY TWO-YEAR COLLEGE MATHEMATICS FACULTY, 1966-67 AND 1970-71

		Doctorate	Master's + 1 yr.	Master's	Bachelor's
Full-Time Faculty					
Public Colleges	1970-71	4.5%	46.7%	42.2%	6.6%
Private Colleges	1970-71	6.7%	25.4%	59.8%	8.1%
All Junior Colleges	1970-71	4.7%	44.9%	43.7%	6.7%
All Junior Colleges	1966-67	3.7%	28.4%	55.8%	12.0%
Part-Time Faculty					
All Junior Colleges	1970-71	9.3%	30.0%	45.9%	14.8%
All Junior Colleges	1966-67	1.3%	19.9%	49.6%	29.2%

statistically is to use the normal academic measure of formal educational qualifications, and to try to interpret them in the light of their relationship to the assigned tasks. We will examine here three ways of looking at this data--total educational sophistication, interest in mathematics, and the amount of mathematics studied. In each of these aspects, whatever the faculty's real qualifications, we can at least make a comparison with the data for 1966-67 which are recorded in our previous volume [E], page 74.

General educational sophistication may be measured by the highest degree which has been achieved by an individual, whatever his field; Table 6.4 shows the highest degrees earned by the mathematics faculty covered in the two surveys. It may be noted that for the full-time faculty, the percentage of doctorates has increased somewhat, while the percentage of those with only a bachelor's degree has been cut almost in half; at the same time half of the master's degree holders now have had an additional year of studies, as compared with one-third in 1966-67. And the part-time faculty, which in 1966-67 was noticeably inferior to the full-time faculty in its degree qualifications, has improved considerably. In fact, the percentage of doctorates among the part-time faculty is now twice that of the full-time faculty; and although the percentage of bachelor's degrees--15 percent--is still distressingly large, it is only half of the former figure.

Table 6.5

FIELD OF HIGHEST LEVEL OF TRAINING OF TWO-YEAR COLLEGE MATHEMATICS FACULTY, 1966-67 AND 1970-71

Field of Highest Degree	Full-Time Faculty 1966-67	Full-Time Faculty 1970-71	Part-Time Faculty 1966-67	Part-Time Faculty 1970-71
Mathematical Sciences	63%	67%	47%	61%
Mathematics Education	23%	23%	21%	14%
Non-mathematical Fields	14%	10%	32%	25%

The choice of the mathematical sciences as their subject of primary interest is demonstrated by grouping faculty members according to the major field of their highest degree, as shown in Table 6.5. In this respect the full-time faculty has turned toward mathematics, but only slightly, over a four year period, but the part-time faculty shows a much greater change. Undoubtedly the greater availability of individuals with advanced mathematical training in recent years has facilitated this shift, and it is more pronounced among the portion of the faculty with part-time assignments--those to whom the institutions do not have a long term commitment for retention.

The amount of mathematics in the educational background of faculty members is harder to measure. As a rough estimate we have considered the typical amount of mathematics which might be expected as represented in the various degrees, and have grouped these in a hierarchical arrangement of the full-time faculty, as shown in Table 6.6. It is evident from this table that the subject matter background of teachers of the mathematical sciences has increased substantially, and especially so at the top level. At the other end of the scale, those who do not have even an undergraduate major in mathematics have not only decreased as a percentage but have not increased in absolute numbers--among the part-time faculty (not shown in the table) the number has been actually reduced by some 40 percent.

We thus conclude that the quality of the junior college mathematics faculty, as measured by its educational qualifications in any of the above aspects, has improved markedly during the

Table 6.6

MATHEMATICAL LEVEL OF FULL-TIME JUNIOR COLLEGE MATHEMATICS FACULTY, 1966-67 AND 1970-71

Mathematical Level of Faculty	Faculty in 1966-67		Faculty in 1970-71	
	Number	Percent	Number	Percent
Doctorate in Mathematical Science	11	0.4%	109	2.2%
Master's + 1 yr. in Math. Science or Doctorate not in Math. Science	626	23.4%	1,698	34.8%
Master's in Mathematical Science or Master's + 1 yr. not in Math.Sci.	1,176	44.0%	2,011	41.2%
Bachelor's in Mathematical Science or Master's not in Math. Science	711	26.5%	905	18.6%
Bachelor's not in Math. Science	153	5.7%	156	3.2%
	2,677		4,879	

four year interval. It seems highly probable that this improvement will continue at least for the near future, if we can judge from the increased availability of individuals with advanced training in mathematical subjects. As a straw in the wind, we note that the American Mathematical Society's annual salary survey [K] indicates that for 168 junior colleges which reported for both 1970-71 and 1971-72 the percentage of doctorates increased from 4.6 percent to 5.6 percent. It might be noted that, although the AMS "sample" is self-selected and not necessarily unbiased, the 1970-71 figure agrees essentially with the 4.7 percent obtained in our survey.

Faculty Utilization

Teaching effectiveness is also related to the conditions under which faculty members work, and a major consideration is, of course, the work load. As a measure of this, we present in Table 6.7 some comparisons of total course enrollments in the mathematical sciences with the size of the faculty. Between

Table 6.7

COURSE ENROLLMENT AND FACULTY COMPARISONS, 1966-67 AND 1970-71

	1966-67	1970-71			Change
	All Junior Colleges	Public Junior Colleges	Private Junior Colleges	All Junior Colleges	1966-67 to 1970-71
Course Enrollments	348,000	534,000	50,000	584,000	+ 68%
Full-Time Faculty	2,677	4,458	421	4,879	+ 82%
Part-Time Faculty	1,318	2,008	205	2,213	+ 66%
FTE Faculty	3,116	5,127	489	5,616	+ 80%
Enrollments per Full-Time Faculty	130	120	119	120	- 8%
Enrollments per FTE Faculty	112	104	102	104	- 7%

FTE = full-time equivalent = full-time plus one-third of part-time.

1966-67 and 1970-71 the fall course enrollment increased by 68 percent, along with the total student enrollment in the junior colleges, but the full-time faculty in the mathematical sciences increased by 82 percent and the FTE faculty by 80 percent; this relative increase in the faculty as compared with course enrollments has resulted in a decrease of 7 percent in the student/faculty ratio from 112 to 104. It is however still true that the student/faculty ratio for junior colleges is much higher than the ratios of 68 and 70 which obtain in public and private four-year colleges (with 55 the ratio in universities), as shown in Table 3.21. Although this difference may be explainable in part by the larger number of small advanced classes in the four-year institutions, the individual attention which may be needed in the larger number of remedial courses given in junior colleges should properly lead to small sections for these students also.

It is more likely, however, that the higher student/faculty ratio for junior colleges is in large part related to the heavier

Table 6.8

PERCENTAGES OF TWO-YEAR COLLEGES HAVING GIVEN TEACHING LOADS FOR MATHEMATICAL SCIENCE FACULTY, 1970-71

Teaching Load	Large Colleges	Small Colleges	All Two-Year Colleges
9 to 11 Hours	0%	4%	2%
12 Hours	12%	16%	14%
13 or 14 Hours	5%	15%	11%
15 Hours	71%	45%	56%
16 or 17 Hours	9%	10%	10%
18 Hours or more	3%	10%	7%
Average	14.8 hrs.	14.8 hrs.	14.8 hrs.

credit-hour teaching loads which obtain in the junior colleges. Our survey indicates that a credit-hour teaching load of 15 hours per week is almost universal--71 percent of the larger colleges report this as their standard. The teaching load for both large and small colleges averages 14.8 hours, although, as Table 6.8 shows, there is greater variation in the load for small colleges because of the logistical problem of making assignments for a small faculty. This average teaching load has not changed since our survey of four years earlier, and it is in sharp contrast with that for four-year colleges (excluding universities), in which, as we have seen in Table 3.14, the median load is 12 hours with the mean slightly less.

If the typical professor in a four-year college teaches four sections for his 12 hours' load, his class size would average 17 students, and if he has only three sections for his 12 hours the class size would be 23. In contrast, the 15 hour teacher in a junior college would have either five classes of 21, four classes of 26, or possibly three classes of 35 each! It is evident that class size in junior colleges exceeds that in four-year institutions, even when the faculty teaches one more class.

Faculty Leadership

Although only 4 percent of the junior college faculty in mathematical science hold a doctorate in some field, these individuals are dispersed throughout the colleges in such a way that 31 percent of the 395 larger institutions and 14 percent of the 608 smaller ones have at least one full-time doctorate on the faculty--an individual who is presumably trained for educational leadership. At the other extreme, our projections indicate that about ten percent of the smaller institutions have no full-time mathematical faculty at all. The 395 large and medium junior colleges have an average mathematical faculty of 9 full-time individuals, aided by 4 part-time ones. If it is reasonable to suppose that at least one of the full-time members might be qualified at the doctorate level, this could be achieved with some 275 additional doctorates. The present availability of qualified mathematical scientists should make this possible in the relatively near future.

Faculty Supply and Demand

We have seen in Table 6.7 that the full-time faculty in junior colleges increased by 82 percent in the period between 1966-67 and 1970-71. This represents an annual increase rate of about 16 percent, and indicates that in the last year of this period the full-time faculty increased by a net of 650 to 700 individuals. According to our survey, this increase was accomplished by hiring some 878 new faculty members from sources outside of the existing full-time faculty, as shown in Table 6.9.

Particularly noteworthy among the (projected) figures in this table is the number of holders of doctorates, 138--about 15 percent of the new faculty. Since, by our figures in Table 6.2, the total full-time faculty in 1970-71 included only 227 doctorates, this appears to initiate a trend. However, there had been a total net increase in doctorates on the faculty of only 127 over the four-year period since 1966; there thus must have been a number who had left junior college teaching during that time. Furthermore, a study of new doctorates in the mathematical sciences awarded in 1969-70 (see the CBMS Newsletter, January 1971, pp. 2-4) revealed that few, if any, of these new doctorates took positions in junior colleges; the 79 doctorates shown in the table as coming from graduate school must have been

Table 6.9

SOURCES OF NEW FULL-TIME MATHEMATICS FACULTY IN TWO-YEAR COLLEGES, 1970-71

Source	Doctorates	Non-Doctorates	Total
From Graduate School	79	311	390
From Four-year Institutions	20	114	134
From Secondary School Teaching	0	151	151
From Part-Time Employment in Institution	0	38	38
From Non-Academic Positions	13	98	111
From Other Sources, or Unemployed	26	28	54
Total New Two-Year College Faculty	138	740	878
Transfers Between Two-year Colleges	0	55	55

almost all in mathematics education or some non-mathematical field. The remaining 59 newly-hired doctorates may, we think, include a number in mathematical science, including some who have been displaced from four-year colleges because of insufficient tenure positions being available there.

It appears from the above calculations that some 200 individuals left the occupation of junior college teaching between 1969-70 and 1970-71, at least 50 of these being holders of the doctorate. Unfortunately, our junior college questionnaire did not seek information as to where they went.

Respondents to our questionnaire did indicate quite universally that they had no difficulty in recruiting new faculty members. In fact, the only reservations in their replies came from two chairmen in small private colleges who felt that their particular salary scales were insufficiently attractive. Except in a few cases, however, salaries for mathematical faculty in junior colleges, as shown in the American Mathematical Society's salary survey [K], appear to be quite competitive with those in institutions which grant the bachelor's as the highest degree, at all ranks from instructor to professor.

Asked how many additional full-time faculty members they planned to seek for 1971-72, the responding chairmen gave replies which, when projected, added up to 80 doctorates and 463 non-doctorates, exclusive of replacements for departing faculty. This is almost as many as the net hiring for the previous year, and the percentage of doctorates desired is also the same. The addition of this number would have provided an 11 percent growth in faculty positions, which is reasonably consistent with the 13 percent increase in total student enrollment which actually occurred. It may be noted that the AMS salary survey figures indicated a faculty increase of only 4 percent for the one-sixth of the colleges which reported; however, these reports were submitted in July and do not therefore include late hiring. The parallel survey made by AMS of new doctorates' placement would indicate that as many as 25 of these new doctorates in the mathematical sciences took positions in junior colleges for 1971-72; while this number is relatively small, it represents a radical departure from previous years and may be a harbinger of those to come.