Chapter IV

OTHER ASPECTS OF UNDERGRADUATE PROGRAMS

In this chapter we discuss several matters which have a certain intrinsic interest but are not related directly to the main themes of the preceding chapters. Among these are computer use by faculty, mathematical requirements for graduation, admissions and placement testing, and various types of curricular innovations, all in degree-granting institutions.

The part of our questionnaire upon which this chapter is based was composed mainly of questions requiring a yes or no answer as a description of some characteristic of a responding department. We are aware that in many instances this forces an oversimplification of the actual situation so that the data collected are perhaps somewhat less objective and more dependent on the judgment of individual respondents than the data of the preceding chapters.

In tables reporting the percentages of departments having given characteristics, the percentages have been calculated by methods described more fully in Chapter I which take into account differences in sampling ratios and response rates. The reader should keep in mind that the data of this chapter are not weighted with respect to numbers of students affected.

Computer Access and Utilization

Table 4.1 shows the percentages of mathematics departments which had access to a computer or to computer terminal facilities. All computer science and statistics departments had such access. The most important fact here is that the percentage of departments in private colleges having access to a computer or to terminals increased from 39 percent in 1965-66 to 75 percent in 1970-71. The colleges reporting no access tended to be the very smallest institutions. To the extent that access to computers for a

Table 4.1

PERCENTAGES OF MATHEMATICS DEPARTMENTS HAVING ACCESS TO A COMPUTER OR TO COMPUTER TERMINAL FACILITIES, 1965-66 and 1970-71

	Percent Having Access 1965-66	Percent Having Access 1970-71
Universities	98%	98%
Public Colleges	62%	87%
Private Colleges	39%	75%

department constitutes access for an undergraduate student, it can be said that in 1970-71 virtually all undergraduates in universities and over 90 percent of undergraduates in four-year colleges had access to computers or to computer terminals.

The respondents were asked if there were courses taught by their departments, other than courses in computer science, in which the use of a computer is specified. An affirmative answer was given by 61 percent of university mathematics departments, by 29 percent of public colleges, and by 40 percent of private colleges. The courses most mentioned as those in which a computer was specified were calculus, numerical analysis, linear algebra, and finite mathematics.

It is difficult to formulate questions which will get usable responses indicating quantitatively the amount of involvement of faculty members and students in computing. As one measure we asked chairmen what percentage of faculty in their departments used computers (a) in research and (b) in teaching. In order to present the results of this question, we have defined (after reviewing the data and for the purposes of this question only) "minimal use" to be use by less than 10 percent of departmental faculty, "moderate use" to be use by between 10 and 25 percent of departmental faculty, and "high use" to be use by at least 25 percent of departmental faculty. Table 4.2 gives the results for research and Table 4.3 gives the results for teaching.

Table 4.2 says, for example, that 84 percent of university mathematics chairmen reported that not more than ten percent of

Table 4.2

PERCENTAGES OF MATHEMATICAL SCIENCE DEPARTMENTS REPORTING MINIMAL, MODERATE AND HIGH USE OF COMPUTERS IN RESEARCH, 1970-71

	Minimal Use: Not More Than 10% of Faculty	Moderate Use: Between 10% and 25% of Faculty	High Use: At Least 25% of Faculty
Universities			
Mathematics	84%	0%	16%
Statistics	4%	45%	51%
Public Colleges	71%	17%	12%
Private Colleges	74%	5%	21%

their departmental faculty made use of a computer in research and Table 4.3 says that 71 percent of university mathematics chairmen reported that not more than ten percent of their

Table 4.3

PERCENTAGES OF MATHEMATICAL SCIENCE DEPARTMENTS REPORTING MINIMAL, MODERATE AND HIGH USE OF COMPUTERS IN TEACHING, 1970-71

	Minimal Use: Not More Than 10% of Faculty	Moderate Use: Between 10% and 25% of Faculty	High Use: At Least 25% of Faculty
Universities			
Mathematics	71%	19%	10%
Statistics	37%	15%	48%
Public Colleges	42%	44%	16%
Private Colleges	63%	7%	30%

faculty used a computer in teaching. It is interesting to note that high faculty use of computers was reported by only 51 percent of statistics departments for research and only by 48 percent for teaching. For colleges, reported research utilization must have been held down by the proportion of faculty members involved in research. With respect to teaching, it is noteworthy that 30 percent of private colleges reported high faculty use compared to only 10 percent in university mathematics departments; however, over half the private colleges had no more than four members of the mathematical faculty, so that "high use" may only mean that at least one member uses the computer.

Mathematical Science Courses as Graduation Requirements

The respondents were asked whether their institutions had some mathematical science course as an institution-wide requirement for graduation. The situation compared with former years is presented in Table 4.4. There does not appear to have been any significant change since 1965-66.

An institution-wide mathematical science requirement was favored by the mathematics chairmen in only 10 percent of universities, 15 percent of public colleges and 4 percent of private colleges.

Table 4.4

PERCENTAGES OF INSTITUTIONS HAVING SOME MATHEMATICAL SCIENCE COURSE AS AN INSTITUTION-WIDE GRADUATION REQUIREMENT

	1960-61	1965-66	1970-71
Universities	21%	20%	20%
Public Colleges	33%	45%	49%
Private Colleges	25%	28%	28%

Of the universities not having a specific mathematical science requirement 49 percent had an institution-wide requirement of an alternative choice of either mathematics or some other subject. The corresponding percentages were 72 percent for public colleges and 48 percent for private colleges. Consequently, a student in 52 percent of universities, 86 percent of public colleges and 62 percent of private colleges could use some mathematical science course to satisfy some institution-wide graduation requirement.

Entrance and Placement Examinations

An admissions examination including questions on mathematics was required in 1970-71 at 63 percent of universities, 35 percent of public colleges, and 91 percent of private colleges. These percentages were lower in all categories than those reported five years earlier, but are quite similar to the requirements of 1960-61, as shown in Table 4.5. The rapid rise and fall of admission examinations over the decade in public colleges and universities is probably correlated with the expanded admission pressures in the middle of the period, followed by the introduction of "open admissions" more recently. Leading examinations were the College Entrance Examination Board Aptitude Examination and the American College Testing examination. Other examinations, including state examinations, institutional examinations, and the CEEB Achievement Examinations were far behind.

Table 4.5

PERCENTAGES OF INSTITUTIONS REQUIRING
ADMISSIONS EXAMINATIONS THAT INCLUDE MATHEMATICS

	1960-61	1965-66	1970-71
Universities	68%	90%	63%
Public Colleges	55%	80%	35%
Private Colleges	91%	96%	91%

In addition there are placement examinations in mathematics. The ten year trend in the percentages of institutions giving such examinations is exhibited in Table 4.6.

Table 4.6

PERCENTAGES OF INSTITUTIONS USING
PLACEMENT EXAMINATIONS IN MATHEMATICS

	1960-61	1965-66	1970-71
Universities	68%	50%	57%
Public Colleges	59%	50%	68%
Private Colleges	48%	39%	37%

These examinations tend to test the student's knowledge of algebra and trigonometry more than of more advanced material. Their goal is principally to place students in appropriate courses with some special emphasis on finding out which students have the necessary mathematical knowledge to undertake regular college courses. Among those institutions giving placement tests, standardized or nationally distributed examinations were used by 46 percent of universities, 45 percent of public colleges and 48 percent of private colleges.

There are striking counter-trends observable in Table 4.5 and 4.6. From 1960-61 to 1965-66, the admissions to public institutions were increasingly controlled through admission examination requirements and other selective procedures because of the unusually rapid increases in college-age population. In the latter half of the decade these admissions restrictions seems to have been moderated, perhaps because of the diversion of many potential candidates to junior colleges and because more adequate physical plant had been built in the meantime. But while the admission requirements were being increased in the early nineteen-sixties, the necessity for placement testing after admission decreased. More recently, as admissions examinations have been eased (and in some instances essentially abolished under "open

admissions" policies), the necessity for testing for purposes of placement again increased. It is noteworthy that neither of these apparently-related trends occurred to any great extent in private colleges, perhaps because they have always been committed to selective admissions in some form.

Related to this subject are programs of advanced standing (advanced placement) in mathematics, in which an entering student, on the basis of high school record or examination, may enroll in courses more advanced than usual for an entering freshman and/or receive college credits for advanced work in high school. Options of this type open to the student over a ten year period are presented in Table 4.7. The variety of existing arrangements of this general nature must be quite large and some exercise of judgment must have been necessary on the part of many of our respondents to determine whether the arrangements constituted an advanced standing program as defined above. The reported data indicate that such programs existed by 1970-71 in almost all universities and private colleges and in about three-fourths of public colleges. The big increase in advanced standing programs occurred between 1960-61 and 1965-66 in public and private colleges and, apparently, even earlier in universities. The most interesting message of Table 4.7 seems to be a great increase between 1965-66 and 1970-71 in the percentage of institutions willing to recognize advanced standing by the award of college credit. Among universities having advanced standing programs, the percentage willing to give credit for advanced standing in calculus increased from 44 percent to 95 percent over this five year period. Similar increases were reported for college algebra-trigonometry in public and private colleges. (The blanks in this table, and the next, indicate that the corresponding question was not asked before 1970-71.)

Curricular Innovations in Undergraduate Programs

Table 4.8 gives the incidence of specified types of curricular innovations between 1960 and 1965 and between 1965 and 1970. The relatively high figures in this table seem to show that courses and programs evolved continously from 1960 to 1970. By comparing percentages for different types of institutions one can observe that strong interest in courses for biological and social sciences began in the first half of the decade in universities but really got going only in the second half of the decade in colleges. It also seems to be true that the intensity of interest in curricular

Table 4.7

ADVANCED STANDING PROGRAMS

	Universities			Public Colleges			Private Colleges		
	1960-61	1965-66	1970-71	1960-61	1965-66	1970-71	1960-61	1965-66	1970-71
Percentages of Institutions Having Programs of Advanced Standing (Advanced Placement)	95%	95%	95%	53%	82%	73%	63%	92%	96%
Percentages of Institutions Having Such Programs In Which Credit Can be Entered on Student's Record for									
(a) College Algebra and/or Trigonometry	40%	30%	34%	34%	31%	99%	29%	20%	95%
(b) Analytic Geometry	35%	34%	29%	28%	19%	22%	27%	20%	4%
(c) Calculus	46%	44%	95%	12%	19%	62%	20%	25%	68%
(d) Courses above Calculus	—	—	53%	—	—	16%	—	—	7%

Table 4.8

PERCENTAGES OF MATHEMATICS DEPARTMENTS REPORTING GIVEN TYPES OF INNOVATIONS IN UNDERGRADUATE PROGRAMS IN TWO FIVE-YEAR PERIODS

	Universities		Public Colleges		Private Colleges	
	1960-65	1965-70	1960-65	1965-70	1960-65	1965-70
1. Have introduced new degree programs	31%	42%	32%	41%	20%	30%
2. Have provided new courses appropriate for the biological and medical sciences	27%	28%	18%	42%	12%	34%
3. Have provided new courses appropriate for the social and management sciences	59%	53%	28%	54%	27%	51%
4. Have provided new courses appropriate for the physical sciences and engineering	68%	32%	33%	38%	30%	30%
5. Have provided new courses appropriate for computing and data processing	64%	54%	50%	59%	27%	36%
6. Have provided new courses or tutorial work to meet broadened admissions policies	—	28%	—	36%	—	36%
7. Have significantly altered the program for freshman year	56%	41%	59%	49%	58%	55%
8. Have introduced or substantially altered a program for the undergraduate preparation of secondary school teachers of mathematics	46%	35%	56%	48%	38%	36%
9. Have introduced or substantially altered a program for the mathematics preparation of elementary school teachers	41%	21%	62%	53%	39%	42%
10. Have introduced other innovations	20%	30%	31%	12%	22%	19%

work in courses for physical scientists and for teachers has declined somewhat in the last five years in universities, while continuing unabated in colleges.

The respondents were asked to give a description of those innovations classified as falling under items 6 through 10. One gets a strong picture of prudent tinkering and adjustment rather than revolutionary change. A substantial number of the respondents indicated they had adopted recommendations of the Committee on the Undergraduate Program in Mathematics [R], or gave a description of some change that was specifically recommended by CUPM. This was especially true with respect to teacher training. The "other" innovations described in item 10 were not startling, being for the most part almost classifiable under one of the earlier headings. Many of the changes reflected a desire to achieve greater variety or flexibility in course offerings. Among the innovations mentioned most frequently were combination of algebra and trigonometry into an elementary functions course, introduction of linear algebra into the standard calculus sequence, offering alternative (and shorter) calculus courses for special groups of students, partial adoption of CUPM courses for elementary school teachers, and the offering or more widespread use of courses in finite mathematics.