UNDERGRADUATE MATHEMATICS TEACHING:
Settings and Staff

by

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CHAPTER I

THE BACKGROUND OF THE STUDY

Professions and skilled occupations ranging from psychiatry to piano tuning are confronted with a common problem in the United States today. In essence, the predicament is one of too few trained practitioners to cope with current and growing demands for goods and services and little prospect for immediate, substantial increases in the numbers of trained individuals in such fields.

Shortages of teaching, medical, engineering, and other personnel have been receiving much attention in the mass media and in the deliberations of professional societies. Not always recognized in these discussions is the fact that the numbers embarking on careers in these fields in recent years have been limited by the low birthrate of the 1920's and 1930's, and that professions and skilled occupations have been competing keenly for the services of relatively small numbers of workers. While in most professions and skilled occupations today the feeling is that adequate numbers of trained and experienced members are lacking, there is little realization that this sentiment is shared with so many others.

The "overabundance" of consumers, students, patients or clients, as the case may be, is the other side of the coin. These surpluses of consumers result from increases in the over-all numbers seeking goods or services, or in a greater demand from some subgroup of consumers or for certain services. Many of the difficulties of elementary and secondary education are attributable to the first of these developments; much of the difficulty in higher education stems from a combination thereof.

In colleges and universities, the problems occasioned by increasing enrollments vary from subject to subject. Such traditional pillars of higher education as Latin, Greek and philosophy have had, at best, modest increases in students; the sciences and mathematics, on the other hand, with the impetus given by the launching of Sputnik, are faced with greatly augmented numbers of undergraduate students and indications that these increases will continue.

Expanded enrollments in mathematics have resulted both from greater numbers electing to study mathematics in its own right and from increasing numbers of students in other fields which require mathematics as a tool. Such a development would likely not have been predicted as little as a decade ago. Writing in 1952, for instance, two students of the American scientific community and of the education of scientists said:

> The tendency of this science [mathematics] to attract proportionally fewer students in recent years [the period 1881 through 1940] is without question related, first, to the fact that the vocational prospects in mathematics have become greatly inferior to those in the sciences which offer applied fields, especially physics and chemistry, and second, to the overthrow of mathematics as a pillar of the classical curriculum.[1]

Be that as it may, by the beginning of the 1960's spokesmen for academic mathematics and mathematics education summed up the difficulties of their field as being basically a problem in manpower--great increases in student enrollment but little or no increase in the supply of potential teachers, all aggravated by greater attractions outside the academic world for trained mathematicians.[2] To counter this it was proposed to attack the manpower problem with two

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[1] R. H. Knapp and H. B. Goodrich, Origins of American Scientists (Chicago: University of Chicago Press, 1952), p. 16.

[2] Identical problems were being experienced also by relative newcomer-fields to college campuses. Writing in 1963, the anthropologist David Mandelbaum reported: "The principal problems of teaching [anthropology] rise from the success of anthropology in recent decades... vast increases in publication, an intense development of special fields, coupled with problems of an unusually high rate of increase in enrollments, of the relatively small size of the profession, and frequent requests for anthropologists to assist with projects other than their own teaching and research." "The Transmission of Anthropological Culture," in The Teaching of Anthropology, David G. Mandelbaum, Gabriel W. Lasker, Ethel M. Albert, eds., Memoir 94 (American Anthropological Association, 1963), p. 1.

weapons--increased productivity of Ph.D.'s in mathematics and increased efficiency and effectiveness of college mathematics teachers in the classroom. Fundamental to action on both fronts was information regarding the conditions and atmosphere in which college mathematics is taught and regarding the characteristics of those teaching it.

From the 1957 report of the Albert Committee[3] there were data on the teaching atmosphere for mathematics in doctorate-producing schools in America. But systematic information on these topics from smaller universities and colleges was lacking. Accordingly, in 1961, the Mathematical Association of America, through its Committee on the Undergraduate Program in Mathematics, asked the National Opinion Research Center of the University of Chicago (NORC) to make a study of mathematical environments and mathematics staffs in undergraduate institutions as a preliminary to action on the problem. The findings from that research are described in Chapters II and III.

Before proceeding, however, it is necessary to say a few words about the schools which NORC studied.[4]

In the sample of 135 baccalaureate-granting schools, drawn by NORC in 1961 and on which this research is based, not quite one school in ten (eight per cent) had awarded a Ph.D. in mathematics or statistics in the period 1948-1959. The remaining nine out of ten had granted none in that period; these "non-granters" constitute the primary focus of this study. Compared to the doctorate-granting schools they were more apt to be under private than public control,

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[3]<u>A Survey of Research Potential and Training in the Mathematical Sciences, Final Report of the Committee on the Survey. Part I, Organization and Data</u> (Chicago: University of Chicago, March 15, 1957); <u>Part II, Recommendations and Subcommitee Reports</u> (Chicago: University of Chicago, June 15, 1957).

[4]Detailed descriptions of the sample and the methodology of the study are contained in Appendix D.

and when private, more likely to have relatively low than relatively high tuition. The great majority of non-doctorate-granting schools had relatively small enrollments as measured by their 1959 graduating classes. They were more likely than the others to be in the Northeastern or South and South Central regions of the country and less likely to be located in the North Central or the West. One non-doctorate-granter in eight had no Arts and Science program but was a technical school or school of education or business. The overwhelming majority of schools in the sample were accredited by a regional accrediting board or professional society; unaccredited schools were found only among the non-doctorate-granters. More precise details are presented in Table I-1.

TABLE I-1

CHARACTERISTICS OF SCHOOLS IN SAMPLE

Characteristic	Percentage		
	All schools	Ph.D. in mathematics or statistics, 1948-59: None granted	Ph.D. in mathematics or statistics, 1948-59: One or more granted
Private control	65	67	48
Public control	35	33	52
Relatively low tuition (less than $900) . .	46	50	6
Relatively high tuition ($900 or more) . .	19	17	42
Public control	35	33	52
Small 1959 graduating class (less than 500)	84	91	8
Medium 1959 graduating class (500-1,499) .	12	9	49
Large 1959 graduating class (1,500 or more)	4	*	43
Northeast geographic region (incl. Del., Md.)	33	34	28
North Central region	34	33	40
South, South Central region	24	24	16
Western geographic region (incl. Hawaii) .	9	9	16
Arts and Science program	89	88	100
No Arts and Science program	11	12	-
Accredited school	96	96	100
Unaccredited school	4	4	-
Unweighted number of schools[a] . . .	(135)	(89)	(46)

[a]These percentages are based on the weighted distributions but the N's given are unweighted.

*Less than one-half of one per cent.

In tables presented in the text and in the appendices many comparisons are made between schools of different types and between mathematics faculty members of various kinds. Given the nature and size of the sample of schools fairly large percentage differences between subgroups are necessary for the differences to be statistically significant. In comparisons between publicly- and privately-controlled non-doctorate-granting schools, for example, differences of about 27 per cent are necessary for significance at the five per cent level. In comparisons between faculty members at the several academic ranks differences in the neighborhood of 15 per cent are required. These statements of statistical reliability are based on the most conservative comparisons, with the observed distribution of response on a question of 50-50. When the distribution is other than 50-50, a smaller difference is required for significance at the five per cent level.

In some tables statistics are presented for subgroups with very small numbers of cases. These statistics are included for the sake of completeness but should be viewed with caution since they are subject to considerable sampling error.

CHAPTER II

MATHEMATICAL ENVIRONMENTS IN SMALLER UNIVERSITIES AND COLLEGES

The Place of Mathematics in Schools

In the decade of the 1960's mathematics occupies a prominent position and plays a major role in American institutions of higher education. For the 1961-62 academic year virtually all smaller universities and colleges with a four-year baccalaureate program offered some undergraduate-level work in mathematics. While a few schools had no real program or sequence of courses in the subject, an overwhelming majority offered a major in mathematics, in mathematics education, or in education with mathematics as the teaching field.

TABLE II-1

MATHEMATICS OFFERINGS IN SCHOOLS NOT GRANTING DOCTORATE IN MATHEMATICS

Depth of mathematics program	Percentage		
	Total schools	Public schools	Private schools
Some undergraduate mathematics courses	98	100	97
Sequence of courses or program in mathematics	94	100	91
Major program(s) in mathematics . . .	90	94	88
Unweighted number of schools	(89)	(37)	(52)

In addition to being a mainstay of undergraduate curricula, mathematics was employed often as a screening mechanism for applicants to a school's Arts and Sciences or Liberal Arts and Sciences program. About three schools in four of those with Arts and Sciences programs required work in high school mathematics or an examination in mathematics of those applying for admission as freshmen to these programs. Privately-controlled schools which could be somewhat more selective in their admission policies were more likely than public schools to have a requirement of this sort (Q. 1, Appendix A).

Mathematical aptitude or achievement was more apt to be utilized in screening for admission than to be considered an essential part of a liberal arts education, however, for only a fifth of the non-Ph.D. granting schools required all students earning an Arts and Sciences bachelor's degree to take some college-level mathematics work (Q. 2, Appendix A).

Considering in conjunction these two stages in the undergraduate career of an Arts and Sciences student, similar proportions of schools--between one-fifth and one-fourth--had no mathematics requirement at either stage as had a mathematics requirement for all students at both stages. Every second school with an Arts and Sciences program required mathematics for admission to, or for all graduates from, that program, but not both.

TABLE II-2

MATHEMATICS REQUIREMENTS FOR ADMISSION TO AND GRADUATION FROM ARTS AND SCIENCES PROGRAMS

Arts and Sciences Requirement	Total Schools
No mathematics requirement for all students at either stage	24%
Requirement for admission or for all students for graduation	57
Mathematics requirement for admission and for all students for graduation.	19
Total	100%
Unweighted number of schools with Arts and Sciences programs . .	(80)

Schools using mathematics as a selection device for an Arts and Science program but not requiring college-level mathematics work of all in that program, more frequently than others considered aptitude or achievement in mathematics as the student started on his undergraduate work. About one school in two "placed" entrants to the Arts and Sciences program through an examination in mathematics, but six in ten of the schools with just an admission requirement in mathematics did so. Similarly, approximately three schools in four reported a program of "advanced placement" in college mathematics; among schools with only an admission requirement, however, the proportion was nine out of ten.

TABLE II-3

SPECIAL USES OF MATHEMATICS IN SCHOOLS IN RELATION TO ARTS AND SCIENCES PROGRAM REQUIREMENTS

Special uses	Percentage			
	Mathematics requirements in Arts and Sciences programs			
	None at all	Only admission requirement	Graduation requirement for all	No Arts and Sciences program
Mathematics placement examination for entrants to Arts and Sciences program . . .	40	61	42	-
"Advanced placement" program in mathematics	64	92	61	-
Unweighted number of schools	(21)	(41)	(18)	(9)

In most non-Ph.D. granting schools in 1961-62, responsibility for undergraduate mathematics instruction was charged to an independent mathematics department or division with mathematics being part of joint or combined department or a program in another host department only about one time in four. Independent status meant, of course, that mathematics enjoyed equal footing with other subjects in a school and not that it was autonomous. At crucial points, the choice of a departmental chairman or adoption of a basic change in program, for example, the "say" of the central administration predominated over that of the mathematics staff (Q. 7D., 46A., Appendix A).

> In sum, a large majority of American colleges and small universities provided no doctoral level training in mathematics or statistics, but nearly all offered undergraduate level instruction in the subject. Many schools, too, selected and "placed" students on the basis of their mathematical know-how and considered some training in mathematics an essential of a liberal arts education. To accomplish these purposes, mathematics instruction more often than not was the responsibility of an independent department or division in the institution.

<u>The Place of Teaching and Research in Schools</u>

In these schools which, in the early 1960's, concentrated on undergraduate students in mathematics and offered little or no work at the graduate level, there was a good "fit," by and large, between the qualities required in the faculty member's job and the qualities the school rewarded. Most staff members, when in residence, were engaged primarily in teaching; other types of professional work tended to be secondary in importance or reserved for off-hours.

Teaching ability first and research ability and amount of publication lowest was the order in which departmental spokesmen thought their administrations rated the three (Q. 14B., Appendix A). With eight departmental spokesmen in ten reporting their administrations rating teaching ability "first," and more than half saying that their school rated research ability and amount of publication low, the contrast in atmosphere with institutions having graduate programs was marked.

Intermediate in importance were personal characteristics such as race, religion, or sex and administrative ability. Privately-controlled schools whose "ideal" faculty member was often of a particular religion or sex were inclined to rank "personal characteristics" slightly higher than public schools were. In schools with "small" mathematics faculties a teacher's academic degrees were reported to rank second in importance only to teaching ability when it was a question of his promotion. Schools with "large" mathematics faculties, on the other hand, tended to handle the question of academic degrees at the recruiting stage or to have explicit requirements for degrees necessary for appointment or promotion to the various ranks.

> Teaching ability was felt to rank highest with school administrations and research ability and amount of publication low in most colleges and smaller universities. Other qualities and characteristics were reported intermediate in importance. Publicly- and privately-controlled institutions ranked these considerations similarly.

Working Conditions

Hours of work, leave time or vacation, promotion possibilities, salary and retirement are important aspects of academic work, just as in non-academic work, although they take somewhat different forms in the two settings.

These aspects of the work of faculty members in academic institutions which stressed teaching and put a premium on teaching ability are described in the following pages.

Weekly Teaching Load

The weekly teaching load in these colleges and smaller universities reflects the fact that teaching was the primary assignment for most faculty members, with much of the week spent either in the classroom or in preparation for classes, and little time on the job spent in other activities (Q. 7 A, Appendix A.). Compared to those in the sciences at some leading universities today,[1] faculty at

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[1] In The Effects of Federal Programs on Higher Education, A Study of 36 Universities and Colleges (Washington: Brookings Institution, 1962), Dr. Harold Orlans reported a mean teaching load of six classroom hours per week in the sciences at 12 leading universities.

smaller schools even at the rank of professor averaged about twice as many hours per week in the classroom.

TABLE II-4

MEDIAN TEACHING LOAD PER WEEK, TO NEAREST QUARTER HOUR

Rank of faculty member	Total schools	Public schools	Private schools
Full professor	13-1/2	15	12-3/4
Associate professor	14-1/4	15-1/4	13
Assistant professor	14-1/4	15-1/4	13-1/4
Instructor	14-1/2	15-1/4	13-1/2

At every rank the weekly teaching load in privately-controlled schools was at least two hours lighter than that in publicly-controlled schools; the private school mathematics teacher of instructor rank, in fact, averaged fewer teaching hours than the full professor in public schools.

Teaching load varied not only with academic rank and type of control of schools but also with the number of students to be taught mathematics, with over-all school policy on the addition of non-teaching duties to teaching assignments, and ultimately, the prestige these duties enjoyed at the school. Using the full professor's teaching load as a measure, it averaged less when the school had just a mathematics admission requirement for the Arts and Sciences program than when there was a mathematics requirement for graduation in the Arts and Sciences program (and thus the likelihood of greater enrollments in mathematics) or no requirement at either stage of the student career.

Such non-teaching duties as administrative work, student advising, committee work, research projects with outside financing, and consultation work off-campus are often added to a faculty member's teaching assignment. Only in the case of the first of these was teaching load "usually lightened" by a majority of schools. For the four other types of added assignment lightened teaching load was a rarity, occurring most frequently, though, with outside-financed research projects. And only in this type of added assignment were there any differences between the practices of publicly-controlled and privately-controlled institutions--schools of the latter type being somewhat more prone than others to lighten the weekly teaching load (Q 7 B, Appendix A.).

Although schools generally tended to cut a faculty member's classroom hours when assigning him administrative duties, the higher the school regarded "administrative ability" the more likely it was to lighten teaching load when administrative work was assigned a faculty member. Three schools out of four ranking "administrative ability" third or higher as a consideration in promotion usually lightened teaching load when administrative duties were added; two out of three of those rating "administrative ability" lower usually did so. Similarly, the higher "research ability" was thought to be ranked by the school over-all, the more likely it was that teaching load would be lightened when a faculty member took on outside-financed research in addition to his teaching.

Leave Policies and Practices

Classroom hours constitute one piece in the picture of academic work and leave policies and practices constitute another. Although a sabbatical leave system is often thought to be synonymous with college and university teaching, leave-with-pay arrangements were not universal among schools having no doctoral program in mathematics. And even among schools which had leave systems it was not always possible for faculty members to take the leave to which they were entitled. Nonetheless, mathematics department spokesmen endorsed the principle that leaves are beneficial. Most frequently mentioned as a benefit of taking leave were the opportunity for the faculty member to continue or complete his formal education and the chance to pursue his own special interests unhampered for a period of time. The first of these was suggested most commonly by speakers for publicly-controlled schools who emphasized the desirability of continuing education in a number of instances; the second was mentioned most prominently by private school spokesmen (Q. 5, Appendix A.).

Sabbatical Leave.--In the 1961-62 academic year some six schools in ten had a regular sabbatical or other leave-with-pay system, publicly-controlled schools being slightly more likely than private ones to have these formal leave arrangements. Three different pay arrangements were reported for those on sabbatical--a set fraction, usually one-half, of annual salary; full salary minus the pay of a substitute teacher; or flat payment regardless of usual salary--with full pay for one-half year off or half pay for a full year off being the most frequent arrangement, regardless of type of school. Two bases for eligibility for leave-with-pay predominated: for four out of ten schools eligibility was determined solely by the number of years a faculty member had served, while for three out of ten eligibility depended on academic rank and years of service in combination. For at least one-half of the publicly-controlled schools with a sabbatical system opportunity for leave-with-pay was virtually a certainty if a teacher just remained on staff long enough (Q. 3, 3 A, 3 B, Appendix A.).

While a majority of colleges and smaller universities had sabbatical systems, over a three-year period mathematics staff members had been on sabbatical leave at less than a third of them. In most cases some faculty member had been eligible for a sabbatical but did not take leave. The most frequent single reason given for this failure was that staff shortages existed already and that, by implication, it was impossible to find a substitute for the teacher eligible for leave (Q. 3 C 1, 3 C 2, Appendix A.).

The sabbatical, it appears, was far from being typical in academic work in mathematics. Only one mathematics faculty in six had a member on leave during the three academic years from fall, 1959, on.

Leave-without-pay.--Leave-without-pay, permitting the faculty member to continue his studies, do research, or take a temporary job elsewhere but still retain his staff position, was possible in most schools and in all under public control. Over a three-year period mathematics staff members from about one-third of the institutions having this type of leave had been on leave (Q. 4, 4 A, Appendix A.). Leave-without-pay was utilized somewhat more than leave-with-pay because it was somewhat easier to find a substitute for the individual going on leave, since funds to pay the substitute teacher would be available.

Leave for professional meetings.--A school policy permitting time off to attend out-of-town professional meetings, either as a school representative or as an individual faculty member, was about as common as a policy permitting leave-without-pay. All publicly-controlled and nine out of ten private schools encouraged meeting attendance by permitting paid time off for such purposes. Many colleges and universities, in addition, paid some of the expenses of some types of faculty attending meetings; when a staff member was acting as school representative, was a society officer, or was presenting a paper, some or all of his expenses were likely to be reimbursed. Many schools also paid some or all of the expenses of each faculty member for at least one out-of-town professional meeting each year (Q. 6, Appendix A.).

Mathematics Faculty Salaries

In the 1961-62 academic year average (median) salaries of mathematics teachers in schools which had no doctoral program ranged from about $9,300 for the maximum at the full professor rank to about

$5,600 for the minimum at the assistant professor rank. These were salaries for the nine-ten month academic year and exclude any reimbursement for summer work; since nine out of ten schools placed no restriction on a faculty member's summer activities, there was opportunity for him to increase his income through off-season work.

More often than not the salaries reported did <u>not</u> cover "off-campus" teaching, evening courses, and the like; when a faculty member took on these responsibilities, he was compensated for the increased work (Q. 10, 10 B, 11, Appendix A.). Finally, the salaries reported usually exclude such fringe benefits as a school's contribution to the faculty member's pension, insurance, etc. In some cases this was a substantial amount.

TABLE II-5

MEDIAN SALARIES OF COLLEGE MATHEMATICS TEACHERS PER NINE-TEN MONTH ACADEMIC YEAR, 1961-62

Rank of faculty member		Total schools	Public schools	Private schools
Full professor:	Maximum . .	$9,323	$10,062	$8,638
	Minimum . .	7,605	8,007	7,407
Associate professor:	Maximum . .	8,356	8,533	8,256
	Minimum . .	6,614	6,886	6,478
Assistant professor:	Maximum . .	7,159	7,503	6,884
	Minimum . .	5,591	5,692	5,509

At all three ranks and for the maximum and minimum salary for each, average salary in publicly-controlled schools was higher than in privately-controlled schools. The differential in reported salaries in 1961-62 ranged from about $1,400 for the maximum of the full professor to about $200 for the assistant professor, minimum. Two points should be borne in mind in connection with Table II-5: first, in a number of cases, private school spokesmen reported "no limit" on maximum salary for a rank and second, the weekly teaching load in publicly-controlled schools was heavier than that of private schools.

Tenure, Promotion, and Retirement Policies

Tenure.--Some form of academic tenure--whether mere verbal understanding between teacher and central administration or backed by firm guarantees--existed in almost all colleges and smaller universities in the early 1960's. Some of the schools which had no tenure system needed none, for their faculties were made up entirely of members of religious orders. Tenure status tended to be based either on academic rank in combination with years of service or on service alone; these two were the bases for academic tenure in about three-fourths of the schools which had such safeguards. The most common basis for tenure in publicly-controlled schools was simply years of service while a combination of rank and years of service was most common in private schools (Q. 8, Appendix A.). As in eligibility for sabbatical, in theory at least, some public school faculty members could attain tenure status simply by sitting tight.

Promotion policies.--The "up or out" personnel practice of many larger institutions was rare among colleges and smaller universities. Only three schools in ten of those which had both an academic rank system and lay faculty members put any limits on the number of years which could be spent at a rank. Privately-controlled schools, though, were twice as likely as public to have such limitations (Q. 15, Appendix A.).

Among schools which did put a formal limit on the length of time at some rank, all limited the years at the instructor level, two-thirds the time as an assistant professor, and one-fifth the length of appointment at the associate professor level.

In the view of the great majority of department spokesmen speaking of the department, teaching ability was of first importance and research ability and amount of publication of much less importance when promotion in rank was the concern (Q. 14, Appendix A.). Whether teaching ability actually did weigh so heavily when it came to actual cases of promotion cannot be known, of course. What is important is that most departmental respondents felt that the department and the school as a whole considered it of prime importance.

Retirement.--While most schools had either a compulsory retirement age or specified an age at which tenure was terminated, this was often set so high as not to work real hardship on either the teacher or the department. And in many institutions, after retirement, a faculty member continued to teach under the terms of a year-to-year contract. This, in fact, was the case with at least one departmental spokesman.

In the 1961-62 academic year six schools in seven specified a retirement age; there were no significant differences between publicly- and privately-controlled schools in the proportions doing so, but private schools, on the average, made retirement compulsory at an earlier age than publicly-controlled schools did (Q. 9, Appendix A.).

TABLE II-6

COMPULSORY RETIREMENT AGE REPORTED FOR FACULTY MEMBERS

Retirement age	Percentage distribution		
	Total schools	Public schools	Private schools
Age 65	74	57	84
Age 66	-	-	-
Age 67	3	1	5
Age 68	2	4	1
Age 69	-	-	-
Age 70 or over .	21	38	10
Total . .	100	100	100
Unweighted number of schools reporting retirement age . .	(82)	(36)	(46)

The compulsory retirement ages at these institutions are quite similar to those reported by Greenough and King[2] from a study of more than 800 colleges and universities across the country. They found that three per cent of the schools required retirement before the age of 65, 68 per cent at the age of 65, and 19 per cent not until 70 or older.

> In 1961-62 classroom teaching load in schools having no doctoral program in mathematics averaged 13 to 14 hours per week and at each academic rank was heavier in public than in privately-controlled schools. On the other hand, public schools were more apt to have various systems for faculty leave and to have slightly higher salary scales. A preponderant majority of institutions had some form of "academic tenure," and most had a compulsory retirement age for faculty members, but only a minority put a formal limit on the number of years which could be spent at the various academic ranks.

Resources and Facilities for Mathematics Instruction

Since earlier days in American education when all that was needed was a log with Mark Hopkins on one end and a student on the other, both resources available for education and the facilities needed have multiplied. For college mathematics today these range from office and work space to electronic computers, from monographs in mathematics to audiovisual aids, teaching assistants, and clerical personnel.

Work Space for Teachers and Students

Office and working space for faculty members and study facilities for undergraduates, it goes without saying, are essentials at any school. But the facilities provided faculties and students may be conducive to scholarly work or they may be so lacking in

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[2] William C. Greenough and Francis P. King, Retirement and Insurance Plans in American Colleges (New York: Columbia University Press, 1959).

privacy and so noisy and crowded as to inhibit it seriously. Schools as a whole, in the view of departmental spokesmen, tended to stack up better in terms of the facilities they provided faculty members than with respect to those for undergraduate students. One school in three in the early 1960's was thought "better" than comparable schools judged on the basis of the adequacy of work space for mathematics teachers, while only about one-half this number was felt to be "better," considering the space furnished undergraduate mathematics students (Q. 37 A, Appendix A.).

More spokesmen from publicly-controlled institutions than from private ones judged their schools to be comparatively poor, taking into account the adequacy of work space for faculty. Since mathematics teaching staffs in public schools were larger, on the average, departmental spokesmen, in all likelihood, were simply reporting a fact of academic life. Pressing as the space problem appeared, there are indications that it was to become more serious in publicly-controlled schools, for almost all of them expected such an increase in mathematics enrollments in the near future as to necessitate enlarged teaching staffs. Among privately-controlled schools, on the other hand, the present and the outlook for the future were not quite so gloomy as far as work space was concerned.

Mathematics' Tools

In teaching and in the research activities of staff and students a variety of tools ranging from the traditional, the library, to the most modern, electronic computers, was employed.[3] The first, of course, is an integral part of any academic institution; the second, although a relatively recent development, has begun to be used by a number of departments which have no graduate work in mathematics.

[3] See Appendix C for an extended description of library facilities for, and collections in, mathematics and electronic computing equipment both in doctoral-granting schools and those with no doctoral program in mathematics.

Library Collections in Mathematics

Most schools, taking into account their library materials in mathematics, were judged to be at least as good as comparable institutions. One in three, in fact, was felt by its mathematics department spokesman to be "better" than others, and only one in eight, "not quite so good." From the standpoint of their library materials more public schools than private ones were thought to compare favorably with other institutions (Q. 37 A, Appendix A.).

These assessments of schools in terms of their library collections were borne out by data on the collections themselves. Average mathematics holdings of publicly-controlled school libraries (as indicated in Appendix C.) measured by certain books, monographs, and periodicals, were larger than those of privately-controlled institutions. Similarly, measured by this same yardstick, schools thought to be "better" than others on the basis of library materials did have more of the selected mathematics materials than schools judged "about the same." These, in turn, tended to have larger collections than schools felt to be "not quite so good," although the actual number of schools in this latter group is small and statistics based on it rather unreliable, consequently.

TABLE II-7

MEAN NUMBER OF SELECTED BOOKS, MONOGRAPHS, PERIODICALS AND SERIALS IN LIBRARY MATHEMATICS COLLECTIONS

Mathematics materials	Total schools	Based on library collections in mathematics, school was judged...			
		Better than most	About the same	Not quite so good	No answer or no mathematics
21 selected books . . .	9.5	12.7	8.7	[7.3]	
13 Carus Monographs .	4.6	6.8	3.8	[3.8]	
17 selected periodicals and serials .	4.6	6.4	3.9	[4.1]	
Unweighted number of schools . .	(89)	(34)	(39)	(12)	(4)

Electronic Computing Equipment and Its Use

No mathematician or mathematics teacher would question the importance of a library to his work; the importance of such modern hardware as the electronic computer is, however, more debatable. While one department spokesman in two reported the opinion that electronic computing equipment was "very" or "fairly important" with respect to the research interests of the mathematics staff, the other half felt such equipment "not really important at all." Similar proportions of spokesmen for public and private schools thought computers unimportant to their staff's research, but those from publicly-controlled schools were twice as likely as others to judge them "very important" (Q. 41, Appendix A.).

In late 1961 every third institution, though having no doctoral program in mathematics, either had computing equipment on-campus or had access off-campus to that of some other agency or academic institution. Publicly-controlled schools which tended generally to have more in the way of tangible equipment than private schools were twice as likely as private schools to have their own computers and half as likely simply to have access to the equipment of others. Among schools which had neither an on-campus computer nor access to any, about one-sixth reported plans under way to remedy this (Q. 40 A, Appendix A.). Having a computer on-campus was related not only to type of control of the institution but also to the importance attributed to computing equipment. The more important computers were felt to be to staff research and work the more likely schools were to have one on-campus.

TABLE II-8

ACCESSIBILITY OF ELECTRONIC COMPUTING EQUIPMENT IN RELATION TO IMPORTANCE ATTRIBUTED TO ACCESSIBILITY FOR MATHEMATICS STAFF

Accessibility of electronic computing equipment	Percentage distribution			
	Importance of access to electronic computing equipment from standpoint of mathematics staff research interests			
	Very important	Fairly important	Not really important	Inapplicable
School had computer on-campus	31	22	4	
School had no on-campus computer but had access to computer off-campus.	25	23	23	
School had neither computer on-campus nor access to one off-campus	44	48	71	
School had no on-campus computer but indeterminate whether access to computer off-campus . .	-	7	2	
Total	100	100	100	
Unweighted number of schools	(21)	(22)	(43)	(3)

Digital or analogue computing equipment had been used sometime by mathematics staff members from one school in every two, publicly-controlled departments being more likely to have "users" known to the department head than private institutions. The use of computers in the year or two preceding the study by faculties from schools of the two types did not differ greatly, but a sizeable number of the public schools reported their staff use of computers to have taken place several years or more previously (Q. 39 A, 39 B, Appendix A.). Staff use of computers as reported by the department spokesman was consistent with his estimate of their importance to the work of that staff; three-quarters of the departments in which computers were judged to be "very important" compared to one-third of those with computers thought "not really important" had had a staff member making use of them at some time or other.

TABLE II-9

USE OF ELECTRONIC COMPUTING EQUIPMENT IN RELATION TO IMPORTANCE ATTRIBUTED TO ACCESSIBILITY FOR MATHEMATICS STAFF

Mathematics staff use of electronic computing equipment	Percentage distribution			
	Importance of access to electronic computing equipment from standpoint of mathematics staff research interests			
	Very important	Fairly important	Not really important	Inapplicable
No computer used	25	46	62	
On-campus computer used recently	16	14	2	
Off-campus computer used recently	33	27	21	
Computer used recently but location indeterminate	3	3	-	
Computer used but not recently	23	10	15	
Total	100	100	100	
Unweighted number of schools . . .	(21)	(22)	(43)	(3)

From the late 1950's on, when computers became more common on campuses, course work relevant to them or electronic data processing had been introduced into the curricula by one-third of the institutions with "large" mathematics departments but no doctoral programs. Publicly-controlled schools were somewhat more likely than private ones to have done so (Q. 45 A, Appendix A.).

Common sense would suggest that courses should be introduced where there was equipment available, and this was the case. Departments in schools which had on-campus computing equipment were about six times as likely to have introduced course work relevant to electronic equipment as were departments having none.

Not all department spokesmen in the 1961-62 academic year felt that their curriculum was set as far as course work relating to computers and electronic equipment was concerned. About one in seven, in fact, suggested that he would like to expand his department's offering in this area either by initiating courses or enlarging those already given. While an on-campus computer had been an important factor in the introduction of course work prior to 1961-62, it was less important for subsequent plans given the increasing availability of electronic equipment off-campus. The proportions of department heads favoring additional work relevant to computers were similar in schools having on-campus computers and in those which had none of their own (Q. 23 B, Appendix A.).

Departmental heads were not alone in advocating the expansion of work in these areas for at least one teacher in four from departments where this had been suggested by the spokesmen themselves specified the field of computer work as one in which they would like to see enlarged course offerings.

Auxiliary Personnel in Mathematics Departments

Clerical help to handle routine department work and semi-professional assistance from mathematics students which release the teacher from some of the "scut work" and permit him to concentrate on the professional phase of his job represent other resources for academic work.

In the early 1960's a majority of schools were felt to be as good as or better than others considering the clerical help available to the mathematics staff for routine non-mathematical work. More private schools than public were judged to be "not so good" from this standpoint, though (Q. 37 A, Appendix A.).

A majority of departments at the same time employed advanced undergraduate or graduate students in mathematics in work which required some mathematical know-how. Most often students worked as paper graders or readers or as teaching assistants. The practices of publicly- and privately-controlled institutions were similar in this except that public schools were more apt to have employed students as teaching assistants. (Actually, many more schools had teaching assistant jobs; they simply had not employed students in this capacity in the year in question.) Most commonly, student help had not been employed because of a lack of funds, secondarily because there was a school policy against it. A small number of schools employing no student help simply felt they had no need of it, however (Q. 30 and Q. 30 D, Appendix A.).

Academic institutions which could release the teacher from some of the mundane work of the department because they had adequate clerical staffs also tended to free him some from the chore work connected with his classes. Practically all schools thought to be "better" on the basis of clerical staff had also employed students in semi-professional capacities and in several different jobs; in contrast, only a third of those judged "not quite so good" with respect to clerical staff had had student help like this, and these in a more limited number of jobs.

Other data suggest that schools which provided the mathematics department with more adequate clerical help tended also to lighten weekly teaching load when other responsibilities were added. Small numbers of cases in the relevant subgroups permit no more conclusive statement, however. Even without this, though, the teacher's obligation in schools thought "better" than others on the basis of clerical staff was lighter than that in other schools. Average teaching load as measured by that of the full professor was one to two hours less per week in schools of the former category than in the latter.

TABLE II-10

EMPLOYMENT OF STUDENT ASSISTANTS IN MATHEMATICS IN RELATION TO OPINION OF CLERICAL AND SECRETARIAL HELP

Employment capacities of student assistants in mathematics	Percentage distribution			
	Based on clerical and secretarial help for routine departmental work in mathematics school was judged:			
	Better than most	About the same	Not quite so good	Inapplicable
Paper graders, paper readers	77	51	26	
Teaching assistants . . .	37	20	5	
Research assistants to faculty members	2	-	-	
Computing clerks	12	-	1	
Miscellaneous: laboratory assistant, drill session help	22	11	12	
No students employed . .	4	38	66	
Total	154	120	110	
Unweighted number of schools . .	(18)	(39)	(28)	(4)

Mathematics department spokesmen, as a group, tended to feel that they were better served in the library materials available to them and in the office and work space for mathematics than in their clerical staffs. Those from public schools thought better of their libraries and clerical staff than of their work space while private school respondents tended to regard their work space more favorably than they did the other two resources, however. Public and private schools did not differ in their employment of students in semi-professional capacities but public schools tended to have more of other tangibles--library materials and computers, for example--and, in fact, put considerable emphasis on the latter.

The Work of Mathematics Departments

Although most of the attention of academic departments in colleges and smaller universities like these is focused on the classroom, much of their work is accomplished outside it. Organizing courses, choosing textbooks, supervising and recruiting instructional staff, assessing teaching methods and techniques, working with individual students are all examples of this.

The Construction of Courses

Most mathematics departments had fairly set procedures which they followed in constructing courses and in dealing with the teaching staff. The rest dealt with these problems too, of course, but in a less formal manner. For a majority of departments the procedure for determining organization and content of undergraduate courses was spelled out quite explicitly, but one school in six employed no single approach--course level, size of enrollment, nature of content--dictating procedure instead. More commonly the job of building courses was the joint responsibility of several individuals--the mathematics staff as a whole or a committee of the faculty if the staff were large--but for one school out of six such responsibility was charged to a single individual. Delegating this responsibility to a single faculty member was more frequent in privately-controlled institutions than in public ones which tended toward group responsibility and group action in this connection (Q. 12 A, Appendix A.).

Similar practices were followed in selecting textbooks for courses as in organizing them. A majority of schools had a set procedure for this, and more often than not responsibility for the choice of reading materials and texts was allotted to a group rather than to a single teacher. One individual, however, was more commonly responsible for selecting books for a course than for working it up, single-handed, the latter being a bigger job, admittedly (Q. 12 B, Appendix A.).

Supervision of Instructional Staffs

Teaching, in American colleges and universities, involves a large element of on-the-job training. Distinct from secondary and elementary school systems, the typical college faculty member has had his graduate work in a particular field but has had little training or experience in educational methods or techniques. This poses problems both for the academic department concerned with the quality of its instruction and for the individual faculty member, novice or not. The problem is a particularly ticklish one in schools such as these which put so much emphasis on teaching and teaching ability.

To deal with this problem a majority of mathematics departments in non-doctoral granting schools had in forme some system designed to ensure the quality of teaching in undergraduate mathematics and to help the teacher become an effective practitioner. The most frequently used techniques were conferences with the individual teacher and discussions of problems at faculty meetings or seminars. Employed also but less often were visits to classes in session and consultations between those teaching different sections of the same course. In general, the practices of public and private schools were similar in this area although publicly-controlled schools, on the average, used more different kinds of supervisory techniques than the others. Twice as many public schools as private ones also tackled the problem of encouraging effective teaching through group discussions of teachers' problems (Q. 13, 13 A, Appendix A.).

The Use of Selected Teaching Techniques

Over the course of the years numerous educational methods and techniques designed to enhance learning and make teaching more efficient have made their appearance in the classroom. More recently, in anticipation of shortages of mathematics teachers, a variety of techniques and devices designed to permit the individual teacher to handle more students at a high level and to delegate the low level aspects of his work have been suggested. Some of these, such as the large lecture session followed by the smaller quiz or help section in the hands of student assistants, are widespread and verge on the commonplace by now; others, for example, teaching machines, scrambled textbooks, and national and local television programs, embody up-to-the-minute developments in the fields of communication, education, and mathematics, and are much more experimental in nature.

By the early 1960's none of a group of techniques (programmed learning, "Continental Classroom," televised programs, films and slides, or lectures with quiz and help sections) had made much headway toward becoming commonly-accepted in mathematics teaching in non-doctoral-granting institutions. This was despite the fact that mathematics staff vacancies already existed bringing with them the need to maximize the number of students that a single faculty member could reach. Only the lecture class followed by "help" sessions and the use of slides and filmed materials had been tried out by any appreciable number of schools, the first in somewhat less than one-half of the total and the second by about one-fourth. Other techniques--"Continental Classroom" courses in mathematics (presented for the first time in 1960-61) and other televised material, various forms of programmed learning, lecture classes with small quiz sections following--had each been used by no more than one school in five. Generally speaking, although these different techniques had not been used extensively, the feeling around the department was that faculty members had found them satisfactory more often than not (Q. 31, Appendix A.).

Schools were not necessarily rejecting these devices and techniques by not trying them. Some, for instance televised programs other than those with national coverage, were not available to schools in all areas of the country; others, like the lecture followed by smaller quiz sections, assumed that large numbers of students were enrolled in particular courses, which was not always the case in smaller schools.

Mathematics Department Programs

By the 1950's and early 1960's the general ferment in the field of mathematics had begun to be felt on the campuses of smaller universities and colleges, and departments and programs were in a state of flux as developments began to be translated into academic reality. In the half decade preceding the 1961-62 academic year, five schools in every six (and almost all publicly-controlled ones) had expanded mathematics course offerings into new areas, while one-third of the "large" mathematics departments had introduced new degree programs. Well over one-half of the schools, in fact, classed developments such as these as their "most recent basic change" (Q. 45 A, 46 B, Appendix A.).

Contemplating the way in which courses in their current program were being taught (and disregarding course organization and content) most department spokesmen expressed general satisfaction. Those who were not entirely satisfied and who specified fields or topics giving them concern (one out of five spokesmen) singled out no one mathematical field as particularly troublesome in this respect. This held true for those from public schools and from private schools as well (Q. 23 A, Appendix A.).

Although most department heads in 1961-62 were satisfied with the courses their department offered from the standpoint of the way courses were taught, a great majority favored expanded offerings or even adding a new degree program. Here again, the six spokesmen in seven wishing to see their department's program enlarged failed to single out any one field as a desirable addition but instead made suggestions ranging across all of mathematics. There was little difference between department spokesmen from public and private schools on this whole question (Q. 23 B, Appendix A.).

Department heads as a group were somewhat more inclined to suggest adding courses in the department than were individual faculty members. Among department spokesmen and faculty members who made suggestions, however, fairly similar changes were proposed. There was also a tendency for teachers from a school and their department head to recommend adding courses in the same areas.

Department heads generally satisfied with the teaching of courses currently offered were as likely as those who were dissatisfied to favor adding courses. They did not make quite as many suggestions for additions, however.

TABLE II-11

SUGGESTIONS FOR CHANGES IN MATHEMATICS DEPARTMENT COURSE OFFERINGS IN RELATION TO SATISFACTION WITH TEACHING OF CURRENT COURSE OFFERINGS

Suggestions for expanding course offerings	Percentage distribution: Extent of satisfaction with teaching of current mathematics course offerings — General satisfaction	Some dissatisfaction
No suggestions for expanding . .	12	18
Suggestions for expanding...		
Algebra	26	23
Geometry	21	6
Analysis	24	26
Probability/statistics	22	30
Computer work	12	28
Set theory, topology	18	28
Courses for students in other fields	9	16
Miscellaneous	19	19
New degree program	10	11
No answer	3	-
Total	176	205
Unweighted number of schools	(65)	(21)

Departments in which the spokesman looked with favor on expanding mathematics course offerings differed from those in which he did not. Only a fourth of the departments in which a broadened program was suggested reported that courses had already been revised, upgraded, or modernized in the department's "most recent basic change." In contrast, almost two-thirds of the spokesmen from schools suggesting no immediate expanded program reported recent basic changes of this nature. The heads of five departments in six of those approving adding courses reported their departments to be contemplating making changes of a general or specific nature. Less than one-half of the department heads in other schools mentioned this possibility. (Because only a small number of schools failed to suggest broadening their programs, only impressions can be derived from them, however) (Q. 46, 47, Appendix A.).

Courses for Students in Other Fields

In the past decade or two mathematics has come to be used increasingly in work in other fields. Formerly of practical importance mainly in engineering and the physical sciences, more and more applications today are being found for mathematics in the fields of business and commerce, the social sciences, and in medicine, to name the more prominent. Some training in mathematics is becoming desirable for students in these disciplines, as a result. Growing enrollment in mathematics courses by students majoring in other fields, in fact, has been a significant element in the over-all increase in enrollment in undergraduate mathematics.

In the early 1960's a majority of smaller universities and colleges offered course work in mathematics especially designed for students majoring in other fields. About one-third had introduced some or all of this work into their curriculum recently, in the five-year period prior to 1961-62. Among schools having an Arts and Sciences program four out of five mathematics faculties had a part in mathematics courses tailor-made for students outside the department.

Schools restricting their curricula to technical subjects, education, business, etc., on the other hand, were somewhat less likely to do so (Q. 32, Appendix A.).

The fields in which specially designed mathematics courses were more prevalent were those in which mathematics and/or mathematical concepts had long played a part. Thus six out of ten departments in schools with Arts and Sciences programs had mathematics courses set up specifically for students in education to prepare them to teach mathematics later; nearly half had course work tailor-made for students in the physical and biological sciences. In contrast, by the 1961-62 academic year only one-fourth of the schools had set up work in mathematics for those in the social sciences--economics, psychology, sociology, and the rest--areas of relatively recent expansion for mathematics and mathematical thinking.

Mathematics departments, because they had the trained personnel, tended to play a larger part in furnishing the instruction for special courses like these than they did in the process of organizing them. Nine times out of ten, in each area, the mathematics staff had sole responsibility for teaching; the rest of the time either the other department participating was responsible for teaching or instruction was a joint obligation. On the other hand, mathematics by itself had sole responsibility for organizing these courses only about half of the time, setting up these courses being a joint endeavor in most of the remaining instances, with the "other" department specifying the end and mathematics, the means to that end (Table II-12).

For the most part the methods by which these joint courses were organized and instruction provided were satisfactory. The dissatisfactions that were expressed by department heads and the remedies that were suggested were varied and quite specific to the situation in each school.

Suggestions that the department program be expanded in the direction of adding courses for students in other disciplines were volunteered almost exclusively by spokesmen from departments which already participated in specially-designed courses. It was almost never suggested when the department took no part in any such courses, although, in fact, the actual number of schools of this kind was small and statistics based on the subgroup somewhat unreliable.

TABLE II-12

DEPARTMENTAL RESPONSIBILITY FOR ORGANIZATION AND CONTENT AND INSTRUCTION IN MATHEMATICS COURSES SPECIFICALLY DESIGNED FOR STUDENTS OUTSIDE MATHEMATICS

Departmental responsibilities	Percentage distribution: Courses specifically designed for students in these fields				
	Bio. sci.-Phy. sci.	Business-Commerce	Education	Engineering	Social science
School did not offer specifically-designed mathematics courses . . .	57	69	41	72	76
School did offer specifically-designed mathematics courses . . .	43	31	59	28	24
Responsibility for organization and content of these specifically-designed courses					
Mathematics responsible	59	55	46	45	57
Other department responsible . .	-	2	7	-	9
Joint responsibility	35	43	22	50	31
Indeterminate responsibility . .	6	-	25	5	3
Responsibility for instruction in these courses					
Mathematics responsible	93	96	88	94	90
Other department responsible . .	-	3	7	1	9
Joint responsibility	7	-	4	5	1
Indeterminate responsibility . .	-	1	1	1	-
Unweighted number of schools with Arts and Sciences program	(80) (37)	(80) (31)	(80) (51)	(80) (30)	(80) (26)

Courses for Students in Education and for Practicing Teachers

Training in mathematics for undergraduates majoring in education and summertime instruction in mathematics for practicing teachers were provided by a majority of colleges and smaller universities. Mathematics departments were actively engaged in this for in six schools out of ten with Arts and Sciences programs the department took part in courses set up especially for education majors. In addition, institutions which restricted their programs to the preparation of teachers (a decreasing number of schools over the years) also offered work in mathematics, but those training only nursery school or kindergarten teachers or preparing religious teachers only might offer little or none.

In the summers of 1960 and 1961 combined, about half of the country's schools, although having no doctoral program in mathematics, offered courses or workshops or institutes in mathematics or mathematics teaching for the continuing education or retraining of elementary or secondary school teachers. About one non-Ph.D.-granting institution in three (but three times as many public schools as private ones) offered work like this in the summer of 1960. By the summer of 1961 close to half had these programs, and the disparity between publicly- and privately-controlled schools was lessened some. Programs under the sponsorship of the National Science Foundation in the summer of 1960 accounted for about one-half of those. From 1960 to 1961, however, there was an increase in the number of schools with summer programs for practicing teachers, and an increase in the number of programs presented, but a decrease in the proportion financed by the N.S.F. In 1961 school sponsorship was the basis for almost two out of three programs, N.S.F. sponsorship accounting for slightly more than one out of three (Q. 44 A, 44 B, Appendix A.).

In late 1961, almost a year after publication by the Mathematical Association of America of a set of recommendations for the training of teachers of mathematics, most department spokesmen were aware that the recommendations had been published but one-tenth did not know about them. When mathematics faculties were familiar with them, more often than not they had reacted or acted favorably on them—in about three-fourths of the cases in publicly-controlled schools and in about one-half of the private schools. About one time in six, however, the reaction was unfavorable or the recommendations were thought irrelevant or inapplicable to a particular situation (Q. 43, Appendix A.).

In schools in which the mathematics staffs participated formally in courses for students in education the department was more likely to have paid some attention to practicing mathematics teachers and to be more alert to problems and programs in mathematics education, than were departments in other schools. In the five years preceding 1961-62, three to four times as many schools with special courses for education students as without had introduced or revised mathematics materials for elementary or secondary teachers in their programs. Similarly, at least three times as many schools with special course work as without had had summer institutes, courses, or workshops in 1960 and 1961, for practicing teachers. And finally, the M.A.A. recommendations on teacher training were more apt to be familiar to faculties already taking part in programs for education majors and they were, in turn, more likely to have reacted to them favorably.

TABLE II-13

MATHEMATICS FACULTY REACTION TO M.A.A. RECOMMENDATIONS ON TEACHER TRAINING IN RELATION TO PARTICIPATION IN COURSES SPECIFICALLY DESIGNED FOR STUDENTS IN EDUCATION

Mathematics faculty's reaction to M.A.A. recommendations on teacher training	Percentage distribution: Mathematics staff participation in mathematics courses specifically designed for students in field of education	
	Does participate	Does not participate
Faculty reported unaware of recommendations	4	11
Faculty reported aware of recommendations but took no action on them	9	38
Faculty reported aware of recommendations and reacted favorably	72	26
Faculty reported aware of recommendations and reacted unfavorably	4	1
Faculty reported aware of recommendations, felt them irrelevant or inapplicable	9	14
Faculty reported aware of recommendations but reaction indeterminate	2	1
Indeterminate whether aware of recommendations or not	-	9
Total	100	100
Unweighted number of schools	(54)	(34)

Most mathematics departments had set procedures which they followed in setting up courses, choosing texts, and in supervising classroom teaching; in public school departments, somewhat more often than in private ones, these tended to be group responsibilities rather than those of a single individual. Traditional teaching techniques and methods of handling classes predominated, comparatively small enrollments in courses and geography making the use of certain new techniques impractical or infeasible in many schools. By 1961-62 a majority of departments had already enlarged, revised, or modernized their programs in some way but a majority also looked forward to further work on the department's course offerings.

Service courses for students majoring in other fields were offered by many departments, those for students in education being most common, for those in the social sciences, least. In all of these mathematics tended to have greater responsibilities for teaching than for the organization of the course. Half of these schools in 1960 or 1961 had been the scene of summer courses or institutes in mathematics designed to serve practicing pre-college teachers.

Mathematics Department Students

Undergraduate enrollment in mathematics reflects not only developments in the field of mathematics and in the non-academic world but also purposeful attempts by colleges and universities to encourage student interest in mathematics.

In the years immediately preceding the 1961-62 academic year over half of the non-doctoral granting universities and colleges took steps to stimulate interest in mathematics and enrollment in mathematics courses among their undergraduate students. To this end numerous devices were used, most commonly by means of undergraduate mathematics fraternities or clubs or through encouraging students to enter tournaments and competitions. Tried also, but somewhat less frequently, were visits to campus by outstanding scholars and trips off-campus by students to laboratories and research centers, as well as prizes for outstanding undergraduate work, discussion groups, and the like. The activities of publicly- and privately-controlled schools were similar, both in the proportions which undertook them and in the types of techniques employed. The more frequent use of undergraduate mathematics fraternities in public schools was the only exception to this (Q. 29, Appendix A.).

Regardless of whether they had tried to encourage undergraduate interest in mathematics or not, substantial increases in mathematics enrollments in the next few years were predicted by most department spokesmen. Among public school department heads, in fact, virtually all foresaw this development. In at least nine out of ten public schools the feeling was that additional staff would have to be recruited to handle the increased load; this feeling was shared by about one-half of the spokesmen from privately-controlled schools (Q. 24, Appendix A.).

Non-Major Students

In addition to serving students with mathematics as a field of concentration, departments served undergraduates who had no major and those with majors in other fields but studying mathematics as a tool subject or as a component of a liberal education. Much (and in some schools, most) of the time and attention of mathematics staffs was devoted to students like these.

For at least eight departments out of ten, the feeling was that the school was at least as good as comparable ones, taking into account the quality of undergraduate non-majors enrolled in mathematics courses. Private school department spokesmen, in part because of the greater likelihood that students had been screened for mathematical aptitude or achievement on applying for admission, felt their schools stacked up better, over-all, than did public school department heads (Q. 37, Appendix A.).

The department spokesman's estimate of his school, considering the quality of these students, was related to the department's record in setting up course work for students in other fields or without any field. The more favorable his opinion of the school in terms of the quality of these "other" students the more likely it was that the department had expanded its course offerings into new areas in the preceding few years and the more likely that the mathematics staff took part in mathematics courses organized specially for students in other departments.

Majors in Mathematics

By the 1961-62 academic year a preponderant majority of schools (nine out of ten) offered a major in mathematics, mathematics education, in education with mathematics as the teaching subject, or in more than one of these. In two out of three of those offering a major in mathematics the department had devoted attention to its major program recently, either introducing it for the first time or revising it. In the remaining schools, however, the major program remained unchanged in a period when the field of mathematics was in a state of flux (Q. 45 A, Appendix A.).

Special programs in mathematics for their superior undergraduate students were offered by fewer non-doctoral granting universities and colleges than were major programs. About one-half of the schools in the country had an honors program or a special research program to encourage independent student work, privately-controlled schools more commonly having one than public schools. Most of these programs in publicly-controlled schools, however, became part of the department's offering fairly recently, and thus could incorporate newer developments, while in private schools a greater proportion had been introduced some years earlier (Q. 27, 45 A, Appendix A.).

The mathematics major program in about one college and small university in five included a special requirement such as an examination, a paper, or special mathematics course work and a somewhat greater number required course work in physics. Private schools were more likely than public to require something special or extra of the student majoring in mathematics, although no more likely to have a requirement in physics. For the great majority of schools, however, the major student in mathematics need only take the prescribed courses and pass the examinations on them at an acceptable level in order to graduate (Q. 28, 45 B, Appendix A.).

Considering the undergraduates majoring in mathematics, nine department heads out of ten assessed their schools as as good as, or better than, comparable ones. Over-all, opinions based on the caliber of major students and of non-major students were similar, but public school respondents, because it was possible for the department to pick and choose its majors, thought better of their schools with respect to major students than non-major students (Q. 37, Appendix A.).

The department spokesman's estimate of his school, taking into account the quality of its mathematics majors, was the end product of several screening steps. Comparing schools thought to be "better" with respect to majors with those thought "about the same," for example, the better the opinion the more likely that entrants to the school's Arts and Sciences program would be "placed" mathematically; the more likely that the school would have an "advanced placement" program in mathematics based on high school work; the more likely that there was a special requirement for the major <u>but</u> the less likely that work in physics would be required; and finally, the more likely it was that the department recognized the ability of its students by employing them in some semi-professional capacity.

> Many mathematics departments had made recent attempts to encourage undergraduate student interest in mathematics and most held relatively good opinions of the caliber of students, both majors and non-majors, so recruited. Major programs in a majority of schools with them had been initiated or revised within the past few years, but only a minority of these programs included some special requirement for the concentrator in mathematics. Generally speaking, fewer students earned the baccalaureate in mathematics when there were special requirements attached to the major, but school and department programs permitting more individualized attention to students resulted in more graduates in mathematics, on the average.

The Mathematics Faculty

The faculty charged with responsibility for the work of the department, stable in a formal sense, was actually in a continuing state of change as individual members resigned or retired, others were hired and assimilated into the groups and the faculty reconstituted. Departmental experiences in this area are outlined in the following section.

Staff Turnover

In the five years preceding the 1961-62 academic year most mathematics departments experienced changes in the constitution of their teaching staffs, a majority having lost faculty members but an even greater number adding to the instructional staff.

From 1956-57 on, four schools in five had had at least one mathematics staff member at the rank of instructor or higher leaving. In most departments which had lost faculty members in that time-span there was the feeling that it would have been desirable for some or all of these to stay on. Four department spokesmen in ten of privately-controlled schools losing mathematics teachers, in fact, expressed the wish that <u>all</u> who left had not done so.

In the view of department heads mathematics teachers left their school for a variety of reasons, three of which predominated.

These were that another job meant promotion in rank or advancement, or that it offered more attractive salary or financial arrangements, or that the faculty member left to continue or complete his formal education. Each of these was cited as an explanation in about one-fourth of the departments which had lost staff. A number of other reasons, such as the teacher's state of health or family responsibilities and attractive aspects of the new job other than financial ones, were reported by department heads too, but less commonly. Because public school departments had lost more mathematics staff members in the aggregate, department spokesmen therefrom, of necessity, reported more reasons for staff losses. More noteworthy than this, however, is the fact that three times as many public school respondents as private ones felt that they had lost desirable teachers because of more attractive salaries elsewhere, and this despite the fact that salary scales in public schools were generally higher, rank for rank, than those in privately-controlled institutions (Q. 16, 16 A, 16 B-C, Appendix A.).

Not quite one-half of the departments losing faculty they would have liked to retain saw them go to teach at another college or university while one-third had staff members returning to their own studies. About one-sixth lost staff to jobs in business, industry, or government. This last represented a relatively recent but increasing drain on college mathematics staffs, for in the years 1954-60, the employment of mathematicians in this type of work more than doubled[4] (Q. 16 D, Appendix A.).

While four mathematics departments in five lost staff over a five-year period, nine out of ten added teachers in the same time-span. One-fifth of the departments, over-all, had added five or more to the mathematics staff during that time, although in publicly-controlled schools the proportion was one-third. As an illustration of

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[4] _Employment in Professional Mathematical Work in Industry and and Government_, Report on a 1960 Survey. Prepared for the National Science Foundation by the Bureau of Labor Statistics of the U. S. Department of Labor in cooperation with the Mathematical Association of America. NSF 62-12.

Baccalaureates in Mathematics, 1960-61

In 1960-61, schools without a doctoral program in mathematics but offering a major in mathematics each conferred the bachelor's degree on an average of a half dozen students majoring in mathematics or mathematics education, the programs for which mathematics departments had greatest responsibility.

The average number of mathematics majors receiving degrees varied with certain characteristics of schools. For example, institutions requiring some mathematics of all students earning a degree in their Arts and Sciences program, on the average, graduated fewer mathematics majors than did schools with no such requirement. Mathematics staffs in schools of the former category dealt less intensively with a large number of students while those in the latter category dealt more intensively with a smaller number. Again, for example, fewer were graduated in mathematics when there were special requirements in the major program than when there were none. (See Table II-14.)

In connection with Table II-14, it should be mentioned, first, that most students graduating from college in 1960-61 had matriculated in 1957-58 just as many of the changes and reforms in science and mathematics education occasioned by the launching of the Russian Sputnik were being put into effect. From these data it is impossible to determine precisely which of these innovations may have gone into effect during the undergraduate years of these students. Second, it should be mentioned that the output of baccalaureates in mathematics could be no greater than the input of those electing it as a major field. Greater average number of graduates in a field, as much as anything, may reflect relatively larger total undergraduate enrollments in schools of a particular type. In view of this it is important to note the proportion of schools of a particular type which produced any baccalaureates in mathematics as well as the average number they turned out.

TABLE II-14

1960-61 BACCALAUREATES IN MATHEMATICS IN RELATION TO CERTAIN BACKGROUND FACTORS

Background factors	Unweighted number of schools	Per cent with no majors in mathematics, mathematics education graduated 1960-61	Per cent with some majors in mathematics, mathematics education graduated 1960-61	Median number of majors in mathematics, mathematics education graduated 1960-61
No mathematics requirement, in A & S program.	(21)	9	91	7.9
Admission mathematics requirement in A & S program	(41)	8	92	7.2
Graduation mathematics requirement in A & S program	(18)	30	70	3.2
Revised, introduced mathematics major recently	(61)	14	86	7.2
Did not revise, introduce mathematics major recently	(23)	18	82	5.4
Physics required for mathematics major	(30)	30	70	4.6
Physics recommended for mathematics major	(24)	13	87	6.4
Physics neither required nor recommended for major	(29)	7	93	7.9
Some special requirement for mathematics major	(16)	20	80	5.9
No special requirement for mathematics major	(68)	14	86	6.8
Special program for superior undergraduates in mathematics . . .	(51)	12	88	6.9
No special program for superior undergraduates in mathematics . . .	(33)	21	79	5.7
School thought "better" on basis of majors' quality	(23)	-	100	8.3
School thought "same" on basis of majors' quality	(50)	21	79	4.7
School thought "not so good" on basis of majors' quality	(9)	-	100	7.7
Attempts made to stimulate interest in mathematics	(63)	18	82	6.6
No attempts made to stimulate interest in mathematics	(21)	12	88	6.3
Substantial increase in mathematics enrollment expected	(65)	13	87	9.1
No substantial increase in mathematics enrollment expected	(19)	25	75	4.6

this, among individual faculty members on staff at these schools in 1960-61, 45 per cent had been appointed initially in the five years beginning with 1956-57 (Q. 18, Appendix A.).

Because of the pyramidal structure of college faculties with formal provision for more positions at the lower ranks and fewer at the higher, departments which had made additions to staff in the five years from 1956-57 on, were more apt to have made appointments at the instructor or assistant professor level and less likely at the associate or full professor rank. Two-thirds of the departments adding to staff had appointed instructors, and the same proportion, assistant professors. Full professors, on the other hand, were added to mathematics staff by only one school in five (Q. 18 A, Appendix A.).

Considering only the number of individual teachers and disregarding academic rank and quality of the faculty members involved, over a five-year period public school departments were more likely than private ones to have added to staff as many or more mathematics teachers as they had lost during the same period of time. At least nine out of ten departments in publicly-controlled schools, compared to three-fourths in private schools, had no net loss in numbers on the mathematics faculty during that time.

TABLE II-15

TURNOVER OF MATHEMATICS FACULTY MEMBERS AT RANK OF INSTRUCTOR OR HIGHER, 1956-57 THROUGH 1961

Turnover result	Percentage distribution		
	Total schools	Public schools	Private schools
In balance . . . . (Loss = Gain)	29	34	27
Net losers . . . . (Loss > Gain)	16	6	21
Net gainers . . . . (Loss < Gain)	53	60	49
Indeterminate	2	*	3
Total	100	100	100
Unweighted number of schools with mathematics faculty members . .	(88)	(37)	(51)

*Less than one-half of one per cent.

In the time period in question departments were about as likely to have to postpone filling vacancies as to be able to fill them in the necessary academic year. Even in the one-half of the departments able to fill staff vacancies, however, it was occasionally necessary to hire a less qualified individual than the job called for or to appoint someone at a lower rank than was desirable. Publicly-controlled schools appeared to have somewhat more difficulty than private ones in this. Some indication of the extent of this problem was given in a recent study of vacancies in college mathematics teaching positions by Keller and Smith.[5] They found that 25 per cent of those employed to fill certain vacancies existing in 1957-58 did not meet minimum-degree requirements for the position (Q. 18 B, Appendix A.).

Recruiting and Staffing

Because replacements were not found for all who left the instructional staff and because new positions were being created as faculties were enlarged, one mathematics department in two, in late 1961 and early 1962, had a faculty vacancy. Although departments in publicly-controlled institutions were more likely to be "even up" or to have had a net gain as a result of staff turnover in a five-year period, vacancies were more common among them and departments having any openings were more apt to have several.

Faculty openings reported in late 1961 were more commonly in the lower ranks and less frequently at the full professor level. This was a consequence both of the fact that there are fewer positions at that rank and that full professors, more likely to have tenure and fringe benefits, were prone to stay on staff until their retirement (Q. 19, Appendix A.).

In addition to staff vacancies which already existed, most department spokesmen looked forward to the need for an enlarged staff

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[5] M. W. Keller and A. H. Smith, A Study of the Shortage and Placement of College Mathematics Teachers. (West Lafayette, Indiana: Purdue University, 1959).

in the next few years brought about by substantially increased enrollments in undergraduate mathematics courses. This was reported as a likelihood in two departments out of three over-all, but by virtually all reporting for departments in publicly-controlled schools. Even in private schools, however, one-half felt that the current staff would not be adequate to handle the increased student load expected (Q. 24, Appendix A.).

The picture of mathematical manpower needs painted for these non-doctoral-granting small universities and colleges was a dark one. In the 1961-62 academic year, four departments out of five already had staff vacancies or expected to have to add to the teaching staff to handle increasing enrollments, or both. One department spokesman in three, in fact, reported openings on his staff <u>and</u> the expectation that undergraduate mathematics enrollment would increase to the extent that his present staff could not handle the load.

In recruiting to fill existing openings or to find candidates for newly-created positions in mathematics departments, heads tried a variety of procedures. By far the most common was through academic channels--to make the vacancy known and to solicit suggestions for candidates from other colleges or graduate mathematics departments. Somewhat less common than this but frequent were inquiries directed to non-professional employment agencies or teacher placement agencies and to professional sources such as professional society job rosters and professional meetings and conferences. On-campus sources were tapped too, with unsolicited applications studied, the faculty canvassed for suggestions, and records of the department's graduates and students reviewed. (The fruitfulness of this last approach is suggested by the fact that about one-fourth of the 1960-61 mathematics staff members of assistant professor rank or above had been students some time at the college in which they were teaching) (Q. 20, Appendix A.).

Given the importance of recruiting and the difficulties associated with it, department heads tended not to rely on any one technique, although three-fourths did make their needs known through the customary academic channels. In addition, though, they explored all the angles possible as they went about the job of staffing.

It was a fairly general feeling among mathematics department spokesmen that they had had more difficulty than other departments at their respective schools in finding qualified teachers, and almost none felt that mathematics had less difficulty. Thinking back over their experiences in recruiting and hiring qualified teachers, a preponderant majority found it "hard," and one-half, "very hard." Looking ahead a few years, only one department head in eight felt that the job would become easier, while six out of ten predicted it would be even harder. Regardless of how difficult they had found recruiting in the past, most spokesmen were pessimistic about the future. Nine-tenths of those who found past recruiting "very hard" thought it would be as difficult or even more difficult in the future; one-half of those finding recruiting "somewhat hard" felt the job would be more difficult in the next few years (Q. 22 A, 22 C, 22 D, Appendix A.).

A major reason for difficulty in recruiting mathematics teachers today, it goes without saying, is simply a shortage of trained mathematicians to fill all of the available academic and non-academic jobs. One department head in five, in fact, could give no explanation for his difficulties in recruiting staff other than that of competition among academic institutions, business, industry, and government for the services of a limited number of trained individuals.

Among department spokesmen who <u>did</u> try to pinpoint the source of difficulty, however, the factor of salary was mentioned most prominently. Such dollars-and-cents reasons were cited four times as frequently as any others, and, interestingly enough, as frequently by those from privately-controlled schools as from public ones. Although the former had been much less inclined than the latter to say that they lost staff members for this reason, they were equally likely to say that non-competitive pay posed a problem in their efforts at recruiting. In connection with the question of salaries for mathematics teachers it is interesting to compare data on salary levels at these schools in 1961-62 with those published by the National Education Association for teachers in all fields in colleges and universities generally for the same period. While the NEA figure for full professor exceeds that of the average maximum for full professor in this sample by almost one thousand dollars, NEA figures for associate and assistant professor are lower than the averages from these schools by several hundred dollars at both ranks. Salaries higher than those of other fields were already being paid at the two ranks where the greatest shortages of mathematics teachers appear to exist.

Difficulties in recruiting were also attributed to the department's program--that it had few graduate students or no Ph.D. program, for example--the greater attractions of academic and non-academic research compared to teaching, and certain characteristics of the school such as teaching load or quality of the undergraduate students. Finally but uncommonly, recruiting difficulties were laid to the fact that a school was too isolated or too urban or that there were uncertainties arising from school integration, or that there were particular requirements of religion or sex for appointment to staff. Similar reasons were reported throughout by heads from public and private schools, the only exception to this being more frequent reports of difficulty due to location and school integration in the former (Q 22 C-1, Appendix A.).

In the same vein, those who had found recruiting "very hard" reported similar reasons (although a few more) for their difficulty as those who had found it only "somewhat hard" suggesting that this is as much a matter of linguistics as any real measure of problems encountered.

TABLE II-16

SOURCES OF DIFFICULTY IN RECRUITING MATHEMATICS FACULTY MEMBERS IN RELATION TO SEVERITY OF DIFFICULTY EXPERIENCED

Source of recruiting difficulty	Percentage distribution — Recruiting found to be.. Very hard	Percentage distribution — Recruiting found to be.. Somewhat hard
Salary or pay specified	70	77
Nature of mathematics program; no graduate program, etc.	18	11
Location of school other than climate . .	7	*
School integration problem specified . . .	2	-
Certain personal characteristics required in faculty	3	-
Competition between research and teaching	14	6
Characteristics of school other than mathematics program	14	2
Miscellaneous difficulties	7	7
"Competition" of unspecified nature	17	19
No source given or no source other than shortage	4	2
Total	156	124
Unweighted number of schools . . .	(50)	(31)

*Less than one-half of one per cent.

Problems of staffing in various geographic regions.--Over the course of years the horizons of academic institutions have been widening until, for some of the largest, at least, they are nationwide. For many smaller universities and colleges, however, boundaries are more restricted, the geographic region being the one from which students and staff are drawn, cooperative educational efforts and athletic competition organized, accreditation based, and the like. Accordingly, some of the problems of staffing and recruiting are described here within their regional setting.

Mathematics staff turnover, over a five-year period from 1956-57 through 1961, was greatest in the South-South Central region, schools there being most likely to have lost mathematics faculty members as well as to have added to staff. Institutions in the Northeast were most like them in this respect. Along the same line more South-South Central schools were unsuccessful in making faculty appointments in the year they were needed, more had mathematics openings in late 1961, and those with vacancies had more. Schools outside the South-South Central region did not experience these problems to quite the same degree.

TABLE II-17

STAFFING PROBLEMS OF MATHEMATICS DEPARTMENTS IN RELATION TO REGION IN WHICH SCHOOL IS LOCATED

Staffing problems	Percentage			
	Geographic region			
	Northeast	North Central	South-South Central	West
Some staff losses reported for five-year period	79	67	84	[66]
Some staff additions reported for five-year period	98	81	100	[88]
Some known postponement in appointment to staff	41	30	64	[*]
Some staff vacancy, end of 1961.	33	45	66	[56]
Unweighted number of schools with mathematics faculty members . . .	(30)	(25)	(21)	(12)[a]

[a]Because of the small number of cases in this subgroup statistics based on it are subject to considerable sampling error.

*Less than one-half of one per cent.

Throughout the country department spokesmen had generally found recruiting and hiring mathematics faculty members a hard job though a handful had felt it "not hard at all." In the South-South Central region, however, there was <u>unanimous</u> agreement that recruiting had been hard; no one had found it otherwise.

Fairly similar sources of recruiting difficulty were reported in the different regions, schools' mathematics programs and other characteristics of school organization being the only two with much variation. Regardless of region, a majority of department heads attributed to "salary" or "pay" much of their trouble in finding and hiring qualified teachers. Although the proportion of spokesmen from the South-South Central region citing this reason was similar to those from other regions, data on salary scales indicate that a substantial differential between the South-South Central and other regions did, in fact, exist. The average for the full professor maximum scale was some $1,000 lower in the South than the average for the country as a whole, while the average maximum scale for the assistant professor rank was about $500 less.

Not only did departmental spokesmen generally feel that recruitment had been hard, but most felt it would continue to be so. Only in the Northeast did any appreciable number feel that difficulties in recruiting would decrease. One department head in four there expressed the opinion that recruiting mathematics teachers would be easier in the next few years.

TABLE II-18

SOURCES OF DIFFICULTY IN RECRUITING MATHEMATICS FACULTY MEMBERS IN RELATION TO REGION IN WHICH SCHOOL IS LOCATED

Source of recruiting difficulty	Percentage distribution			
	Geographic region			
	North-east	North Central	South-South Central	West
Salary or pay specified	67	75	77	
Nature of mathematics program; no graduate program, etc.	21	3	22	
Location of school other than climate	1	2	11	
School integration problem specified	-	-	4	
Certain personal characteristics required of faculty	-	-	8	
Competition between research and teaching	21	4	9	
Characteristics of school other than mathematics program	29	2	-	
Miscellaneous difficulties	1	11	12	
"Competition" of unspecified nature	13	27	10	
No source or no source other than shortage	6	*	3	
Total	159	124	156	
Unweighted number of schools experiencing difficulty	(28)	(22)	(21)	(10)

*Less than one-half of one per cent.

The trend over time of experiences and expectations in the area of faculty recruitment varied from region to region, the situation becoming more hopeful in one part of the country, less so elsewhere. Departments in the South-South Central region tended to have had recruiting difficulties before the 1961-62 academic year, to have staff vacancies in 1961, and to foresee little likelihood of improvement in their situations in the future. In the Northeast spokesmen had experienced difficulty in recruiting, but were less likely than in the South to have staff openings in 1961, and tended to feel more optimistic about the future. In the North Central region, finally, there was less experience of difficulty earlier, problems in 1961 were of moderate severity, but the general feeling was that recruiting would grow more difficult soon.

Mathematics' manpower pool.--The pool of mathematical manpower from which schools recruited their mathematics faculties included "old hands" at teaching as well as newcomers to the field. In addition to differing in amount of on-the-job experience, older and newer recruits to college mathematics teaching had received their professional educations in dissimilar atmospheres. New entrants to college teaching, for instance, were more likely to have been beneficiaries of increased interest in and encouragement of science and scientific education. In post-Sputnik years this often took the form of greater financial support for teaching materials and faculty as well as for students.

Comparing those who had become available for college teaching in the post-Sputnik era with those who began to teach earlier, department spokesmen generally felt that the newcomers, despite these advantages, were no better than the old hands with respect to several factors relevant to mathematics teaching. In training, aptitude, and interest in teaching undergraduate mathematics, in ability to do mathematical research, and in general intellectual ability, new entrants to teaching were thought to be "the same" or "poorer" than older teachers more frequently than they were thought to be "better." While pluralities of department heads thought the two groups were "the same" as far as these five factors were concerned, they were most inclined to think the newcomers "better" in training for teaching and "poorer" in terms of interest in teaching and research ability. Spokesmen for departments from public and privately-controlled schools assessed the two groups in a similar fashion, although one-half of those from the latter compared to one-third from the former felt new recruits were "better" in training for teaching; and those from private schools were less inclined to think new entrants "poorer" as a group in ability to do research (Q. 22 B., Appendix A.).

Retaining Staff Members

Even with the ink dry on a contract, department staffing problems continued. The task then became one of keeping the staff intact and preventing inroads by recruiters from other agencies, which was not simple, for over a five-year period one or more faculty members in eight or nine "large" departments out of ten had been offered a position in mathematics elsewhere. This was more apt to have been the case in publicly- than in privately-controlled schools. Most commonly, offers to current staff members had come from other colleges or universities, two out of three reporting this while one-half as often job offers had been made to mathematics faculty members by business or industry or government (Q. 17, Appendix A.).

One-fourth of the departments in which staff members had received offers of other jobs made some particular effort, such as a raise in pay or promotion to match or counter offers. Twice as many private schools as public ones, in part because the former had greater flexibility in matters of salary and rank, responded to attempts to raid their faculties with counter offers to those who had been approached. More significant, however, is the fact that the three-fourths of the schools making no counter offers succeeded in holding on to the staff members in question on into the 1961-62 academic year, at least (Q. 17 B., Appendix A.).

Schools which had responded with counter-offers to attempts to hire their faculty away were also apt to behave in somewhat unorthodox fashion in the hiring process. Twice as many of those which had made a counter-offer as had not (37 per cent vs. 19 per cent) had hired younger or less experienced mathematicians at higher salaries or rank than experienced individuals already on the staff. The effect this had on the morale of those on the faculty already is unknown.

> Over a five-year period ending in 1961, most mathematics departments had experienced some turnover in staff, almost one-half still had staff openings, and a majority expected increasing enrollments to necessitate an enlarged staff.
>
> Finding qualified teachers had proved to be "hard" for a majority of departments, and recruiting was not expected to become much easier. Salaries, noncompetitive with other schools or non-academic employment, were thought the major source of recruiting difficulty, although only one of several reasons why staff members left a school. Recruiting and staffing problems existed in all geographic regions, but the situation in the South-South Central appeared most acute.
>
> Members of a majority of departments had been approached with offers of jobs elsewhere, but many departments had succeeded in holding on to their staffs without any differential treatment of those approached. Although non-academic jobs were drawing increasing numbers away from campuses, the major competition still remained that between academic institutions.

<u>Mathematics' Contacts On- and Off-Campus</u>

Important components of professional work of all kinds are contacts and communication with fellow professionals at other institutions and agencies and communication with those in related disciplines for the dual purpose of keeping individuals abreast of developments in the professional world and for the stimulation these contacts provide. In the academic world these may take the form of interdepartmental and interdisciplinary arrangements on-campus and off-campus relationships with professional organizations, academic institutions, and with non-academic agencies and groups.

On-campus contacts.--In the 1961-62 academic year almost one mathematics department in two participated formally or informally with other departments in its school in various ways, serving to facilitate communication between departments and scholarly fields. Faculty seminars and informal faculty discussion groups were the means employed most frequently to provide interdisciplinary communication and the stimulation of scholarly work. A handful of colleges and smaller universities, most of them publicly-controlled, had systems of joint appointments to several departments which worked toward the same end. Except for this latter, practices in public and private schools were fairly similar, both in the proportions having arrangements such as these and the particular ones that existed. In all likelihood, in these schools with relatively small faculties and campuses, contact between fields was actually greater than that implied by these results (Q. 33, Appendix A.).

Off-campus contacts.--Although contacts between mathematics and other fields on-campus may have been adequate, relations with the field of mathematics generally were felt to be too limited in kind or insufficient in amount. The great bulk of department spokesmen, four in five, felt that members of their department did _not_ have enough to do with mathematics and mathematicians elsewhere and that greater communication with the off-campus world was called for. Two factors--heavy workload affording the faculty member little free time, and limited funds--were held mainly responsible for these inadequacies. Explanations such as those that faculty members did not really consider themselves to be mathematicians or that distances and geography made connections with other institutions difficult were offered, but infrequently. The factor of limited funds was cited most commonly by those from publicly-controlled schools even though such institutions were more apt to have leave arrangements encouraging trips off-campus for meetings and the like. Similarly, the factor suggested as the prime reason in privately-controlled schools was workload, where teaching load was, in fact, lighter on the average (Q. 36, 36 B, Appendix A.).

Relationships between faculty and professional organizations were those most often thought to be lacking, closer work with other academic institutions and their faculties and additional formal training being suggested half as often as the first. Finally, visits to the campus by other scholars, the need to involve more individual faculty members, the need for closer ties with those in applied mathematics or mathematical research, for example, were mentioned (Q. 36 A, Appendix A.).

Although most spokesmen from mathematics departments were dissatisfied with the extent to which their faculty shared in the affairs of mathematics generally, they were not starting from scratch in attempts to change this. In 1961 a majority of mathematics faculty members from non-Ph.D.-granting schools belonged to one or more of three professional mathematical organizations, and every second faculty member, since earning his highest academic degree, had continued his studies formally. Similarly, a number of schools had had scholarly visitors to the campus, some had had teachers on leave for visiting appointments, and many individual mathematics teachers had plied their trade in a non-academic setting at some time or other.

Experiences with the M.A.A. Visiting Lecturer Program.--The M.A.A. Visiting Lecturer program contained elements to satisfy two of the suggestions of department spokesmen--increased contacts between faculty and professional organizations and on-campus appearances of notable figures in mathematics.

Since the Visiting Lecturer Program was initiated in the 1950's every third non-Ph.D.-granting department had participated in it, and one in five of those which had not had requested a visit. Similar proportions of publicly- and privately-controlled school departments had actually taken part in the program by the end of 1961; but private school departments were more likely than public ones to have submitted a request for a visit which had not been granted.

In those schools which had had a Visiting Lecturer on-campus, faculty reaction, as reported by the department head, was overwhelmingly favorable, rather than neutral or unfavorable, in a ratio of ten to one (Q. 35, 35 A, B, Appendix A.).

Regardless of whether the staff had reacted favorably to the Visiting Lecturer or not, the effect of his visit was to make the department and the staff more aware of the M.A.A. and its activities and to be more approving of them. Among schools which had participated in the Visiting Lecturer Program, for example, about three departments in four were familiar with the M.A.A. recommendations on teacher training and had taken some action to further them. In schools which had not been visited, on the other hand, four in ten only were both familiar with the recommendations and approving of them.

TABLE II-19

MATHEMATICS FACULTY REACTION TO M.A.A. RECOMMENDATIONS ON TEACHER TRAINING IN RELATION TO VISITS MADE BY M.A.A. VISITING LECTURER

Mathematics faculty's reaction to M.A.A. recommendations on teacher training	Percentage distribution: Participation in Visiting Lecturer Program	
	School was visited	School was not visited
Faculty reported unaware of recommendations	6	8
Faculty reported aware of recommendations but took no action on them . .	6	31
Faculty reported aware of recommendations and reacted favorably	73	41
Faculty reported aware of recommendations and reacted unfavorably . . .	2	4
Faculty reported aware of recommendations, felt them irrelevant or inapplicable	11	12
Faculty reported aware of recommendations but reaction indeterminate .	2	1
Indeterminate whether aware of recommendations or not	-	3
Total	100	100
Unweighted number of schools with mathematics program . . .	(43)	(43)

Visiting appointments off-campus.--In the two years preceding 1961-62, faculty members from only a minority of non-Ph.D.-granting departments had been on leave to serve as visiting faculty, on educational missions, and the like. During those years one department in four had had one or more staff members away, serving in these capacities. While the number of departments with anyone on leave for these purposes was small, the impact on departments with someone on leave was apt to be substantial, however. Close to half of those with any faculty member away on such an assignment either had more than one teacher off or one individual away more than once in the two years in question (Q. 34, Appendix A.).

Contacts with the National Science Foundation.--By the end of 1961 every second mathematics department had, as a department, made application to the National Science Foundation for financial support of some program or had a staff member who had done so.

Most frequently, and by a wide margin, application had been made to hold summer institutes or workshops for teachers. According to the reports of department spokesmen, applications by publicly-controlled schools without a doctoral program were much more likely to be acted on favorably than those from private schools of the same type. Academic Year or In-Service institutes for practicing teachers, programs for work with high school students or for undergraduate research, combined, provided the basis for application to the N.S.F. about one-fourth as often as the summer programs.

Non-Academic Employment in Mathematics

Non-academic work in one's field in free hours and free school terms confers a number of benefits in addition to its dollars and cents reward. It permits the student to observe his potential life's work at first hand and from a point of view other than that of the classroom; it enables the teacher to see the practical applications of principles developed in the classroom and the study, and it provides for the non-academic a refresher in the theoretical bases of his work.

Mathematical work in non-academic settings convenient to the campus was available to faculty and advanced students of somewhat less than one institution without a doctoral program in every three. Another small group of schools for which no specific job opportunities were reported was located in large cities where the probability was great that non-academic work did exist. For two schools in three, however, no work of this kind in the vicinity was known to the department's spokesman (Q. 38, Appendix A.).

Although employment opportunities in mathematics and near to schools appear to be restricted, modern transportation and communitication being what they are, distance was actually no barrier. There is no reason not to believe that a number of mathematics faculty members who engaged in non-academic work in 1961-62 commuted or worked at long distance.

> About one department in two was a part of some system for facilitating contacts between scholarly fields on-campus and in additional schools this took place automatically without any explicit arrangements. Communication between mathematics on-campus and its varied forms off-campus was felt to be insufficient generally, largely for financial reasons and work pressures. Even so, the sum total of these activities was not unimpressive; one-third of the schools had been participants in the M.A.A. Visiting Lecturer Program; one-quarter had had mathematics faculty away on visiting appointments; one-half had had some dealing with the National Science Foundation; and off-campus mathematical employment was available to the staff in one-third.

Current Mathematics Staffs

Comparing their own school with others, most department spokesmen were not displeased with the quality of the mathematics staff they and their predecessors had recruited. Nine department heads out of ten felt their schools to be the "same" or "better" in this respect; only one spokesman in ten thought his own institution "not quite so good." In the preponderant majority of cases the staffs in question consisted of several teachers, for the one-man mathematics staff in 1961-62 was a rarity. Found in about one-eighth of the privately-controlled institutions, it was non-existent in public ones (Q. 37 A, Appendix A.).

Opinions that schools were "better," the "same," or "not quite so good" considering staff quality, reflected, in part, speech patterns and attitude set. Department spokesmen who found their school "better" on this basis were also most likely to find it "better" with respect to library collections, student quality, work space, and the like. The same obtained for those feeling their institution "about the same" and those thinking it "not quite so good," although there were actually too few schools in the last category to permit meaningful comparisons. (see Table II-20).

But there was also some factual basis for these different opinions. Among mathematics teachers coming from schools considered "better" 65 per cent had an earned doctoral degree and 22 per cent had professional publications in mathematics to their credit. In comparison, the figures for those from schools thought "about the same" were 38 per cent and eight per cent and from schools "not quite so good," 26 per cent and four per cent.

TABLE II-20

RELATIONSHIP BETWEEN OPINION OF SCHOOL BASED ON QUALITY OF CURRENT MATHEMATHCS STAFF AND OPINIONS BASED ON OTHER MATHEMATICS DEPARTMENT RESOURCES AND FACILITIES

Mathematics department resources and facilities	Percentage distribution: Based on quality of current mathematics staff school was judged: Better than most	About the same	Not quite so good	No answer
Library collection in mathematics				
Better	60	26		
Same	40	59		
Not so good	-	12		
No answer	-	3		
Over-all quality of undergraduate students enrolled in but not mathematics majors				
Better	38	6		
Same	53	84		
Not so good	9	10		
No answer	-	-		
Adequacy of office and work space for mathematics faculty				
Better	51	34][a]		
Same	21	42]		
Not so good	28	24]		
No answer	-	-]		
Clerical and secretarial help for routine work in mathematics				
Better	30	12][a]		
Same	46	55]		
Not so good	24	33]		
No answer	-	-]		
Over-all quality of undergraduate students majoring in mathematics				
Better	52	15][b]		
Same	40	77]		
Not so good	-	8]		
No answer	8	-]		
Unweighted number of schools	(25)	(51)	(10)	(3)

[a]Excludes one school with no instructor half time or more.

[b]Excludes three schools with no mathematics major.

"Better" schools, those "about the same," and those "not quite so good" differed from one another with respect to several aspects of school organization. Weekly teaching load, sabbatical systems, and on-campus interdisciplinary arrangements were all more attractive to mathematics faculty members in "better" schools than in those the "same." Weekly teaching load of the full professor in mathematics, for example, averaged (median) almost two hours less per week in the first group compared to the second; one and one-half times as many schools in the first as the second had some sort of leave-with-pay system and three times as many from the first group as from the second had had mathematics faculty away on sabbatical in the several years preceding. In addition, two-thirds in the first group contrasted to one-third in the second had some interdepartmental or interdisciplinary setup to further communication between mathematics and other fields. There were, on the other hand, almost no differences between "better" schools and those "about the same" in the area of contacts with mathematics off-campus except that mathematics departments in the first group were much more likely than others to have had some contacts with the National Science Foundation.

In addition to differing in respect to certain tangibles, departments in "better" schools and those "about the same" differed in intangible ways, the former being more research- and less teaching- and administration-oriented than the latter. Research ability and amount of publication were rated higher as considerations in faculty promotion in schools of the first type compared to the second and the former were also somewhat less likely to rate teaching ability, administrative ability, and personal characteristics as being as important as were the latter. The fact that almost twice as many faculty members in schools in the first group compared to the second had the doctorate and that almost three times as many had mathematical publications to their credit seems to bear this out.

TABLE II-21

RELATIONSHIP BETWEEN OPINION OF SCHOOL BASED ON QUALITY OF CURRENT MATHEMATICS STAFF AND IMPORTANCE DEPARTMENT ASCRIBED TO CHARACTERISTICS AS FACTORS IN PROMOTION

Importance department ascribed to characteristics as factors in promotion in rank	Percentage distribution			
	Based on quality of current mathematics staff school was judged:			
	Better than most	About the same	Not quite so good	No answer
Teaching ability				
First	84	93		
Second	14	5		
Third	2	2		
Fourth	-	-		
Fifth	-	-		
Amount of publication				
First	-	1		
Second	3	3		
Third	47	12		
Fourth	42	33		
Fifth	8	51		
Research ability				
First	9	6		
Second	45	11		
Third	9	29		
Fourth	34	35		
Fifth	3	19		
Administrative ability				
First	-	-		
Second	-	6		
Third	10	47		
Fourth	39	26		
Fifth	51	21		
Personal characteristics				
First	-	-		
Second	45	71		
Third	13	7		
Fourth	18	10		
Fifth	24	12		
Unweighted number of schools rating importance of characteristics .	(25)	(47)	(9)	(3)

Spokesmen from departments in "better" schools and schools "about the same," considering staff quality, had almost identical opinions about problems in recruiting but dissimilar experiences along that line. Three-quarters of those reporting for departments of each type felt mathematics had more difficulty in finding qualified teachers than other fields at their own school; slightly over one-half from each of the two types had found it "very hard" in the past to locate and hire faculty of the desired caliber; and about two-thirds felt recruiting would become even harder.

In contrast, departments from "better" schools were somewhat more likely both to have lost mathematics staff members and to have added to the faculty during a five-year period, virtually all reported current members of their staffs to have had offers of jobs elsewhere, and finally, two-thirds compared to one-third from schools believed "about the same" had staff openings at the end of 1961.

Contrary to what might be expected, the problem of recruiting and staffing in mathematics actually appeared to be more difficult among schools offering more resources and facilities for mathematics instruction and more attractive academic settings generally.

> Most departmental spokesmen (and similar proportions from public and private schools) considered their institutions to be as good as, or better than, others with respect to the quality of the faculty in mathematics.
>
> Schools thought "better than most" on the basis of staff quality compared to those "about the same," had, on the average, higher proportions of staff with the doctorate and professional publications, somewhat lighter teaching loads, and were more likely to have sabbatical systems and setups facilitating communication between mathematics and other disciplines in the school. Departments in the former were also somewhat more research- and somewhat less teaching- and administration-oriented than others.
>
> Despite all this, departments in "better" schools had slightly more turnover among mathematics teachers and generally had somewhat greater problems than others in recruiting and retaining staff.

CHAPTER III

CHAPTER III

TODAY'S COLLEGE TEACHERS OF MATHEMATICS

Much of the instruction in undergraduate mathematics in the United States takes place in settings such as those just outlined. What are the characteristics of mathematics staffs and staff members teaching in colleges and universities which do not grant the doctorate in mathematics? What are the academic preparation and work history of staff members? What impressions do they have of the schools at which they teach? How do they feel about teaching and about research and administration--about academic and non-academic work? And finally, what do they think about the field of mathematics? In the following pages we will describe some of the more important features of these mathematics staffs and staff members, and suggest some answers to these questions.[1]

Personal Characteristics: Sex, Age, and Family Factors

Sex

Mathematics as a scholarly field has its heroic female figures--Sonya Kovalevsky and Emmy Noether to name two--but the stereotype inside and outside the discipline is that mathematics is a masculine field. The sex composition of contemporary college mathematics teaching staffs provides added "evidence" for this idea; in the 1960-61 academic year in non-doctorate-granting schools seven out of eight teachers at the rank of assistant professor or higher were male. Small though the proportion of women teachers was, however, it is likely that they were actually more numerous in these schools than in the doctorate-producing schools with their somewhat different requirements for appointment to staff (Item e, Appendix B.).

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[1] See Appendix D for a description of the source of these data and the method by which they were collected.

Age

By tradition, mathematics is a discipline emphasizing youth--a field in which great discoveries could be made by the scholar in his twenties and in which, theoretically, he could be "burned out" by his thirties. But while youthfulness may be necessary or desirable or just traditional, for mathematical research, it is seen to be less of a factor in college teaching staffs.

In 1961 no teacher of college mathematics at the rank of assistant professor or higher was less than twenty-five years old. One in six was twenty-five to thirty-four, and one in sixteen was sixty-five or over. Teachers at the lower ranks, as one would expect, were younger on the average than those higher up on the academic ladder. A third (36 per cent) of the assistant professors were thirty-four or less and only one per cent sixty-five or more, compared to two per cent and 15 per cent for full professors in the same age groups (Q. 16, Appendix B.).

As a group college mathematics teachers were older than individuals currently employed in professional mathematical work in industry or government.[2] Four-fifths of the teachers of mathematics, but only two-fifths of those employed in mathematics in industry or government were thirty-five or over in 1961. In this connection it should be noted, however, that the average educational level of the non-academic mathematicians was lower than that of the academic ones.

In looking at mathematics staffs from the standpoint of the sex and age of their members, an interesting fact emerges: female teachers were disproportionately in the older age brackets and rarely in the younger age groups. Among active female mathematics faculty members, 15 per cent were sixty-five or over in 1961 compared to four per cent for the male, and five per cent of the women were thirty-four

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[2] Employment in Professional Mathematical Work in Industry and Government, Report on a 1960 Survey. Prepared for the National Science Foundation by the Bureau of Labor Statistics of the U. S. Department of Labor in cooperation with the Mathematical Association of America. NSF 62-12.

or less in contrast to 21 per cent of the men. When cohorts of teachers are compared, changes in the proportions of male and female staff members become clearer; with each added decade female teachers constituted an increasing proportion of the total in the cohort. Thus, in 1961, women accounted for three per cent of those teachers twenty-five through thirty-four years of age, eight per cent of those thirty-five through forty-four, and so on until the age group sixty-five or more, in which women accounted for 36 per cent (Table III-1).

TABLE III-1

SEX AND AGE OF FACULTY MEMBERS

Age of Faculty Members	Total per cent	Per cent		Per cent in cohort	
		Male	Female	Male	Female
25-29 years in 1961 .	6	7	-	97	3
30-34 years in 1961 .	12	14	5		
35-39 years in 1961 .	19	20	10	92	8
40-44 years in 1961 .	16	16	13		
45-49 years in 1961 .	11	12	10	84	16
50-54 years in 1961 .	12	11	19		
55-59 years in 1961 .	10	10	10	80	20
60-64 years in 1961 .	8	6	18		
65-69 years in 1961 .	4	3	10	64	36
70 years or over in 1961	2	1	5		
Total	100	100	100	87	13
Unweighted number of faculty members . .	(533)	(473)	(60)	(473)	(60)

There are several possible explanations of this: similar proportions of men and women had been appointed in the various age groups but older women teachers tended to remain on the staffs of colleges and universities such as these while older men teachers tended to leave them (including those dying younger), or progressively fewer women were being hired to teach, or some combination of these trends. Because the individuals were still active faculty members in spring, 1961, their data can tell us nothing about their former contemporaries who were no longer members there. Some evidence on the second alternative is offered by the previously-cited study of mathematical employment in industry and government. Women, in non-academic mathematical work, constituted the same proportion of the total work force as they did in college mathematics teaching. In the age group under thirty-five, however, they were one-sixth of the total compared to being only three per cent among faculty members. Regardless of whether colleges and universities had wanted to hire these particular young female mathematicians, it is noteworthy that new and attractive alternatives to academic positions had come into being and that many younger women chose one of these alternatives and were thereby eliminated from the academic market.

Family Factors

Few 1960-61 college mathematics teachers arrived at their careers by walking directly in their father's (or stepfather's) footsteps; only a handful (less than one per cent) of the current group reported that their father or stepfather was a mathematician or a mathematics teacher when they themselves were at an age to begin considering their life's work. Staff members were hardly more likely to have gone into teaching in general on the basis of their father's example for only one in twenty had a father who taught any subject at any level of educational institution (Q. 17, Appendix B.).

On the other hand, mathematics teachers, like most college teachers, tended to come from backgrounds conducive to the pursuit of a college education--the first step in any academic career. Four mathematics teachers in ten were from families whose heads were in professional or managerial occupations while they were in secondary school. In contrast, as late as 1950 (and most staff members were high school age long before that), some two in ten of the employed males in the country as a whole were in the professional and managerial occupations.

Educational Background

Mathematics staffs were divided almost half and half into faculty members teaching with an earned doctorate degree and those with a master's degree only. Very few teachers had neither of these (Q. 1 a, Appendix B). Disregarding academic rank and level of highest degree, one teacher in two reported having done some formal academic work since receiving his highest level degree (Q. 1 l, Appendix B).

Mathematics or statistics was the field in which the majority (62 per cent) had earned their highest level degree. Education was the field of preparation of the next largest group, followed by physics, engineering, and "other science." Those teaching with only a bachelor's degree (fourteen individuals in the sample) were most likely to have degrees in subjects other than mathematics or statistics and to be on the staffs of colleges which had no academic rank system (Q. 1 e, Appendix B) (Table III-2).

TABLE III-2

FIELD OF DEGREE BY HIGHEST LEVEL DEGREE OF FACULTY MEMBER

Field of highest level earned degree	Total per cent	Percentage--highest level earned degree--			
		Doctoral degree	Master's degree	Bachelor's degree	Other degree
Mathematics, statistics	62	65	65	16	-
Education	17	19	16	5	-
Engineering	5	1	4	32	-
Physics	6	8	6	-	-
Other physical or natural science	5	5	6	-	-
Social science	1	1	1	-	-
Humanities, language . .	1	1	1	-	-
Business, accounting . .	3	-	*	47	-
Other specified field . .	*	-	1	-	-
Indeterminate field . . .	*	-	*	-	-
Total	100	100	100	100	-
Unweighted number of faculty members.	(533)	(278)	(238)	(14)[a]	(3)

[a]Because of the small size of the group involved, these percentages are subject to considerable sampling error.

*Less than one-half of one per cent.

The Mathematics Staff Member with the Doctoral Degree

Almost half of all mathematics staff members had a doctoral degree, and having one was directly related to and a factor in, the teacher's academic rank; four out of five full professors but only one in four assistant professors had a doctorate. Over-all, among teachers with a doctorate about two out of three had their degree in mathematics or statistics, though the proportion among assistant professors was higher because few had a doctorate in another field (Q. 1 j, Appendix B).

Disregarding the field of the degree, almost a third of those staff members with a doctorate had earned it within the five preceding years (in 1956 or later). One-fifth, however, had held the degree for twenty years or longer (Table III-3).

TABLE III-3

YEAR IN WHICH FACULTY MEMBER OBTAINED DEGREE BY HIGHEST LEVEL DEGREE OBTAINED

Year in which obtained	Percentage distribution	
	Doctoral degree	Master's degree
1960-61	9	5
1956-59	22	17
1951-55	26	17
1941-50	22	30
1931-40	14	22
Prior to 1931	7	9
Year indeterminate . .	*	*
Total	100	100
Unweighted number of faculty members . .	(278)	(238)

*Less than one-half of one per cent.

Teachers with an earned doctorate in mathematics or statistics had completed work on their degrees more quickly, on the average, than those on mathematics faculties but with a doctorate in some other field. Two-thirds of the former needed less than ten years to complete the course from the baccalaureate to the doctorate. In comparison, only one-third of the latter had earned their doctoral degree in less than ten years. At the other extreme, while only four per cent of those with a mathematics or statistics Ph.D. needed twenty or more years to complete work on it, a third of those with a doctorate in another field required that much time (Table III-4).

TABLE III-4

NUMBER OF YEARS REQUIRED TO OBTAIN DOCTORATE BY FIELD OF DOCTORATE

Years elapsed between bachelor's and doctor's	Percentage all doctorates	Percentage distribution	
		Doctorate in mathematics or statistics	Doctorate in other field
Two years or less	*	*	-
More than two years but less than five	13	12	14
Five or more years but less than ten	42	55	21
Ten or more years but less than fifteen . . .	19	17	23
Fifteen or more years but less than twenty	11	12	8
Twenty or more years . . .	15	4	34
Lapse of indeterminate length	*	*	-
Total	100	100	100
Unweighted number of faculty members	(278)	(217)	(61)

*Less than one-half of one per cent.

For many who were faculty members in the 1960's, World War II or the Korean War had forced an interruption in graduate training. Measured by the length of time elapsed between receipt of the bachelor's and doctor's degrees even under these circumstances, mathematicians appeared to have done better than scholars in other fields. Those with a doctorate in mathematics whose student careers were less likely to have been interrupted by world events (women and the youngest and oldest men) were more apt than other candidates in mathematics to have completed the doctoral program in less than five years. More of those whose studies were likely to have been interrupted finished up their work in another five years, however, so that two-thirds of both groups of mathematicians had earned the doctorate in less than ten years. In contrast, only one-half of those unlikely to have had interrupted studies for the doctorate in other fields and only one-fourth of those subject to interruption finished doctoral work in less than ten years. Regardless of whether or not their studies were likely to have been interrupted, just a handful of mathematicians spent twenty years or more in work for the doctorate; in contrast, from a quarter to a third of the doctoral candidates in other fields spent at least twenty years in the process (Table III-5).

One staff member in five with a doctorate, according to his own report, had had postdoctoral fellowship or some other formal study since receiving his degree. Continued study after receipt of the doctorate was related to, and in fact was an element in, academic rank. Assistant professors with the doctorate but with two more rungs to climb on the academic ladder were more likely than both associate and full professors to have had some postdoctoral study (Q. 1 ℓ., Appendix B).

TABLE III-5

NUMBER OF YEARS REQUIRED TO OBTAIN DOCTORATE BY FIELD OF DOCTORATE AND LIKELIHOOD OF INTERRUPTION IN STUDY

Years elapsed between bachelor's and doctor's	Percentage distribution					
	Doctorate in mathematics or statistics			Doctorate in other field		
	Total	Interruption		Total	Interruption	
		Unlikely[a]	Likely[b]		Unlikely[a]	Likely[b]
Two years or less . . .	*	*	*	-	-	-
More than two years but less than five. .	12	19	9	14	30	5
Five or more years but less than ten . .	55	47	59	21	20	21
Ten or more years but less than fifteen . .	17	11	20	23	23	23
Fifteen or more years but less than twenty	12	18	8	8	-	13
Twenty or more years.	4	4	4	34	27	38
Lapse of indeterminate length	*	1	-	-	-	-
Total	100	100	100	100	100	100
Unweighted number of faculty members . . .	(217)	(91)	(126)	(61)	(21)	(40)

[a]Faculty member was female, male born since 1930 or receiving doctorate before 1942.

[b]Other faculty member.

*Less than one-half of one per cent.

The Mathematics Staff Member with the Master's Degree

Every second teacher of college mathematics had a master's as his highest degree. These staff members without the academic union card were concentrated in the associate and assistant professorial ranks, in each of which they constituted the majority.

In field of preparation those with only the master's degree resembled those with the doctorate; two-thirds had their degrees in mathematics or statistics and one-sixth had a degree in education. Teachers at the two levels of formal academic preparation were similar in age also, members of each group being in their early forties, on the average (Table III-2).

However in other respects faculty members with the doctorate and those with only the master's were dissimilar. Those with the master's, on the average, had had their degrees for a longer period of time and were also more likely to have continued or to be continuing their studies since their degrees were awarded. While one-third of those with the doctorate had received the degree since 1955, only one-fifth of those with the master's had such a recent degree; conversely, one-fifth with the doctor's and one-third with the master's had a degree dating from 1940 or earlier (Table III-3).

Whether candidates for the doctorate or not, three out of four teachers with the master's had had some formal study since they received their degrees. Not unexpectedly, attendance at summer sessions was most commonly reported, but one-half of those who had kept on with their studies had managed to take work during the regular academic year (Table III-6).

For faculty without the doctorate, just as for those with it, a higher proportion of the assistant professors than of the full professors had kept on with their studies since being awarded their highest degree.

TABLE III-6

FORMAL STUDY SINCE OBTAINING DEGREE BY
HIGHEST LEVEL DEGREE OBTAINED

Continuing formal study through summer, 1961	Percentage Distribution	
	Doctoral	Master's
Attended summer school, summer sessions sometime after receiving degree	19	26
Attended school during academic year sometime after receiving degree		5
Attended school during summers and during academic year sometime after degree . . .		32
Attended school during indeterminate term sometime after degree		13
No continuing formal study after receiving degree reported	81	23
Indeterminate whether any continuing formal study . .	-	1
Total	100	100
Unweighted number of faculty members . .	(278)	(238)

Work Experience

Mathematics teaching staffs were composed largely of individuals with teaching or other work experience. When first appointed to the staff of the school at which they taught in 1960-61, three out of four were already working at another college or university, in elementary or secondary schools, or in business, industry, or government. Those who were students, members of the armed forces, or not working for some other reason when hired constituted a minority. Half of those whose appointment represented a move from one job to another had been employed just previously by another college or university (Q. 5, Appendix B).

The proportions of teachers engaged in these different activities when originally appointed depended on the length of time they had been working and so varied with their 1961 rank. More full professors than assistant professors had been employees of (and probably on the faculties of) other colleges, public school systems, or of business or government, and fewer had been going to school themselves.

Irrespective of what they were doing at the time of original appointment, three-quarters of all those teaching college mathematics had taught somewhere else sometime in their careers. Only a quarter were first recruited to teaching by their original appointment to this school. The majority of those with teaching experience had been on a college or university staff, not simply teaching assistants or fellows. About a third, however, had experience only in pre-college teaching. Compared to assistant professors, 1961 full professors were more likely both to have had some experience in teaching and to have taught in institutions of higher education.

The Old School Tie

Academic inbreeding, although it did occur, was not the rule for mathematics faculties in colleges and universities which had no Ph.D. programs in mathematics. Some three teachers in four had been neither undergraduate nor graduate students in the college or university in which they were teaching. The proportions with<u>out</u> student ties ranged from four-fifths of the full professors to three-fourths of the assistants. When a staff member <u>had</u> been enrolled earlier as a student, it was more apt to be at the undergraduate than at the graduate level, because in mathematics, at least, the master's degree was the highest one granted by these schools (Q. 1 k, Appendix B).

Although the majority of mathematics staff members, for 1960-61 at any rate, had not been students at the schools in which they were teaching, there was a slight tendency for an individual to have his first college teaching appointment where he had studied. Of those on their very first teaching job, one-third had been undergraduate or graduate students at the college or university in which they were currently instructing. For those with secondary or elementary teaching experience only, 30 per cent had been students earlier. On the other hand, only one mathematics faculty member in eight with teaching experience at another college or university was on the instructional staff of a school in which he himself had studied (Table III-7).

Length of Time on Staff

Mathematics faculties in 1960-61 were made up of similar proportions of "rookie year" staff members and "20-year-plus" veterans. Disregarding academic rank, the 1960-61 academic year was the first year on staff for 12 per cent, while 15 per cent had been appointed in 1940-41 or earlier. Not unexpectedly, length of time on staff was related to academic rank, even though a majority of these schools--

as was pointed out in Chapter II--put no limit on the number of years spent at the various ranks (Q. 15, Appendix A). Two per cent of the full professors were 1960-61 appointees, while 35 per cent had been on the staff over twenty years; on the other hand, among assistant professors, 17 per cent were serving their first year, while only three per cent had been on the staff since 1940-41 (Q. 3 A, Appendix B).

TABLE III-7

RELATIONSHIP BETWEEN FACULTY MEMBER'S ATTENDANCE AT SCHOOL AND APPOINTMENT TO INSTRUCTIONAL STAFF

Relationship between schools attended and school employing in 1960-61	Nature of prior teaching experience			
	Percentage distribution			
	None at all	Elementary or secondary	College or university	Level in-determinate
Awarded graduate degree by employing school . . .	10	8	4	5
Graduate work but not graduate degree from employing school	3	3	1	1
Undergraduate degree but no graduate work at employing school	24	17	7	10
Undergraduate work only from employing school . .	*	2	*	1
Neither undergraduate nor graduate work or degrees from employing school	63	70	88	83
Total	100	100	100	100
Unweighted number of faculty members	(144)	(92)	(252)	(45)

*Less than one-half of one per cent.

Getting Ahead

A majority of college mathematics teachers had climbed a rung or more up the academic ladder at the school where they taught since first being appointed to its faculty. Although slightly more than one-half of the assistant professors--more recent appointees on the average--had not been promoted since being hired, three-quarters of the associate professors and two-thirds of the full professors originally appointed at a lower rank had been advanced. Over-all, two mathematics teachers in three, who reported the rank of their original appointment as being other than "full professor," had been promoted in rank since joining the staff. But promotion was not necessarily automatic or swift. Three per cent of the spring, 1961 assistant professors had joined the instructional staff in 1940-41 or before (Q. 3 B, Appendix B).

The Mobility of Mathematics Teachers

College faculties today, like most professional work groups, are in a continual state of flux, some individual members moving up through promotion, some moving out by retirement or resignation, and still others being appointed to fill the vacancies so created. Staffs change also through the addition and subtraction of teaching positions within departments, but with increasing student enrollment in mathematics the latter is a lesser problem for mathematics departments of the 1960's. Staff members leaving to join the faculties of other schools or to return to their own studies is an old story; staff members leaving to take up mathematical work outside the academic setting constitutes a relatively new development, but a significant one according to departmental spokesmen (Q. 16 D, Appendix A).

By 1961-62, one mathematics staff member in ten had left the faculty of the college employing him the year before. Because of the pyramidal structure of college faculties, with fewer positions the higher the rank, more of those leaving were assistant than associate professors, and more were associate than full professors.

Every second teacher leaving college mathematics staffs went on to employment of some kind at another college or university. Of the remainder a small portion switched to mathematics in public schools, business or industry, and a larger portion went into non-mathematical-non-academic work, returned to their own studies, or left the labor force for other reasons.[3]

Almost all who had "arrived" at a particular school--the full professors in the spring, 1961 term--remained on its staff the next academic year. In 1961-62 only two per cent of them had moved to another college or university; one per cent had retired from teaching. In comparison, one assistant professor in eight had either resigned or retired. One-half of the assistants who left went on to work at another institution of higher education; many of the others, though employed, had left teaching or both teaching and mathematics (Item a, Appendix B).

Mathematics Teachers' Impressions of Their School

To at least one-half of those teaching mathematics in the early 1960's, the esteem of colleagues in the institution where they worked was, in the long run, more important than the esteem of fellow members in the same field but in different schools or agencies. A preference to be known and respected locally rather than discipline-wide was expressed by teachers in each of the

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[3]The actual number of individuals participating in the study but who had left college teaching altogether by 1961-62 was too small to yield reliable statistics, but does permit this impression. The group included teachers of two types: older "genuine" mathematicians who had the doctorate in mathematics, belonged to professional societies, and served on staff until retirement age, and a larger group of younger teachers, having at most a master's degree, not belonging to mathematical societies, not considering themselves "mathematicians" but who had been students at the school and finally severed connection with it to enter more congenial work.

three ranks, with full professors slightly more likely than those at the assistant rank to make this choice (Q. 21, Appendix B).

In indicating this preference for the local repute, faculty members from non-Ph.D.-granting colleges and universities appear to differ markedly from those in larger colleges and universities. Studying liberal arts departments in a number of major American universities, Caplow and McGee[4] reported the impression that mathematics had reached a quasi-guild status, disciplinary ties being far stronger than those of the local institution for the college mathematician. Such a statement seems extreme for all but the most discipline-oriented staff member in these smaller schools.

The Place of Teaching, Research, and Administration

Much has been written to suggest that faculty research is everything and teaching nothing in American colleges and universities, but faculty members in a significant portion of educational institutions expressed a contrary opinion. In the view of mathematics staff members, just as in that of departmental spokesmen, teaching was the aspect of academic work the school held in highest regard. And, like the departmental respondents, mathematics teachers felt the school valued research least of all and administrative duties intermediate between the two. Greatest agreement among faculty members was in their construal of the school administration's chief concern being for teaching. There was less agreement among staff members in the ratings they felt their schools gave to the other two facets of academic work (Q. 14 B, Appendix B).

Full, associate, and assistant professors were generally agreed in their estimates of the value their particular school put on teaching and on research. Between full professors and the others, however, there were differences with respect to the value attributed

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[4]Theodore Caplow and Reece J. McGee, The Academic Marketplace (New York: Basic Books, 1958), p. 85.

to administrative responsibilities. Full professors tended to feel that the school thought least of these. A factor in these differing estimates, as we will see later, was whether or not the faculty member himself had administrative responsibilities in addition to his teaching assignment.

Satisfactory Aspects of Schools

Conglomerates of blackboards and ivy, teaching loads and academic deans, grading examinations and visiting professors--schools varied in the areas in which and the extent to which they met the expectations and satisfied the needs of their instructional staffs.

Among aspects found most satisfying, members of mathematics faculties were most inclined to pick "relations with colleagues," "quality of the program in (one's) field," and "climate or geographic location." Each of these items was checked by four to five staff members in ten.

"Colleague relations" and "climate or location" (i.e., closeness to family and friends as well as to cities and other institutions) were among the top three chosen by all three ranks. With higher rank, staff members were increasingly inclined to approve of "quality of faculty" and "quality of undergraduate students," and less likely to feel similarly about "relations with colleagues" and "climate or location" (Q. 15, Appendix B).

Personal traits and experiences of the individual teacher and features of the school or department had a bearing on what he found most satisfactory. For instance, about twice as many who had studied at a college as had no ties as a student picked "general reputation of the college"; two to three times as many with no sentimental attachments as with them picked "salary scale." Individual teachers who rated research first, among the aspects of academic work, were more likely than others to express approval of the "research facilities" of a school.

For the most part, staff members with a "local" bent and those with a "disciplinary" inclination derived similar gratifications from their jobs. More than half of each, for instance, found "relations with colleagues" rewarding. On the other hand, those with a "local" bent were more inclined than others to look with approbation on "general reputation of the college" and "relations between faculty and administration," while those with a "disciplinary" bent were more apt to name "salary scale" and "quality of program" (Table III-8).

TABLE III-8

SATISFACTIONS DERIVED FROM SCHOOL BY FACULTY MEMBERS OF DIFFERING ORIENTATIONS

Satisfactory aspects of school	Percentage distribution of--		
	Total	Local orientation	Disciplinary orientation
Relations with colleagues	55	58	52
Climate and/or geographic location	46	44	47
Quality of the program in your field	41	35	48
Relations between faculty and administration	34	38	29
Quality of undergraduate students	23	23	23
Salary scale	18	12	24
Intellectual stimulation	18	20	18
General reputation of the college	16	20	12
Quality of faculty in your field	15	16	15
Retirement provisions or benefits	12	12	12
Cultural opportunities available	10	12	10
Housing available to faculty .	4	4	3
Research facilities	3	1	4
No answer	2	2	2
Total	297	297	299
Unweighted number of faculty members	(533)	(254)	(252)

Teachers from publicly-controlled schools compared to those from private ones were more apt to approve of certain non-academic aspects: "geography or location," "salary," and "retirement provisions." Staff members from private schools for their part more frequently named "quality of undergraduate students" and "general reputation of the college." Differences in salary scale and fringe benefits and in admission requirements for students reported by departmental spokesmen from schools of the two types in Chapter II are called to mind by this. Comparison of the replies rank by rank of staff members from schools of the two types suggests the different worlds they inhabit (Table III-9).

TABLE III-9

SATISFACTIONS DERIVED FROM SCHOOL BY FACULTY MEMBERS FROM PUBLIC AND PRIVATE SCHOOLS

Satisfactory aspects ~~of school~~	Percentage distribution								
	Total	Public control school				Private control school			
		Total	Full Prof.	Assoc. Prof.	Asst. Prof.	Total	Full Prof.	Assoc. Prof.	Asst. Prof.
Relations with colleagues	55	51	44	44	61	58	54	51	71
Climate and/or geographic location	46	61	57	63	61	33	29	35	39
Quality of the program in your field	41	38	45	43	31	44	38	42	41
Relations between faculty and administration . .	34	35	36	46	25	34	36	34	32
Quality of undergraduate students	23	9	16	9	7	34	51	28	23
Salary scale	18	27	40	13	33	10	6	13	16
Intellectual stimulation.	18	14	4	18	15	22	17	18	20
General reputation of the college	16	11	9	11	12	20	24	14	17
Quality of faculty in your field	15	13	14	13	12	16	26	12	16
Retirement provisions or benefits	12	20	28	19	18	5	-	20	1
Cultural opportunities available	10	10	7	9	12	11	10	8	16
Housing available to faculty	4	3	7	-	5	4	-	5	7
Research facilities	3	3	7	1	2	3	5	-	1
No answer	2	2	3	3	-	2	1	7	-
Total	297	297*	317	292	294	296	297	287	300
Unweighted number of faculty members	(533)	(285)*	(66)	(99)	(119)	(248)*	(76)	(51)	(107)

*Includes "Other" category.

Staff Satisfaction with Student and Faculty Quality and with Program

Faculty members and the spokesmen for their departments saw eye to eye on many questions and tended to express similar feelings on others. Among these were the satisfactoriness of certain important aspects of their work situation--the quality of a school's undergraduate students and the caliber of its faculty. Mathematics staff members from schools judged by the department spokesman "better" than other schools were two to three times as likely as other teachers to mention student or faculty quality approvingly. Because members of the faculty were volunteering reports on the several aspects of the school most satisfying to them personally, comparison of the impressions from these two sources in all likelihood understates the extent of agreement between the department head and the staff in these two areas (Table III-10).

TABLE III-10

RELATIONSHIP BETWEEN OPINIONS OF DEPARTMENTAL SPOKESMEN AND FACULTY MEMBERS ON QUALITY OF STUDENTS AND QUALITY OF FACULTY

Aspect picked as "one of most satisfactory" by faculty member	Faculty members from schools thought on the basis of quality of undergraduate mathematics majors to be . . .		
	Better	About the same	Not so good
Quality of undergraduate students	36%	19%	14%
Unweighted number of faculty members .	(168)	(260)	(76)
	Faculty members from schools thought on the basis of quality of current mathematics staff to be		
	Better	About the same	Not so good
Quality of faculty in (your) field	22%	13%	7%
Unweighted number of faculty members .	(169)	(271)	(80)

The quality of the program in their field met with the approval of close to one-half of those who taught college mathematics in the early 1960's. Two faculty members in three, however, thought some change in program content desirable. For the most part their suggestions were for courses to be added to the mathematics curriculum, but two per cent of those favoring change proposed new degree programs. Full professors, for whatever reason, were somewhat less likely than others to have any suggestions at all, but those who did, made as many as staff members at other ranks.

The most popular proposal was the addition of courses in the field of analysis, with expansion in the fields of algebra, in probability and/or statistics, in set theory, topology, and the foundations of mathematics somewhat less frequently mentioned. New courses in a number of other fields were recommended also but uncommonly (Q. 12, Appendix B).

Staff members and the spokesmen for their departments tended to see similar needs (or absence of need) for course expansion although they were far from unanimous. Close to one-half of the teachers from departments in which the department respondent suggested adding nothing to the program themselves recommended no changes. In comparison, one-fourth of those from departments in which the department head did suggest something felt nothing new necessary or desirable. Similarly, when staff members came from a department in which the departmental spokesman proposed the introduction of courses in computer work, data processing and the like, 28 per cent suggested these also. Compared to this, proposals for these courses were made by only seven per cent of the teachers from schools in which the head failed to make such a recommendation. In connection with this general question it should be noted that suggestions for change from departmental spokesmen and their staff members reflected both recognition of gaps in the departmental program and a desire to see work in one's own specialty a part of the curriculum (Table III-11).

TABLE III-11

RELATIONSHIP BETWEEN SPOKESMAN'S SUGGESTIONS FOR COURSE ADDITIONS AND FACULTY MEMBERS' SUGGESTIONS

Additions suggested by departmental spokesman	Per cent of faculty members suggesting area when spokesman. . .		Unweighted number of faculty from school when spokesman. . .	
	Suggested it	Did not suggest it	Suggested area	Did not suggest area
Nothing suggested .	44	28	(60)	(473)
Algebra	28	10	(98)	(435)
Geometry	21	5	(77)	(456)
Analysis	25	20	(110)	(423)
Probability and/or statistics	21	9	(175)	(358)
Computer, EDP	28	7	(95)	(438)
Set theory, topology, foundations of mathematics	27	8	(128)	(405)
Courses for students in other disciplines	3	9	(121)	(412)
New degree program. .	6	*	(85)	(448)

*Less than one-half of one per cent.

Faculty Members' Work

Even in schools which emphasized teaching and de-emphasized the other components of academic work a faculty member spent a good portion of his time in non-teaching duties on-campus and in off-campus work.

One college teacher of mathematics in two, in addition to his teaching assignments, had administrative responsibilities such as department head, course coordinator, or director of the electronic computer installation. The proportion with administrative duties increased with higher academic rank, so that three-quarters of the full professors (three times the proportion among assistant professors) had some kind of administrative assignment other than just the paper work connected with their courses (Q. 13, Appendix B). Onerous though this sounds, it should be remembered from Chapter II that the teaching load of the full professor was, on the average, somewhat lighter than that of staff members at lower ranks, and that the majority of schools usually lightened work load further when a staff member took on administrative work in addition to his teaching assignments.

The kinds of administrative responsibilities assumed by, or thrust on, mathematics faculty varied with rank. One-half of those with such responsibilities were heads or departmental officers, but the proportions with this kind of a duty ranged from three-quarters of the full professors to one-seventh of the assistant professors. One-fourth of those with administrative responsibilities acted as departmental student adviser, a third as many full as assistant professors functioning in that capacity. And again, half as many full as assistant professors had formal responsibilities in the area of courses and curriculum.

Generally speaking, the responsibilities carried by a faculty member reflected his position in the school hierarchy. The assistant professor--lowest man on the totem pole save instructors and teaching assistants--rarely exercised authority over his fellow staff members unless he <u>were</u> the ranking member. The full professor, more apt to have the professional hallmark and earmarks, was more frequently assigned responsibility for the department and authority over his colleagues. In some three-quarters of the schools the department head who found the job to his liking could hold it indefinitely, or, as one departmental spokesman noted, "Well, I've been head forty years."

Off-Campus Work

It has been estimated in recent years that about one American worker in twenty held down more than one job. In the academic profession, however, as a result of its more flexible work hours, growing off-campus demand for the specialized knowledge of scholars, and economic pressures, to hold two jobs or to engage in reimbursed work off-campus was apparently more common than that. In the early 1960's, one mathematics teacher out of four did some kind of work for pay in addition to that connected with his faculty appointment. Of full professors, in fact, some four in ten had second jobs (Q. 4, Appendix B).

The mathematics faculty member with a second commitment might be doing any one of a number of things--teaching, consulting, editing or writing, farming, inventing, or practicing law, to name a few. The kind of work a staff member did off-campus depended in part on the spread of his reputation and the market for his skills, and in part on the kind of activities which school regulations permitted; as a result staff at the three ranks were characteristically engaged in different kinds of jobs. Higher rank faculty members were more apt to be serving in a consultant capacity and less likely to have second jobs teaching or outside mathematics altogether. Almost three times as many full professors as assistant professors were consultants to, or employed by, business, industry, or government, while only one-half as many had teaching positions or non-mathematical employment elsewhere.

Faculty Members' Views of Teaching, Research, and Administration

Busy with administrative chores and off-campus activities though they were, mathematics staff members nonetheless put a premium on the teaching aspect of their work. Speaking for themselves, nearly nine out of ten at each academic rank accorded it first place. Research was rated second as a work component by a majority, while almost as many gave lowest ranking to the administrative phase of work as gave highest rank to teaching. Full, associate, and assistant professors as groups were similar in the relative positions they ascribed to each of the three (Q. 14 A, Appendix B).

The positions faculty members accorded teaching, research, and administration to a considerable degree reflected the ratings made by the spokesmen for their departments (Table III-12). Their personal ratings in turn were clues to the rankings of the three components they attributed to the school as a whole (Table III-13).

Comparison of the order in which staff members personally ranked teaching, research, and administration, the order they felt the school as a whole gave to them, and the relative positions departmental spokesmen reported for the department and for the school generally, points up possible trouble spots. Research, given second place by most faculty reporting their own sentiments, was ranked lowest in all other instances. This would appear an unfavorable sign, at least, for the one faculty member in ten who placed highest value on the research angle of work. Four-fifths of them indeed felt their school thought less highly of research than they themselves did. Another potentially dissatisfied group consisted of those with formal administrative responsibilities. Compared to staff members with no such duties they gave a higher average ranking to administration as a part of academic work, while feeling at the same time that the school over-all ranked it lower than those with no responsibilities did. Some, at least, with administrative assignments felt their efforts unappreciated and unrewarded.

Other studies[5] have demonstrated a positive relationship between the orientation of a faculty member, his "local" or "disciplinary" bent, and the value he puts on teaching and on research. Though these schools and staffs differ in organization and in program from those studied previously, similar relationships appear

[5]Two of the best known of these are: Caplow and McGee, op. cit.; Alvin Gouldner, "Cosmopolitans and Locals: Toward an Analysis of Latent Social Roles," Parts I and II, Administrative Science Quarterly, Vol. 2, pp. 282-306, 444-480.

here. Ninety-four per cent of mathematics teachers with a local orientation, but 77 per cent of those with a disciplinary orientation, ranked teaching as first in importance. Conversely, only two per cent of those with a local orientation compared to 22 per cent with a disciplinary bent personally ranked research as most important.

TABLE III-12

RELATIONSHIP BETWEEN DEPARTMENTAL RATING OF COMPONENTS OF ACADEMIC WORK AND FACULTY MEMBERS' RATING

Faculty member personally rated--	Percentage distribution					
	Faculty members from departments rating as--					
	First	Second	Third	Fourth	Fifth	No rating
Teaching	Teaching ability					
First	90	64	56			
Second	9	33	39			
Third	*	*	2			
No rating	1	3	3			
Total	100	100	100			
Unweighted number of faculty members	(362)	(87)	(62)			(22)
Research	Research ability					
First	25	17	4	5	7	
Second	56	60	60	60	48	
Third	18	22	35	34	42	
No rating	1	1	1	1	3	
Total	100	100	100	100	100	
Unweighted number of faculty members	(96)	(179)	(73)	(127)	(36)	(22)
College administration	Administrative ability					
First			2	2	2	
Second			32	17	17	
Third			65	78	81	
No rating			1	3	*	
Total			100	100	100	
Unweighted number of faculty members	(-)	(9)	(78)	(126)	(298)	(22)

*Less than one-half of one per cent.

TABLE III-13

RELATIONSHIP BETWEEN FACULTY MEMBERS' RATING OF COMPONENTS OF ACADEMIC WORK AND RATING ATTRIBUTED TO SCHOOL

Faculty member thought school rated--	Percentage distribution: Faculty member personally rated as-- First	Second	Third	No rating
Teaching	**Teaching**			
First	71	39		
Second	18	53		
Third	8	7		
No rating	3	1		
Total	100	100		
Unweighted number of faculty members	(433)	(90)	(3)	(7)
College administration	**College administration**			
First		13	20	
Second		68	32	
Third		18	45	
No rating		1	3	
Total		100	100	
Unweighted number of faculty members	(6)	(102)	(418)	(7)
Research	**Research**			
First	21	8	9	
Second	31	39	11	
Third	47	50	76	
No rating	1	3	4	
Total	100	100	100	
Unweighted number of faculty members	(76)	(321)	(129)	(7)

The value a mathematics faculty member put on a particular aspect of work had, in turn, considerable bearing on whether or not he engaged in particular activities. Among staff members personally rating research first in academic work, only 14 per cent failed to report research activities in mathematics in progress; in comparison, two out of three of those rating research lowest reported no current mathematical research. Similarly, those putting less value on the administrative aspects were less likely to have formally-recognized administrative assignments than those thinking better of them. Finally, three-fourths of those giving teaching first place liked the work well enough to have taken a second teaching position; 66 per cent of those rating teaching second had also done so (Table III-14).

TABLE III-14

RELATIONSHIP BETWEEN FACULTY MEMBERS' RATING OF COMPONENTS OF ACADEMIC WORK AND PRACTICES

Components of academic work and practices	Percentage distribution		
	Faculty member personally rated in importance--		
	First	Second	Third
Research activities	Research		
No current research activities in mathematics reported	14	38	64
Unweighted number of faculty members	(76)	(321)	(129)
Administrative responsibilities	Administration		
	First or Second		
No formally-recognized administrative responsibilities reported	42		54
Unweighted number of faculty members	(108)		(418)
Teaching experience	Teaching		
No known teaching experience before appointment to current position	24	34	
Unweighted number of faculty members	(433)	(90)	

Non-Academic Work

Past Employment

With receipt of the bachelor's degree those aiming for eventual college teaching were more likely than not to turn their backs on full-time non-academic work, temporarily or permanently. After completing undergraduate work less than one-half of today's teachers had spent some time primarily in non-academic non-mathematical work. And at least one-fourth of those reporting such work included service in the armed forces in that category. An even smaller proportion (about one in six) had, since receiving the baccalaureate, worked in a non-academic mathematical capacity. Spring, 1961 associate professors, possibly because of their ages relative to world events, were more likely than others to have been employed in non-academic non-mathematical work and less likely in non-academic mathematical work (Q. 7, Appendix B). A majority of those in both kinds of non-academic employment spent less than ten years altogether at it. A handful, however, had been in non-academic work for thirty years or more.

Immediately before appointment to his school for the first time, one mathematics staff member in five had been non-academically employed by business, industry, or government, or as a member of the armed forces. Quite likely a considerable portion of the 16 per cent employed just previously by business or government was engaged in mathematical work; it is unlikely, however, that many of those in the armed forces were so employed (Q. 5, Appendix B).

Present Employment

In early 1962 four in ten of those college teachers with second jobs were serving as consultants to non-academic clients in business or government, and some two in ten were engaged in non-mathematical work, most of it non-academic in nature. By virtue of "moonlighting," one full professor out of every four had one foot on-campus and the other off-campus.

Potential Employment

Regardless of whether or not they had actually been employed in the off-campus world, many teachers had had job offers therefrom. Most often employment offers had been made by business or industry, less frequently by government or the armed forces, with one-third having job offers from the first source and one or two in ten from the other two. There was little trend by rank in the reports of offers from business or government. More full than associate professors and more associate than assistant professors, however, had been approached by the armed forces. Because there is no information on when these offers were made by the armed forces, these differences cannot be decisively explained. About twice as many spring, 1961 full professors as assistant professors had served in the armed forces, however; the offers reported may have been coincident with, or the consequence of, that service (Q. 8, Appendix B).

Spring, 1961 associate professors were less likely than others to have had job offers from business or industry or from government agencies, just as they were less likely to have worked as mathematicians outside an academic setting. Compared to full professors, the associates, as a group, appear to have been "born too late" and, relative to the assistant professors, "born too soon," mathematically.

Non-academic job offers mentioned by individual teachers were consistent with the reports of departmental spokesmen. Frequent as non-academic offers appear to be, it is important to note that offers from other colleges and universities were two to three times as common, according to departmental sources.

Training and Experience Outside Mathematics

Mathematics staffs included individuals trained in mathematics or statistics but with special abilities in other fields and others whose field of specialization was outside mathematics but who were prepared in it as well.

About two mathematics staff members in three had earned their highest degree in either mathematics or statistics. Among the remaining one in three, though, a fifth had studied mathematics or statistics as a "major" some time in his student career. Counting in minors in one or the other of the fields, nine out of ten teachers had either a degree or a major or minor in the field of his teaching assignment. Many of the rest not reporting degrees or fields of concentration in either of the two had actually been trained in fields requiring mathematical competence such as engineering or physics (Q. 1 e, f, g, Appendix B).

Education was the most common field of training of non-mathematicians teaching mathematics. Reported by others were backgrounds in physics or engineering or other sciences, and less commonly, business or accounting, a social science, humanities or language. Each of these non-mathematical fields was represented in fairly similar proportions by teachers in the three ranks.

Both those with degrees in mathematics and statistics and those specializing in other subjects had had academic work in other areas. Half of all staff members had had a major concentration in some subject other than that of their highest degree, and about three-quarters, an academic minor in still some other field. This was generally true at all three ranks.

A majority of faculty members (six out of ten) had a special ability in a non-mathematical subject. Several areas of interest--engineering, physics, science--were reported with great frequency but special competences ranging from English literature to forestry management and textiles demonstrate the variety of interests represented on a mathematics staff (Q. 9, Appendix B).

Every third college mathematics teacher had taught something other than mathematics or worked in some non-mathematical field in an academic institution. Assistant professors were least likely of all teachers to have done so, associate professors, most likely. (The latter also were most apt to have worked outside mathematics off-campus.) A majority of those working outside mathematics totaled less than ten years at it. But full professors who had been working longer altogether, on the average, also averaged more than ten years in a field other than mathematics (Q. 6, Appendix B).

Mathematics Teachers and the Field of Mathematics

Mathematical Activities

Current research.--At least one-half of these faculty members--though on the staffs of schools which, by their estimate and that of departmental spokesmen, put a low value on research work--were, in early 1962, engaged in an activity which could be broadly defined as research. This varied by rank from two-thirds of the full to one-half of the assistant professors.

Curricular or course experimentation and preparation of a book were the pursuits occupying the greatest numbers, but one faculty member in five was learning a new field of mathematics or was engaged in more conventional mathematical research. Activities such as preparing papers and articles, work with professional organizations, and acting as a consultant engaged the attention of others.

Staff members at the three ranks tended to be pursuing different types of research work. Fewer full professors than others, predictably, were learning new fields of mathematics on their own or continuing their studies formally, and fewer were preparing papers and articles. More full professors, though, were serving as consultants, working with professional groups, and experimenting with college-level courses and programs (Q. 2, Appendix B).

A school policy of lightening teaching load when a staff member took on outside-financed research projects was evidently not a factor in encouraging mathematics faculty members to take on work of the kind described. Identical proportions of teachers from schools in which the work load was "usually lightened" and from schools in which it was "not usually lightened" were carrying on work of a research nature.

Professional society memberships.--Over half of those on mathematics staffs belonged to one or more of three professional societies: the Mathematical Association of America, the American Mathematical Society, and the Society for Industrial and Applied Mathematics. With the emphasis on teaching in these colleges, it is no surprise that, disregarding rank, almost twice as many belonged to the Mathematical Association of America as to the American Mathematical Society, and only a few to the Society for Industrial and Applied Mathematics (Item c, Appendix B).

Society memberships, both in number and in kind, were related to the rank of the staff member. Three-quarters of the full, two-thirds of the associate, and one-half of the assistant professors belonged to at least one of the professional organizations. At all three ranks 80 to 90 per cent of those belonging to one of the three societies were members of the M.A.A.; with higher rank, however, an increasing proportion of those belonging to any belonged to the A.M.S.

Departmental spokesmen from the publicly-controlled schools were more likely than those from private schools to advocate greater participation in professional organizations by their staffs as a means of broadening contacts with off-campus mathematics. In the light of this it is interesting to note that two-thirds of the staff members from publicly-controlled as compared to one-half of those from privately-controlled colleges and universities were members of one or more of the three organizations.

Professional publication.--"Publish or perish" was hardly the rule in these colleges and universities, for, as we saw in Chapter II, both department and school administration were reported to put little value on publications. It is not surprising then that only a small minority of mathematics teachers had published professionally. About one teacher in ten, according to the Twenty-Volume Author Index of Mathematical Reviews, had authored or co-authored one or more professional papers or books. The range was from about one out of every four full professors to one in twenty assistant professors. Full professors also were most likely to have more than one publication to their credit (Item d, Appendix B).

Though departments generally did not stress the need for publication, the departmental rating of the importance of publication as a factor in promotion was reflected in staff members' activities. Thirty per cent of the faculty members from colleges and universities in which "amount of publication" was rated first or second in importance by the department, had themselves published. The percentage with publications decreased steadily as departmental emphasis declined; only four per cent of staff members in departments rating publication least important were listed in the Index. Whether these differences were due to the varied atmospheres of departments or whether certain departments tended to recruit staff members who had already published cannot be determined from these data (Table III-15).

TABLE III-15

RELATIONSHIP BETWEEN PROFESSIONAL PUBLICATION AND DEPARTMENTAL RATING OF IMPORTANCE OF PUBLICATION

Faculty members' publications	Percentage distribution				
	Departmental rating of "Amount of Publication" as factor in promotion in rank				
	First or second	Third	Fourth	Fifth	In-determinate
Faculty member not listed by *Index* as having any publication	70	81	92	96	100
Faculty member listed by *Index* as having one publication .	13	12	4	2	-
Faculty member listed by *Index* as having more than one publication	17	7	4	2	-
Total	100	100	100	100	100
Unweighted number of faculty members . .	(126)	(125)	(187)	(73)	(22)

Although it was a rare faculty member who had published, the prospect is for a growing number. Eleven per cent of all faculty members, unpublished as indicated by the *Index*, reported work on book manuscripts as a current research activity, while a few more were preparing papers and articles. Those who had already published were continuing their research and writing. Over a third of this group reported work on a book in 1962 and a few worked on papers and articles.

Membership in professional societies, professional publication and continuing research were all related. Seventeen per cent of those belonging to one or more of the professional societies had published in contrast to four per cent of those belonging to none of the organizations. Ninety-three per cent of those who had mathematical publications to their credit, compared to 52 per cent of those with none, were engaged in mathematical research in 1962.

Identities and Influences

Identities.--Most mathematics staff members felt mathematics to be "their" field, though a wide range of callings was represented among those who did not feel so. One-half of all those responsible for teaching college mathematics thought themselves "a mathematician" primarily and an additional one-fifth emphasized their function, describing themselves as "a teacher of mathematics." Twelve per cent saw themselves as "a teacher" without specifying subject. The remainder were a mixture of self-styled physical chemists, actuaries, social scientists, lawyers, and Indian chiefs (Item b, Appendix B).

Faculty members at the higher ranks tended to see themselves in a different light than did staff members at the lower ranks. Almost two-thirds of the full compared to one-half of the assistant professors thought of themselves primarily as "a mathematician." One-fourth of the full professors, but one-third of the assistant professors considered themselves to be either "a teacher of mathematics" or "a teacher." The increase in the number of those thinking of themselves as "a mathematician" and the decrease in number feeling themselves primarily "a teacher" or "a teacher of mathematics" with higher academic rank result from several causes--the faculty member's growing confidence in his right to call himself "a mathematician," the fact that those at the lower ranks actually do spend more time teaching, and the movement out of the field and into other occupations of those not considering themselves even potentially mathematicians.

Influences.--A majority of college mathematics teachers felt that their own careers had been strongly influenced by some mathematician at some time. Assistant professors, though, were as likely as not to feel that they had been uninfluenced. The type of influential individual mentioned most often was someone the faculty member had come to know during his own undergraduate college days or, less frequently, someone from graduate school days. Other kinds of influences--high school teachers, individuals known through their work but not personally, current colleagues, legendary figures in the field--all figured more rarely as influentials (Q. 19, Appendix B).

In part because they were thinking back over time periods of differing lengths, faculty at the three ranks differed some in the kinds of influentials they remembered. Full professors, for instance, were least inclined to recall a high school teacher or someone from a college they themselves had not attended while they, along with associate professors, were more apt than the assistant professors to feel that someone from undergraduate college had left his mark on them.

A Career in Mathematics

Not all who taught college mathematics in 1960-61 thought of that as their long-term career field. One staff member in four, in fact, made an explicit statement to the contrary. The percentage of those teaching mathematics but feeling their true calling to be elsewhere was greatest among the assistant professors, least among the full professors (Q. 18, Appendix B).

Three out of four who had settled on mathematics as their life work had made that decision by the time they graduated from undergraduate school, and almost one-half had reached the decision while they were undergraduates when the model of a college mathematics teacher was usually first available.[6] A few remembered settling on a career in mathematics when of grammar school age or younger. The fact that such reports were made by 12 per cent of the full professors and by only two per cent of those at the assistant rank tells more about the memory factor than about any change in mathematics' efforts at recruiting (Table III-16).

TABLE III-16

AGE AT WHICH FACULTY MEMBER DECIDED ON CAREER IN MATHEMATICS

Age of career decision	Percentage distribution				
	Spring, 1961 rank				
	Total	Prof.	Assoc. prof.	Asst. prof.	Other
13 years old or less, or "grammar school age"	6	12	7	2	
14-17 years old, or "high school age" .	24	24	23	25	
18-22 years old, or "college age" . . .	43	42	45	43	
23-25 years old . . .	14	8	14	16	
26-30 years old . . .	7	9	4	8	
31 years old or more .	4	2	4	5	
Age of decision indeterminate	2	3	3	1	
Total	100	100	100	100	
Unweighted number of faculty members . .	(441)	(126)	(126)	(184)	(5)

[6]See R. L. Wilder, Material and Method in Undergraduate Research in Mathematics (Northfield, Minn.: Carleton College, 1961), p. 9.

The type of individual which the mathematics teacher felt had influenced his own career was related to the age at which he reported having decided on his life's work. Faculty members who reported a high school teacher as the earliest type of influence on career were very likely to say they had decided on their career in high school; those naming someone at their undergraduate college were most likely to say they had settled on mathematics while an undergraduate. Staff members reporting someone at graduate school as the earliest strong influence were most likely of all teachers to report a decision on career postponed to post-baccalaureate years, though a plurality of these, too, reported they had chosen mathematics as college undergraduates (Table III-17).

TABLE III-17

RELATIONSHIP BETWEEN AGE OF CAREER DECISION AND KIND OF INDIVIDUAL INFLUENCING FACULTY MEMBER

Reported age of career decision	Percentage distribution Kind of individual named as earliest strong influence		
	High school teacher(s)	Individual(s) at undergraduate school	Individual(s) at graduate school
Grammar school age or younger .	10	8	6
High school age	58	21	16
Undergraduate college age	26	55	47
When 23-25 years old	-	11	14
When 26-30 years old	1	2	10
When over 30 years old	-	1	7
Age of decision indeterminate . .	5	2	-
Total	100	100	100
Unweighted number of faculty members naming an influence	(23)	(174)	(153)

Having decided on mathematics as their field, most "careerists" were satisfied with the choice. Forty-four per cent expressed the sentiment that mathematics was the "only career" that could satisfy them, and only one in one hundred felt that there were other more satisfying occupations. In contrast, 31 per cent of the "non-careerists" expressed the view that there were other careers more satisfying than mathematics. The full professor rank contained the largest group of completely contented individuals, 51 per cent feeling that mathematics was the "only career" and none that there were more satisfying pursuits. Among assistant professors, however, almost two out of three had some reservation about their choice (Table III-18).

TABLE III-18

RELATIONSHIP BETWEEN SATISFACTION WITH CAREER AND ACADEMIC RANK

Satisfaction with career	Percentage distribution Spring, 1961 rank				
	Total	Prof.	Assoc. prof.	Asst. prof.	Other
It is the only career that could really satisfy me	44	51	49	36	
It is one of several careers that I could find almost equally satisfying	53	48	46	61	
I can think of other careers that would be more satisfying to me	1	-	1	3	
No answer	2	1	4	*	
Total	100	100	100	100	
Unweighted number of faculty members	(441)	(126)	(126)	(184)	(5)

*Less than one-half of one per cent.

Differences between those choosing mathematics as a career and those who did not were summed up succinctly by the faculty members themselves. Asked to indicate the characteristics of mathematics which they found most attractive, six out of ten "non-careerists" cited the numerous applications possible with mathematics; a similar proportion of "careerists," on the other hand, picked the purity and abstract quality, or the creative and intuitive aspects of the field. To the "non-careerist," mathematics was a means to an end, to the "careerist," an end in itself.

Some Types of College Mathematics Teachers

Efforts to combat manpower shortages by altering teaching procedures and making the instructor more effective in the classroom must take into account the fact that teaching situations and teachers vary. In some institutions, for instance, the teacher-student ratio is such that the need for more efficient teaching is critical while in others it is much less pressing. Furthermore some faculty members identify themselves with the field of mathematics, feeling problems in the field to be their problems but others identify less strongly or not at all with the subject. Finally, academicians differ in the extent to which they are concerned with teaching and teaching problems compared to research activities and in the degree to which they focus attention on the local institution rather than the discipline at large.

It is clear from this that mathematics teachers constitute not one audience but a number of audiences and educational activities and channels of communication utilized successfully in reaching one may be less effective in reaching others. Several types of faculty member, important in terms of this general problem, are outlined in the following section.

Faculty Members in "More-Selective" vs. "Less-Selective" Institutions

Academic departments and their staffs may be called on to handle comparatively small numbers of well-qualified undergraduate students, on the one hand, or on the other, fairly large numbers of relatively unselected ones. In the field of mathematics these extremes are approximated by those institutions having a mathematics requirement for admission to, but not graduation from, an Arts and Science program contrasted to those requiring college-level work in mathematics for all earning a baccalaureate in the Arts and Sciences.[7]

The important difference between the two is that, in the first instance, final determination of who and how many enroll in mathematics lies with the department, but in the second, with the school administration as a whole. From the standpoint of student load mathematics teaching in the first case is apt to be more stimulating and rewarding, but in the second, less stimulating and even burdensome. This conclusion is consistent with several other characteristics of schools of these two kinds. For example, weekly teaching load in mathematics in "less-selective" institutions (those with a graduation requirement in mathematics) averages some two hours greater than in "more-selective" schools (those with only an admission requirement in mathematics). A sabbatical system is about half as common in the former also. Furthermore, "less-selective" institutions are not as likely as others to "place" mathematically students entering the Arts and Sciences program and not as likely to have an "advanced placement" program in mathematics. Variations like these, together with differing mathematical environments of departments, require consideration in programs to increase the number of capable college mathematics teachers and the classroom efficiency of those already teaching.

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[7]In certain respects these resemble what Martin Trow has described on the school level as "highly-selective" and "people-processing." See Martin A. Trow, "Reflections on the Recruitment to College Teaching," in Faculty Supply, Demand, and Recruitment, Proceedings of a Regional Conference Sponsored by the New England Board of Higher Education (Winchester, Massachusetts, Nov. 5-7, 1959), p. 62.

In skeleton form mathematics staff members from schools of these two kinds look like this:

TABLE III-19

CHARACTERISTICS OF MATHEMATICS FACULTY MEMBERS IN MORE-SELECTIVE AND LESS-SELECTIVE INSTITUTIONS

Faculty member's characteristics	Faculty members from schools having mathematics requirement in Arts & Science program for—	
	Admission only	Graduation
Age		
Less than 40 years old in 1961	31%	40%
60 years old or more in 1961	14	11
Training		
Doctorate in mathematics, statistics	40	18
Doctorate in other field	17	15
Non-doctorate but continued education	72	64
Work history		
No prior teaching experience	24	34
Prior college, university teaching	52	35
Only prior elementary or secondary teaching .	14	27
Joined staff 1956-57 or later	37	42
Still on staff in 1961-62	92	92
Identification with mathematics		
Highest degree in mathematics, statistics . .	68	65
Membership in one or more of three societies.	64	59
Named mathematician as influence	63	60
Considered self careerist in mathematics . .	79	74
Special non-mathematical interests	59	61
Reported offer of mathematical job		
from business or industry	37	38
from government	21	26
from armed forces	14	4
Research orientation		
Reported mathematical research activity in 1961-62	63	54
Published in mathematics	16	7
Personally rated research "first"	13	4
Thought school rated research "first"	13	7
Attracted by maths' creative, intuitive side.	35	22
Attracted by maths' potential for application	31	39
Teaching orientation		
Considered self "teacher"	26	39
Personally rated teaching "first"	80	95
Thought school rated teaching "first"	67	57
Relations to school		
Student at school previously	18	32
Had formal administrative responsibilities .	53	53
Had paying off-campus work	31	33
"Institutional" orientation	49	48
Per cent of college mathematics teachers	44	22

To sum up, the faculty member from the "less-selective" school compared to his counterpart from the "more-selective" one is...

...similar in orientation to the local institution and the discipline at large

...similar in his relations with the school employing him

...somewhat more likely to have studied earlier at the school in which he teaches

...similar in seeing mathematics as his field of interest and engaging in mathematical activities

...less likely to have a doctoral degree in any subject

...more likely to put primary emphasis on the teaching aspect of academic work

...less likely to have had other college or university teaching experience

...less likely to feel his own school rates teaching first as an aspect of work

...less likely to be research-oriented and to pursue research activities

...equally likely to be reached in educational activities of professional mathematical bodies

...equally likely to be reached through formal academic channels such as summer and academic year programs

...more likely to be reached in educational activities channeled through the department

...less likely to be reached in educational activities channeled through the school as a whole

Non-Careerists vs. Careerists of Institutional and Disciplinary Orientation

Most of those teaching college mathematics in 1960-61 felt they were working in their chosen field. To the extent that these were interested in teaching rather than other types of work, a considerable potential for improved mathematics teaching existed. A minority of faculty members only, careerists in other fields temporarily appointed to mathematics staffs or individuals with mathematical training but preferring other occupations, presumably have less interest in becoming better teachers of college mathematics.

"Careerists" and "non-careerists" in mathematics had these characteristics:

TABLE III-20

MATHEMATICS FACULTY MEMBERS' CHARACTERISTICS IN RELATION TO CHOICE OF MATHEMATICS AS CAREER FIELD

Faculty member's characteristics	Careerist		Non-careerist
	Disciplinary orientation	Institutional orientation	
Age			
Less than 40 years old in 1961	45%	31%	38%
60 years old or more in 1961	10	17	10
Training			
Doctorate in mathematics, statistics .	50	25	1
Doctorate in other field	12	10	31
Non-doctorate but continued education . .	89	71	72
Work history			
No prior teaching experience	27	23	27
Prior college, university teaching . . .	51	41	29
Only prior elem. or second. teaching. .	14	29	32
Joined staff 1956-57 or later	53	34	46
Still on staff in 1961-62	89	95	84
Identification with mathematics			
Highest degree in math, statistics . . .	85	72	12
Membership in 1 or more of 3 societies.	79	60	23
Named mathematician as influence . . .	80	64	28
Special non-mathematical interests . . .	56	50	83
Reported offer of mathematical job			
from business or industry	53	36	11
from government	27	18	6
from armed forces	14	11	6
Some years as academic non-mathematician	12	27	76
Research orientation			
Reported mathematical research activity in 1961-62	77	47	38
Published in mathematics	21	7	2
Personally rated research "first" . . .	26	1	5
Thought school rated research "first" .	15	8	5
Attracted by maths' purity, abstract quality	46	40	11
Attracted by maths' creative, intuitive side	38	26	15
Attracted by maths' potential for application	20	38	59
Teaching orientation			
Personally rated teaching "first"	71	94	91
Thought school rated teaching "first" .	57	76	67
Relations to school			
Student at school previously	15	23	33
Had formal admin. responsibilities . .	43	55	46
Had paying off-campus work	38	21	31
Only mathematics admission requirement in school	48	43	36
Graduation mathematics requirement in school	22	24	23
Per cent of college math. teachers	34	38	25

To sum up, the faculty member who is a "non-careerist" in mathematics compared to his "careerist" counterpart is...

...similar in orientation to the local institution and the discipline at large

...similar in his relations with the school employing him

...more likely to have studied earlier at the school at which he teaches

...totally dissimilar in seeing mathematics as his field of interest and much less likely to engage in mathematical activities

...less likely to have a doctoral degree in any subject

...somewhat more likely to put primary emphasis on the teaching aspect of academic work

...less likely to have had other college or university teaching experience and more likely to have had only elementary or secondary teaching experience earlier

...equally likely to think his own school rates teaching first as an aspect of work

...less likely to be research-oriented in mathematics and to pursue research activities

...much less likely to be reached in educational activities of professional mathematical bodies

...equally likely to be reached through formal academic channels such as summer and academic year programs

...less likely to be reached in educational activities channeled through the school as a whole because of greater geographic mobility

And the "careerist" focussing attention on his local institution compared to the "careerist" oriented to the field at large is

...older, on the average

...more likely to have on-campus responsibilities and less likely to have off-campus commitments

...slightly more likely to have studied earlier at the school at which he teaches

...identical in seeing mathematics as his field of interest but less likely to engage in mathematical activities

...less likely to have a doctoral degree in any subject

...more likely to put primary emphasis on the teaching aspect of academic work

...less likely to have had other college or university teaching experience and more likely to have had only elementary or secondary teaching experience earlier

...more likely to think his own school rates teaching first as an aspect of work

...less likely to be research oriented and to pursue research activities

...less likely to be reached in educational activities of professional mathematical bodies

...less likely to be reached through formal academic channels such as summer and academic year programs

...more likely to be reached in educational activities channeled through the school as a whole

More efficient and effective teaching can be fostered among such types of faculty members as these.

APPENDIX A

APPENDIX A

Marginal Percentages: Responses of Spokesmen for Mathematics Departments in Interviews Conducted December, 1961--January, 1962

Q 1. Does (SCHOOL) currently have a requirement in high school mathematics for students applying for admission as freshmen to the Arts and Sciences program?

Variable	Non-Ph.D. Granting Schools[a] Total	Public Control	Private Control
School has no Arts and Sciences Program	12%	7%	15%
School has Arts and Sciences Program .	88	93	85
No current requirement, no plans for any	23	39	14
No current requirement, some plans for one reported	3	1	4
Course requirement, determinate in nature	36	32	38
Course requirement, indeterminate in nature	26	17	31
Examination requirement but no course requirement	12	11	13
Total	100%	100%	100%
Unweighted number of schools[b].	(89) (80)	(37) (35)	(52) (45)

[a]Schools granting no Ph.D. in mathematics or statistics, 1948-59. Based on Table 6, Page 1155, American Universities and Colleges, 8th ed. (American Council on Education, 1960), and U.S. Office of Education, Earned Degrees Conferred 1958-59, Bachelors and Higher Degrees, OE-54013 Circular No. 636 (Washington: U.S. Government Printing Office, 1961).

[b]The data were derived from the responses given by departmental respondents from a random sample of colleges and universities. Since these schools were selected with unequal probabilities, it is necessary to weight the data from the respondent from any given school by the reciprocal of the probability that the school had of being selected. All of these percentages are based on the weighted distribution. But since the reliability of a given statistic is a function of the number of actual cases, the N's given are unweighted. Consequently, one cannot combine subgroups by weighting the relevant distributions by the given N's, nor should one take the distribution of N's among the subgroups as being equivalent to the weighted distribution for the particular variable involved.

Q 2. To earn the bachelor's degree in the Arts and Sciences program here, can a student be awarded the degree without taking any college-level mathematics at all?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
School has no Arts and Sciences Program	12%	7%	15%
School has Arts and Sciences Program .	88	93	85
Arts and Sciences students can be awarded degree without taking any college-level mathematics	79	67	85
Arts and Sciences students cannot be awarded degree without taking any college-level mathematics . .	21	33	15
Total	100%	100%	100%
Unweighted number of schools .	(89) (80)	(37) (35)	(52) (45)

Q 3. Does (SCHOOL) have a regular system of sabbatical leave or other similar leave with pay for faculty members?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction	98	100	97
Mathematics instruction but no system of sabbatical leave or other leave with pay	39	29	43
Mathematics instruction and a system of sabbatical leave or other leave with pay	61	71	57
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 3A. Who is eligible to participate (in this system of leave)?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
Eligibility reported to be based on:			
Years of service only	42%	56%	33%
Rank only	4	2	5
Tenure status only	1	2	-
Combination of rank and years of service	30	20	37
Combination of tenture and years of service	3	1	5
Basis indeterminate	13	14	12
No regular system but leave with pay can be arranged	7	5	8
Total	100%	100%	100%
Unweighted number of schools with some leave with pay . .	(58)	(29)	(29)

B. What proportion of your salary does school pay when you are on sabbatical?

School pays set fraction of annual salary	90%	90%	89%
School pays full salary minus pay for substitute	2	6	-
School pays flat amount regardless of amount of annual salary	6	-	10
Amount paid indeterminate	2	4	1
Total	100%	100%	100%
Unweighted number of schools with some leave with pay . .	(58)	(29)	(29)

Q 3C. (1) Since the summer of 1959 (and including this academic year), has any member of the mathematics faculty been on sabbatical or on similar leave with pay? How many have been on sabbatical...?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No one on leave though school has system	70%	65%	73%
One gone	23	22	24
Two gone	1	2	-
Three or more gone	3	3	2
Indeterminate whether any gone	3	8	1
Total	100%	100%	100%
Unweighted number of schools with some leave with pay . .	(58)	(29)	(29)

(2) Why is that (that no one has been on sabbatical or leave with pay when school has such a system)?

	Total
No one eligible in the period specified	25%
Someone eligible but did not request leave for indeterminate reason	21
Someone eligible but did not request leave because of heavy workload, staff shortage	24
Someone eligible but did not request leave because of inadequacy of financial arrangements	2
Someone eligible but did not request leave because of other given reasons	14
Indeterminate why no one has been on leave	15
Total[a]	101%
Unweighted number of schools with some leave with pay but no mathematics faculty member on leave in period specified	(35)

[a]Total is more than 100 per cent because some gave more than one reason.

Q 4. Can faculty members from (SCHOOL) ever take leave without pay, to study or write, do research, serve as a visiting professor elsewhere, or take a temporary job with government or in industry?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some instruction but no salaried mathematics instructors (Catholic schools)	2	-	3
Some instruction and salaried instructors	96	100	94
No leave without pay system	6	-	9
Some leave without pay system . . .	94	100	91
Total	100%	100%	100%
Unweighted number of schools .	(89) (87)	(37) (37)	(52) (50)

A. Since the summer of 1959 and up to the present, has (any member of the mathematics department) (anyone who teaches mathematics) taken leave like this?

No one on leave though school has system	62%	59%	64%
One instance of leave taken in period specified	19	18	19
More than one instance of leave taken in period specified	9	14	6
Indeterminate number of instances of leave taken in period	8	9	8
Indeterminate whether such leave taken	2	-	3
Total	100%	100%	100%
Unweighted number of schools with leave without pay system	(83)	(37)	(46)

Q 5. In your opinion what is the main benefit the individual faculty member derives from being on leave?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Chance to continue own formal education	42	61	33
Chance for rest, vacation, release from pressure	7	6	7
Opportunity to further career, to advance financially	7	10	6
Opportunity to pursue own interests in the field	39	30	44
Make faculty member a better teacher	25	38	18
General, unspecified benefits . . .	52	47	55
No answer to question	2	-	3
Total[a]	174%	192%	166%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

[a]Total is more than 100 per cent because some reported more than one benefit.

Q 6. What is (SCHOOL'S) policy as far as faculty members attending out-of-town professional meetings is concerned? Does it just permit time off for such purposes or permit time off and payment for some portion of expenses, or just what?

Variable	Non-Ph.D. Granting Schools					
	Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction and instructors	98		100		97	
No set policy		4		-		6
Policy of no time off, no expenses.		2		-		3
Policy of time off for anyone but expenses only if society officer, meeting participant, or school representative		7		5		9
Above policy plus expenses for one meeting for all other staff . . .		15		7		19
Policy of time off and expenses under other set conditions . . .		7		14		3
Policy of time off and expenses but conditions unspecified . . .		63		74		57
No answer to question		2		-		3
Total		100%		100%		100%
Unweighted number of schools .	(89)	(88)	(37)	(37)	(52)	(51)

6A. How frequently can any one faculty member take time off to attend meetings?

Variable	Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction and instructors	98		100		97	
No set policy		4		-		6
Policy of no time off, no expenses.		2		-		3
Policy of time off and specified limit to number of absences . . .		36		33		37
Policy of time off but no specified limit to number of absences for any one faculty member		50		64		43
Policy of time off but indeterminate whether or not there are specified limits		6		3		8
No answer to whole question		2		-		3
Total		100%		100%		100%
Unweighted number of schools .	(89)	(88)	(37)	(37)	(52)	(51)

Q 7A. On the average and disregarding instances in which the teaching load is lightened due to administrative duties or research, how many hours each week in the regular school year do mathematics faculty members at the various ranks teach? (How many hours a week altogether do staff at the various ranks teach?)

Variable	Non-Ph.D. Granting Schools Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no academic ranks in school	8	-	11
Some mathematics instruction and academic ranks in school	90	100	86
FULL PROFESSOR			
8 hours or less per week	5	7	4
9 hours	3	-	4
10 hours	5	4	6
11 hours	2	1	3
12 hours	30	16	39
13 hours	9	11	7
14 hours	11	11	11
15 hours	27	35	23
16 hours or more	8	15	3
Total	100%	100%	100%
Unweighted number of schools .	(89) (84)	(37) (37)	(52) (47)
ASSOCIATE PROFESSOR			
8 hours or less per week	*%	-%	*%
9 hours	5	-	7
10 hours	4	4	5
11 hours	3	-	4
12 hours	27	14	36
13 hours	7	7	7
14 hours	16	17	16
15 hours	28	37	22
16 hours or more	8	15	3
Varies or no answer	2	6	-
Total	100%	100%	100%
Unweighted number of schools .	(84)	(37)	(47)

*Stands for less than one-half of one per cent throughout.

Q 7A. Continued

Variable	Non-Ph.D. Granting Schools Total	Public Control	Private Control
ASSISTANT PROFESSOR			
8 hours or less per week	*%	-%	*%
9 hours	4	-	6
10 hours	5	4	6
11 hours	2	-	4
12 hours	27	17	32
13 hours	6	6	7
14 hours	15	13	16
15 hours	33	45	26
16 hours or more	8	15	3
Total	100%	100%	100%
INSTRUCTOR			
8 hours or less per week	*%	-%	*%
9 hours	3	-	5
10 hours	3	-	5
11 hours	3	-	5
12 hours	23	14	28
13 hours	6	6	7
14 hours	16	17	15
15 hours	33	47	24
16 hours or more	7	14	3
Varies or no answer	6	2	8
Total	100%	100%	100%
TEACHING ASSISTANTS			
School has academic ranks but no teaching assistants	53%	32%	66%
School has academic ranks and teaching assistants	47	68	34
Total	100%	100%	100%
Unweighted number of schools .	(84)	(37)	(47)

Q 7B. Is the teaching load at (SCHOOL) usually lightened when a faculty member takes on . . .

Variable	Non-Ph.D. Granting Schools Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
ADMINISTRATIVE DUTIES?			
Usually lightened	71%	72%	71%
Not usually lightened	27	28	26
Inapplicable	2	-	3
JOB OF ADVISING STUDENTS?			
Usually lightened	10%	6%	12%
Not usually lightened	84	94	79
Inapplicable	6	-	9
COMMITTEE WORK?			
Usually lightened	6%	-%	9%
Not usually lightened	87	100	81
Inapplicable	7	-	10
RESEARCH PROJECTS WITH OUTSIDE FINANCING?			
Usually lightened	27%	23%	29%
Not usually lightened	32	47	24
Inapplicable	39	30	44
No answer	2	*	3
OUTSIDE CONSULTATION WORK?			
Usually lightened	7%	10%	6%
Not usually lightened	60	60	59
Inapplicable	31	24	35
No answer	2	6	-
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 7C. At (SCHOOL) what is the usual length of the term of office of the chairman (or head) of the mathematics faculty?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors but single-person faculty or no full-time instructors	8	-	11
Some instructors and instruction and more than one full-time equivalent . .	90	100	86
Usual term of office without limit.	74	69	77
Usual term of office limited and depends on administration	8	7	8
Usual term of office limited to set number of years with no exceptions reported	9	7	10
Usual term of office limited to set number of years with exceptions reported	5	7	4
Usual term of office indeterminate.	4	10	1
Total	100%	100%	100%
Unweighted number of schools .	(89) (84)	(37) (37)	(52) (47)

7D. How much does the senior faculty (in the department) have to say in the choice of the head (chairman)--a great deal, a moderate amount, or almost nothing at all?

Great deal	12%	9%	14%
Moderate amount	24	32	19
Almost nothing	45	51	41
No answer or no senior faculty	19	8	26
Total	100%	100%	100%
Unweighted number of schools .	(84)	(37)	(47)

Q 8. How is "academic tenure" attained here? Does it depend on reaching a certain academic rank, or is it acquired through a combination of rank and years of service, or what is the process?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Years of service only	26	42	19
Combination of years of service and academic rank	44	36	49
Rank only	4	1	5
Combination of years of service and academic degree	12	17	9
Other combinations	2	1	2
Tenure system but indeterminate requirements	3	-	4
No tenure system, non-Catholic school	7	3	9
No tenure system, Catholic school	2	-	3
Total	100%	100%	100%
Unweighted number of schools	(89) (88)	(37) (37)	(52) (51)

Q 9. Does (SCHOOL) have a compulsory retirement age or an age at which tenure terminates for faculty? What is it?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
No compulsory retirement age or tenure termination reported . . .	14	6	18
Retirement age of 65	64	53	69
Age of 66	-	-	-
Age of 67	3	1	4
Age of 68	2	4	1
Age of 69	-	-	-
Age of 70 or over	17	36	8
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 10. What would minimum and maximum salaries in the mathematics department be for . . . (For people who teach mathematics here, what would minimum and maximum salaries be . . . ?)

Variable	Non-Ph.D. Granting Schools: Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no ranks, no salary, or no scale	25	21	27
Some mathematics instruction and ranks and salary scale	73	79	70
FULL PROFESSOR, MINIMUM			
Less than $5,500	9%	7%	10%
$5,500 - 6,499	13	7	16
$6,500 - 7,499	24	24	24
$7,500 - 8,499	17	18	17
$8,500 - 9,499	12	11	13
$9,500 -10,499	18	25	14
$10,500-11,499	2	3	1
$11,500 and over	*	1	-
No answer	5	4	5
Total	100%	100%	100%
FULL PROFESSOR, MAXIMUM			
Less than $7,500	6%	-%	9%
$7,500 - 8,499	28	33	26
$8,500 - 9,499	8	12	6
$9,500 -10,499	8	9	7
$10,500-11,499	6	5	6
$11,500-12,499	11	14	10
$12,500-13,499	8	14	4
$13,500-14,499	4	11	1
$14,500-15,499	1	-	2
$15,500 and over	2	2	1
No limit or no answer	18	-	28
Total	100%	100%	100%
Unweighted number of schools .	(89) (70)	(37) (31)	(52) (39)

Q 10. Continued

Variable	Non-Ph.D. Granting Schools Total	Public Control	Private Control
ASSOCIATE PROFESSOR MINIMUM			
Less than $4,500	3%	7%	-%
$4,500 - 5,499	16	7	22
$5,500 - 6,499	25	25	25
$6,500 - 7,499	24	23	25
$7,500 - 8,499	22	26	20
$8,500 and over	3	8	-
No answer	7	4	8
Total	100%	100%	100%
ASSOCIATE PROFESSOR, MAXIMUM			
Less than $5,500	3%	-%	4%
$5,500 - 6,499	8	7	8
$6,500 - 7,499	19	25	15
$7,500 - 8,499	16	18	16
$8,500 - 9,499	19	11	23
$9,500 -10,499	19	31	12
$10,500-11,499	2	6	1
$11,500 and over	*	2	-
No answer	14	-	21
Total	100%	100%	100%
ASSISTANT PROFESSOR, MINIMUM			
Less than $4,500	7%	10%	6%
$4,500 - 5,499	38	32	42
$5,500 - 6,499	35	43	30
$6,500 and over	17	15	18
No answer	3	-	4
Total	100%	100%	100%
ASSISTANT PROFESSOR, MAXIMUM			
Less than $5,500	3%	-%	5%
$5,500 - 6,499	22	11	29
$6,500 - 7,499	31	39	27
$7,500 - 8,499	30	33	27
$8,500 - 9,499	5	15	-
$9,500 and over	1	2	-
No answer	8	-	12
Total	100%	100%	100%
Unweighted number of schools	(70)	(31)	(39)

Q 10B. Would this salary cover "off-campus" teaching, evening courses, and the like, or would there be added reimbursement for teaching such courses?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
Would cover such activities	30%	34%	28%
Would not cover all such	47	47	47
Inapplicable; school offers none . . .	20	19	20
No answer	3	-	5
Total	100%	100%	100%
Unweighted number of schools with rank and set salary scale	(70)	(31)	(39)

Q 11. Is any restriction placed on faculty summer activities or income?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction	98	100	97
No restriction of any kind	88	90	87
Restriction on activities	10	3	13
Restriction on income	2	7	-
Restriction on both	*	-	*
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 12A. How are the organization and content of undergraduate mathematics courses determined?

Variable	Non-Ph.D. Granting Schools: Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no program in mathematics	4	-	6
Some mathematics instruction and a program in mathematics	94	100	91
By individual instructor(s) only	15	6	20
By course chairman only	1	-	1
By faculty committee, staff as whole	46	55	40
By department head only	1	2	1
By combination of individuals above	20	13	25
Depends on course level	8	17	2
Depends on number of sections .	9	6	11
No answer	*	1	-
Total	100%	100%	100%
Unweighted number of schools	(89) (86)	(37) (37)	(52) (49)

12B. And who usually chooses the textbooks for courses?

Variable	Total	Public Control	Private Control
Individual instructor(s) only . .	31%	17%	39%
Course chairman only	3	-	4
Faculty committee, staff as whole.	24	37	18
Combination of individuals above .	19	10	24
Depends on course level	11	25	3
Depends on number of sections . .	12	11	12
Total	100%	100%	100%
Unweighted number of schools	(86)	(37)	(49)

Q 13, 13A. Does the mathematics department (do you) do anything special to ensure effectiveness in the teaching of undergraduate mathematics courses? How do you go about it?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Employ no procedures to ensure effective teaching	29	15	33
Employ procedures only with TA's or graduate assistants	*	-	*
Confer with individual teachers . .	54	49	57
Discuss at faculty meetings	40	60	31
Observe, visit classes	18	22	15
Confer with, observe students . . .	3	9	-
Consultation, cooperation of those teaching same course	5	3	5
Other procedures	7	9	6
No answer whether or not procedures employed	2	-	3
Total[a]	158%	167%	150%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

[a]Total is more than 100 per cent because some reported more than one procedure.

Q 14A. When promotion (in rank) is under consideration, how does the mathematics department (would the mathematics staff) rate the importance of teaching ability, amount of publication, research ability, administrative ability, and personal characteristics . . . (and academic degrees)?

Q 14B. And how would the school administration as a whole rate these five (six) considerations, would you say?

Variable	Departmental Rating			Administration Rating		
	Total	Public Control	Private Control	Total	Public Control	Private Control
No instruction	2%	-%	3%	2%	-%	3%
Instruction but no ratings . .	9	9	9	10	5	12
Instruction and some ratings .	89	91	88	88	95	85
TEACHING ABILITY						
First . . .	91%	91%	91%	85%	83%	86%
Second . .	7	7	7	12	12	12
Third . . .	2	2	2	2	1	2
Fourth . .	-	-	-	1	4	-
Fifth . . .	-	-	-	*	*	-
AMOUNT OF PUBLICATION						
First . . .	1%	1%	1%	5%	8%	4%
Second . .	3	5	2	6	12	2
Third . . .	28	19	32	21	12	26
Fourth . .	33	36	32	36	40	33
Fifth . . .	35	39	33	32	28	35
RESEARCH ABILITY						
First . . .	6%	3%	8%	2%	4%	1%
Second . .	26	25	26	20	20	21
Third . . .	21	33	14	22	26	19
Fourth . .	35	26	40	41	32	46
Fifth . . .	12	13	12	15	18	13
ADMINISTRATIVE ABILITY						
First . . .	-%	-%	-%	*%	1%	-%
Second . .	4	5	3	9	12	7
Third . . .	33	29	34	39	30	43
Fourth . .	32	31	33	17	16	17
Fifth . . .	31	35	30	35	41	33
Unweighted number of schools .	(89) (82)	(37) (34)	(52) (48)	(89) (80)	(37) (34)	(52) (46)

Q 14A., 14B. Continued

Variable	Departmental Rating: Total	Departmental Rating: Public Control	Departmental Rating: Private Control	Administration Rating: Total	Administration Rating: Public Control	Administration Rating: Private Control
PERSONAL CHARACTERISTICS						
First	-%	-%	-%	4%	4%	5%
Second	60	64	59	55	44	62
Third	9	12	7	13	26	5
Fourth	12	10	13	8	11	6
Fifth	19	14	21	20	15	22
Unweighted number of schools	(82)	(34)	(48)	(80)	(34)	(46)
ACADEMIC DEGREES						
First	5%			26%		
Second	62			51		
Third	24			10		
Fourth	5			4		
Fifth	-			5		
Sixth	4			4		
Unweighted number of schools with "small" department and giving rating	(23)			(24)		

Q 15. Here at (SCHOOL) is there any limit on the number of years a faculty member can spend at the various academic ranks?

Variable	Non-Ph.D. Granting Schools: Total	Non-Ph.D. Granting Schools: Public Control	Non-Ph.D. Granting Schools: Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no academic ranks or Catholic orders only.	10	-	14
Some instruction and academic ranks and at least some lay faculty	88	100	83
No limit for any ranks in school . .	71	86	65
Some limit for at least one rank . .	29	14	35
Unweighted number of schools . .	(89) (83)	(37) (37)	(52) (46)

Q 15A. What is the limit at the rank of Instructor? Assistant Professor? Associate Professor?

	Total
Schools have some limit for at least one rank:	
Some limit on number of years as Instructor	100%
Some limit on number of years as Assistant Professor . .	63%
Some limit on number of years as Associate Professor . .	20%
Unweighted number of schools	(22)

Q 16. About how many individuals who taught mathematics here at the rank of instructor, lecturer, or higher, have left during the past five years?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction	98	100	97
None left	19	15	22
Some left	79	85	75
Indeterminate whether any left . . .	2	-	3
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 16A. How many of these would you have liked to have stay on?

Wanted none to stay on	16%	23%	12%
Wanted some but not all to stay on . .	45	54	39
Wanted all to stay on	34	22	41
Indeterminate whether or not wanted any to stay on	5	1	8
Total	100%	100%	100%
Unweighted number of schools with some mathematics teachers known to have left during past five years	(74)	(33)	(41)

Q 16B. Among those you would have liked to have stay on, what were the main reasons they left, would you say?

and

Q 16C. In how many cases would your being able to pay a higher salary or award a promotion have enabled you to keep here someone you wanted to keep?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
Salary, financial reasons specified .	26%	45%	16%
Promotion, advancement, or greater chance for them	29	40	23
Bigger school, school with graduate department	8	18	3
Continue own education	28	33	25
Other personal reasons: health, family	16	16	17
Retirement age	14	11	15
Miscellaneous, primarily aspects of school or its facilities	16	6	21
Indeterminate reason	*	1	-
Total[a]	137%	170%	120%
Unweighted number of schools with teacher leaving, whom school would have liked to have stay on	(58)	(25)	(33)

[a]Total is more than 100 per cent because some reported more than one.

Q 16D. Of those you would have liked to keep, how many went to teach at another college, went into business or industry, went into government work, went back to their studies?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
One or more:			
Went to teach at another college .	45%	59%	37%
Went into business or industry . .	12	28	4
Went into government work	6	9	5
Went back to their studies	33	45	26
Retired	10	11	10
Miscellaneous destinations	18	7	24
Indeterminate destinations	8	4	10
Total[a]	132%	163%	116%
Unweighted number of schools with teacher leaving whom school would have liked to have stay on	(58)	(25)	(33)

Q 17, 17A. About how many of the individuals currently teaching mathematics here have received outside job offers for work in mathematics during the past five years? Were these offers primarily from industry, government, or other schools?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but "small" department	50	38	55
Some mathematics instruction and "large" department	48	62	42
No outside offers to current staff that respondent is aware of . . .	11	4	16
One or more offers from industry .	32	40	25
One or more offers from government.	22	29	15
One or more offers from colleges or universities	68	74	63
One or more offers from other or indeterminate sources	1	-	2
Indeterminate whether or not any offers to current staff	7	4	9
Total[a]	141%	151%	130%
Unweighted number of schools .	(89) (61)	(37) (30)	(52) (31)

17B. Did your school make a counter-offer of promotion or salary increase in order to keep these people here?

No outside offer that respondent is aware of	11%	4%	16%
At least one instance of counter-offer reported	21	14	25
No instances at all of counter-offers reported	61	78	49
Indeterminate whether or not any counter-offers made	*	-	1
Indeterminate whether or not any outside offers made originally	7	4	9
Total	100%	100%	100%
Unweighted number of schools with "large" department . .	(61)	(30)	(31)

[a]Total is more than 100 per cent because some reported more than one.

Q 18. (17.) Aside from teaching assistants, how many members altogether have been added to the mathematics staff in the past five years?

Variable	Non-Ph.D. Granting Schools: Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
No additions in past five years . .	8	3	11
One addition	32	12	43
Two additions	18	17	19
Three additions	10	19	4
Four additions	11	13	10
Five or more additions	21	35	13
Indeterminate number added	*	1	-
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

18A. (17A) At what ranks did they come?

Variable	Total	Public Control	Private Control
One or more instructors added	62%	79%	52%
One or more assistant professors added	62	81	52
One or more associate professors added	22	31	16
One or more full professors added . .	19	14	22
Additions in "no-rank" school or at indeterminate rank	7	1	10
Total[a]	172%	206%	152%
Unweighted number of schools with mathematics teachers joining staff in past five years	(82)	(36)	(46)

[a]Total is more than 100 per cent because some schools added more than one to staff.

Q 18B (17B) Were you able to get people for the academic years you needed them or did you have to postpone filling some vacancies?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No postponement but sacrifice in quality possible	51%	41%	57%
Some postponement	44	59	36
Indeterminate whether or not postponement	5	*	7
Total	100%	100%	100%
Unweighted number of schools with mathematics teachers joining staff in past five years	(82)	(36)	(46)

Q 19 (18) Do you have any vacancies on the mathematics faculty (staff) now? At which ranks?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Instructorship(s)	9	18	4
Assistant professorship(s)	12	26	5
Associate professorship(s)	12	20	7
Full professorship(s)	4	6	3
Vacancy at indeterminate rank or in "no-rank" school	20	11	24
No empty slot but understaffed . .	*	1	-
No current vacancy in any sense . .	53	41	58
Total[a]	110%	123%	101%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

[a]Total is more than 100 per cent because some schools have more than one vacancy.

Q 20. (19) When there is a vacancy, what general procedure do you follow in searching for possible recruits to your faculty (the mathematics staff)?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Get in touch by phone or in writing with other colleges, graduate departments	74	81	70
Recruit in person on campus	1	2	1
Send out printed announcements, fliers, notices	5	14	*
Send representatives to professional meetings, conferences	19	25	16
Review professional society job rosters	20	20	20
Get in touch with employment agencies, teachers' agencies, other than those maintained by professional societies	45	38	49
Look over own graduates and students	9	2	13
Review unsolicited applications . .	10	10	10
Canvass own faculty for suggestions	9	6	10
No answer on general procedure . .	2	-	3
Total[a]	194%	198%	192%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

[a]Total is more than 100 per cent because some reported more than one procedure.

Q 21. (Asked only for schools with "large" departments.)

During the past few years some schools have found it necessary to hire younger mathematicians or those with less experience or preparation at higher salaries or rank than more experienced people already on the staff. Has your department found it necessary to do this?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but "small" department	50	38	55
Some mathematics instruction and "large" department	48	62	42
No unusual practices according to respondent	78	72	82
Some unusual practices according to respondent	22	28	18
Total	100%	100%	100%
Unweighted number of schools .	(89) (61)	(37) (30)	(52) (31)

Q 22A. (20A) Compared to other departments (fields) at (SCHOOL), do you think that mathematics has had less difficulty, about the same amount of difficulty, or more difficulty in finding qualified teachers?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Less difficulty	2	1	3
Same amount of difficulty	24	9	32
More difficulty	72	90	62
No answer	2	-	3
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 22B. (20B) Thinking of the people who've become available to teach college mathematics since late 1957 (that is, in the post-sputnik years), would you consider them, as a group, better, about the same, or poorer than those who began to teach before that, in terms of the following:

Variable	Non-Ph.D. Granting Schools: Total	Non-Ph.D. Granting Schools: Public Control	Non-Ph.D. Granting Schools: Private Control
No mathematics instruction	2%	-%	3%
Instruction but no ratings given . . .	18	-	26
Instruction and ratings given	80	100	71
TRAINING FOR TEACHING UNDERGRAD MATH?			
Recent better	43%	32%	52%
Recent about same	50	54	46
Recent poorer	7	14	2
APTITUDE FOR TEACHING UNDERGRAD MATH?			
Recent better	23%	19%	26%
Recent about same	66	65	67
Recent poorer	10	16	6
No answer	1	-	1
INTEREST IN TEACHING UNDERGRAD MATH?			
Recent better	35%	35%	35%
Recent about same	45	53	39
Recent poorer	18	12	23
No answer	2	-	3
INNATE ABILITY TO DO RESEARCH IN MATH?			
Recent better	24%	16%	29%
Recent about same	57	53	59
Recent poorer	12	22	5
No answer	7	9	7
GENERAL INTELLECTUAL ABILITY?			
Recent better	25%	23%	26%
Recent about same	69	72	68
Recent poorer	5	5	5
No answer	1	-	1
Unweighted number of schools .	(88) (75)	(37) (37)	(51) (38)

Q 22B. (20B) Continued

Variable	Non-Ph.D. Granting Schools: Total	Public Control	Private Control
(Asked only for schools with "large" departments)			
APTITUDE IN TEACHING GRADUATE MATH?			
Recent better	26%	22%	29%
Recent about same	40	47	35
Recent poorer	13	13	12
No answer	21	18	24
INTEREST IN TEACHING GRADUATE MATH?			
Recent better	33%	43%	24%
Recent about same	38	31	45
Recent poorer	4	8	-
No answer	25	18	31
Unweighted number of schools with "large" departments and giving ratings	(56)	(30)	(26)

22C. (20C) Generally speaking, have you found it (has it been) very hard, somewhat hard, or not hard at all to locate and hire faculty members of the caliber that you want?

	Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction and instructors	98		100		97	
Very hard		57		72		49
Somewhat hard		35		25		40
Not hard at all		5		3		7
No answer		3		-		4
Total		100%		100%		100%
Unweighted number of schools .	(89)	(88)	(37)	(37)	(52)	(51)

Q 22C.1. (20C.1.) Aside from the general shortage of mathematicians, what do you think the major reasons for this are?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
Some mathematics instruction and recruitment "not hard at all"	5%	3%	7%
Some mathematics instruction and recruitment "very" or "somewhat hard".	95	97	93
Salary, pay specified	72	73	72
Nature of school's mathematics program	16	20	13
Location of school other than climate	5	13	-
Problem of "integration" specified.	1	3	-
Necessity for certain personal characteristics in faculty (e.g., specific race, sex, religion) . .	2	-	3
Competition but not in pay or type of work	18	16	18
Competition between research and teaching	11	7	13
Characteristics of this school . .	10	6	12
Miscellaneous reasons	7	5	8
No reason, no reason other than "shortage"	3	2	3
Total[a]	145%	145%	142%
Unweighted number of schools with instruction	(88) (81)	(37) (35)	(51) (46)

[a]Total is more than 100 per cent because some mentioned more than one.

Q 22D. (20D) Considering the problem of recruiting, do you think that it will be a harder job or an easier job in the next few years?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Harder job	60	57	62
Easier job	13	6	16
About the same difficulty	23	37	16
No answer	4	-	6
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 23A. (21A) When you think of the courses that you offer (the mathematics courses offered) from the standpoint of the experience and academic preparation of the staff members assigned to teach them, are you generally satisfied or are there courses or topics that aren't so satisfactory from this standpoint?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no mathematics program	4	-	6
Some mathematics instruction and a program	94	100	91
General satisfaction with courses .	82	76	85
Some dissatisfaction in...			
Algebra	5	12	1
Geometry	4	7	2
Analysis	6	11	4
Probability and/or statistics . .	2	2	1
Other applied course(s)	4	5	3
Remedial or introductory course .	6	6	7
Courses for students in other disciplines	2	5	-
Topology, set theory	5	9	2
Miscellaneous courses	1	-	2
Total[a]	117%	133%	107%
Unweighted number of schools .	(89) (86)	(37) (37)	(52) (49)

[a]Total is more than 100 per cent because some mentioned more than one.

Q 23B. (21B) Would you like to expand your course offerings in mathematics? (Would [SCHOOL] like to expand its course offerings in mathematics?) What fields or topics would you like to add?

Variable	Non-Ph.D. Granting Schools: Total	Non-Ph.D. Granting Schools: Public Control	Non-Ph.D. Granting Schools: Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no mathematics program	4	-	6
Some mathematics instruction and a program	94	100	91
No addition or expansion desired .	13	13	13
Addition or expansion in...			
Algebra	25	30	23
Geometry	19	25	15
Analysis	25	28	23
Probability and/or statistics . .	24	13	29
Computer programming, etc.. . . .	15	10	17
Set theory, topology	19	21	19
Courses for students in other disciplines	10	7	12
Miscellaneous courses	19	17	20
Add new degree program	10	17	7
Indeterminate whether addition or expansion desired	3	-	4
Total[a]	182%	181%	182%
Unweighted number of schools .	(89) (86)	(37) (37)	(52) (49)

[a]Total is more than 100 per cent because some mentioned more than one.

Q 24. (22) At (SCHOOL) do you anticipate a substantial increase in enrollment in undergraduate mathematics courses in the next few years? Do you think that your present mathematics staff will be able to handle the increased student load or will it be necessary to enlarge the staff?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some instruction but no one instructor as much as half time	4	-	6
Some instruction and instructors half time or more	94	100	91
Substantial increase not anticipated	21	3	31
Substantial increase anticipated; present staff adequate	12	2	17
Substantial increase anticipated; present staff not adequate . . .	67	95	52
Total	100%	100%	100%
Unweighted number of schools .	(89) (86)	(37) (37)	(52) (49)

Q 25. (23) Does either the school at large or the mathematics department administer a placement examination in mathematics to entering Arts and Science students? (Do you administer a placement examination in mathematics to entering Arts and Science students?)

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
School has no Arts and Science Program	12%	7%	15%
School has Arts and Science Program . .	88	93	85
School or department administers examination	42	43	40
School or department does not administer examination but "places" students on basis of others' tests	10	10	11
School or department does neither .	48	47	49
Total	100%	100%	100%
Unweighted number of schools .	(89) (80)	(37) (35)	(52) (45)

Q 26. (24) Does (SCHOOL) have a program by which students can have "advanced placement" in college mathematics on the basis of their high school mathematics work?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction	98	100	97
School does have a program	72	58	79
School does not have a program but plans one	5	13	1
School does not have a program and does not plan one	23	29	20
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 27. (25) In the mathematics department (in mathematics), is there any special program--like an honors program or a special program of research projects--for superior undergraduate students in mathematics?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no program	4	-	6
Some mathematics instruction and a program	94	100	91
Have a special program for superior undergraduates	53	38	61
No special program for superior undergraduates	47	62	39
Total	100%	100%	100%
Unweighted number of schools .	(89) (86)	(37) (37)	(52) (49)

Q 28. (26) Do you have any special requirement such as a senior paper or thesis or general examinations for mathematics majors? (Is there any special requirement now?) What is required specially?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no majors	8	6	9
Some mathematics instruction and majors	90	94	88
No special requirement	79	93	72
Require special paper, thesis . . .	7	1	10
Require special examination	18	6	24
Require special courses	*	-	*
Total[a]	104%	100%	106%
Unweighted number of schools .	(89) (84)	(37) (36)	(52) (48)

[a]Total is more than 100 per cent because some have more than one.

Q 29. (27) In the past few years has there been any particular attempt to stimulate undergraduate interest in mathematics at your school by having your students enter mathematics contests, or through a student mathematics club, or some other means? What has been done?

Variable	Non-Ph.D. Granting Schools: Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no program in mathematics	4	-	6
Some mathematics instruction and a program	94	100	91
No particular attempt made	39	32	43
Used contests, tournaments, competitions	24	32	19
Clubs or fraternities	45	59	37
Visits by mathematicians, other scientists	14	10	16
Trips to universities, laboratories	10	6	12
Seminars, discussion groups	2	2	3
Other: awards, prizes, films . . .	7	5	8
Total[a]	141%	146%	138%
Unweighted number of schools .	(89) (86)	(37) (37)	(52) (49)

[a]Total is more than 100 per cent because some mentioned more than one.

Q 30. (28) During the 1960-61 academic year, were any advanced undergraduate students or graduate students employed in connection with a mathematics course in any capacity--such as paper-grader, computing clerk, or research or teaching assistants? In what capacity(ies) were they employed?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no program	4	-	6
Some mathematics instruction and a program	94	100	91
Employed none	41	43	41
Employed as paper grader or reader.	47	45	49
Employed as teaching assistant . .	18	30	12
Employed as research assistant . .	1	-	1
Employed as computing clerk	2	*	3
Employed in other capacities: in laboratory, help or drill session	13	12	14
Total[a]	122%	130%	120%
Unweighted number of schools .	(89) (86)	(37) (37)	(52) (49)

[a]Total is more than 100 per cent because some mentioned more than one.

30D. (28D) What was the principal reason you didn't employ any student to help like this? (students weren't employed for work like this in mathematics?)

	Total
Lack of money	51%
No need of such help	22
Against school policy	34
Miscellaneous reasons	8
Reasons indeterminate	7
Total[a]	122%
Unweighted number of schools not employing students	(28)

[a]Total is more than 100 per cent because some mentioned more than one.

Q 31. (29) In mathematics classes for undergraduates, have you ever used any of the following techniques, either on a regular basis or experimentally? If so, did the staff find it generally satisfactory or unsatisfactory?

Variables	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction	98	100	97
LECTURE CLASS WITH SMALLER QUIZ SECTIONS?			
No	85%	84%	87%
Yes, satisfactory	11	12	10
Yes, unsatisfactory	3	2	3
Indeterminate whether used or not	1	2	-
LECTURE CLASS WITH "HELP" SESSIONS?			
No	57%	58%	57%
Yes, satisfactory	35	37	33
Yes, unsatisfactory	7	4	9
Yes, indeterminate whether satisfactory or not	1	1	1
PROGRAMMED LEARNING OR TEACHING MACHINE?			
No	92%	92%	92%
Yes, satisfactory	5	-	7
Yes, unsatisfactory	-	-	-
Yes, indeterminate whether satisfactory or not	3	6	1
Indeterminate whether used or not	*	2	-
"CONTINENTAL CLASSROOM" TELECASTS?			
No	80%	70%	85%
Yes, satisfactory	10	12	6
Yes, unsatisfactory	7	15	6
Yes, indeterminate whether satisfactory or not	2	1	3
Indeterminate whether used or not	1	2	-
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 31. (29) Continued

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
OTHER TELEVISED PROGRAMS?			
No	95%	98%	94%
Yes, satisfactory	*	*	*
Yes, unsatisfactory	5	2	6
FILMED MATERIALS OR SLIDES?			
No	70%	57%	77%
Yes, satisfactory	20	40	10
Yes, unsatisfactory	4	1	6
Yes, indeterminate whether satisfactory or not	5	*	7
Indeterminate whether used or not	1	2	-
Unweighted number of schools .	(88)	(37)	(51)

Q 31A. (29B) Does (SCHOOL) have any special facilities for the use of films or televised programs? What facilities?

	Total
No special facilities	10%
Some special facilities	82
Indeterminate wither special facilities	8
Total	100%
Unweighted number of schools using TV and/or films	(27)

Q 32. (30) At (SCHOOL) does the mathematics staff in Arts and Sciences participate in either basic or advanced mathematics courses specifically designed for students in any of these fields?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no specially designed courses	21	10	27
Some mathematics instruction and some specially designed courses	77	90	70
BIOLOGICAL, PHYSICAL SCIENCES?			
None for biological, physical sciences but some special	44%	55%	37%
Indeterminate whether special for biological, physical sciences . .	2	2	1
Have special for biological, physical sciences	54	43	62
BUSINESS, COMMERCE?			
None for business, commerce but some special	64%	65%	64%
Have special for business, commerce.	36	35	36
EDUCATION?			
None for education but some special.	26%	10%	37%
Indeterminate whether special for education	1	-	1
Have special for education	73	90	62
ENGINEERING?			
None for engineering but some special	64%	59%	67%
Indeterminate whether special for engineering	1	2	-
Have special for engineering	35	39	33
SOCIAL SCIENCES?			
None for social sciences but some special	71%	82%	64%
Indeterminate whether special for social sciences	2	2	1
Have special for social sciences . .	27	16	35
Unweighted number of schools . .	(89) (73)	(37) (35)	(52) (38)

Q 32B. (30B) And which is responsible for the instruction in these courses?

and

Q 32C. (30C) From your point of view, have these (various) arrangements been satisfactory or would you like to see some changes?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No changes desired	76%	80%	74%
Some change desired	24	20	26
Unweighted number of schools with some specially designed course	(73)	(35)	(38)

Q 33. (31) Are there any formal or informal arrangements like joint faculty appointments or faculty discussion groups at (SCHOOL) to facilitate interdisciplinary research or the communication of findings from one field to another? Is the mathematics department (staff) involved in any of these?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no one instructor as much as half time	4	-	6
Some mathematics instruction and instructors half time or more	94	100	91
No such school arrangements at all	52	57	49
Such arrangements but mathematics not included	3	-	4
Such arrangements and mathematics included:			
Joint appointments	4	9	1
Faculty seminars	20	15	23
Informal discussions, clubs	18	16	20
Arrangements indeterminate in nature: "committee"	4	5	4
Total[a]	101%	102%	101%
Unweighted number of schools	(89) (86)	(37) (37)	(52) (49)

[a]Total is more than 100 per cent because some reported more than one.

Q 34. (32) Recently, say since the summer of 1959, has any member of the mathematics staff (anyone from mathematics here) been a visiting member of the faculty of some other college or school?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no one instructor as much as half time	4	-	6
Some mathematics instruction and instructors half time or more	94	100	91
No such visits at all	75	68	79
No such visits to colleges but one or more to high school	1	2	1
No such visits but served on "Continental Classroom" or government education mission	2	4	-
One visit away	11	12	10
Two visits	5	11	2
Three or more visits away	6	3	8
Total	100%	100%	100%
Unweighted number of schools	(89) (86)	(37) (37)	(52) (49)

Q 35. (33) Has (SCHOOL) ever been visited by any mathematician under the Visiting Lecturer program of the Mathematical Association of America?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no program	4	-	6
Some mathematics instruction and a program	94	100	91
School and MAA say there was a visit	27	29	27
School says Yes, MAA says No	10	15	7
School says No, MAA says Yes	1	-	1
Both school and MAA say no visit	62	56	65
Total	100%	100%	100%
Unweighted number of schools	(89) (86)	(37) (37)	(52) (49)

Q 35A,B (33A,B) In general what was the mathematics department's (faculty's) reaction to the visit? Have you ever made a request to the Mathematical Association for a visit?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no program in mathematics	4	-	6
Some mathematics instruction and a program	94	100	91
Generally favorable reaction	34	42	31
Neutral or unfavorable reaction . . .	3	2	3
No visit but one requested	10	1	15
No visit, no request, but "good idea".	4	-	6
No visit, no request, no other comment	49	55	45
Total	100%	100%	100%
Unweighted number of schools . .	(89) (86)	(37) (37)	(52) (49)

Q 36. (34) All in all, do you think that the mathematics staff at (SCHOOL) has enough contact with the field of mathematics and mathematicians elsewhere or would more contact be desirable?

Variable	Non-Ph.D. Granting Schools					
	Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction but no one instructor as much as half time	4		-		6	
Some mathematics instruction and instructors half time or more	94		100		91	
Staff has enough contact		18		16		19
Staff does not have enough		82		84		81
Total		100%		100%		100%
Unweighted number of schools	(89)	(86)	(37)	(37)	(52)	(49)

Q 36A. (34A) In your opinion what other or additional contacts should the staff have?

Variable	Total	Public Control	Private Control
More formal training	23%	22%	23%
Contact with, participation in professional organizations	48	56	43
More contact with other colleges or faculties but not formal education	24	21	26
More people visiting this school	18	19	17
More people on staff need contacts, broaden the base of those contacts	1	2	-
Miscellaneous, general contact	31	19	38
Indeterminate in nature	1	2	-
Total[a]	146%	141%	147%
Unweighted number of schools	(86)	(37)	(49)

Q 36B. (34B) What are the main reasons there isn't enough?

Variable	Total	Public Control	Private Control
Limitation of funds	36%	56%	25%
Heavy workload	45	40	48
Distance, geography	8	13	5
Characteristics of the faculty	10	14	8
Vague reasons: inertia, never enough	22	15	25
No reasons given	3	-	5
Total[a]	124%	138%	116%
Unweighted number of schools with inadequate contact reported	(65)	(29)	(36)

[a]Total is more than 100 per cent because some mentioned more than one.

Q 37A. (35B) When you think of (SCHOOL) in comparison with colleges similar to it in size and type (that is, in method of financing, kinds of students enrolled, type of program offered, and the like) would you consider (SCHOOL) better than most similar colleges, about the same as most, or not quite so good as most with respect to the following:

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction	98	100	97
LIBRARY COLLECTION IN MATHEMATICS?			
Better	32	43	27
Same	51	45	54
Not so good	13	12	13
No answer	4	-	6
Total	100%	100%	100%
OVER-ALL QUALITY OF UNDERGRADUATE STUDENTS ENROLLED IN BUT NOT MATHEMATICS MAJORS?			
Better	13%	11%	15%
Same	74	67	78
Not so good	11	22	4
No answer	2	-	3
Total	100%	100%	100%
OVER-ALL QUALITY OF CURRENT MATHEMATICS STAFF?			
Better	25%	24%	26%
Same	63	67	61
Not so good	10	9	10
No answer	2	-	3
Total	100%	100%	100%
Unweighted number of schools . .	(88)	(37)	(51)
ADEQUACY OF OFFICE AND WORK SPACE FOR MATHEMATICS FACULTY (TEACHERS)? Of those with instructor half time or more...			
Better	36%	27%	41%
Same	35	28	38
Not so good	29	45	21
No answer	*	-	*
Total	100%	100%	100%
Unweighted number of schools . . with instructor half time or more	(89) (86)	(37) (37)	(52) (49)

Q 37A. (35B) Continued

Variable	Non-Ph.D. Granting Schools Total	Public Control	Private Control
CLERICAL AND SECRETARIAL HELP FOR ROUTINE DEPARTMENTAL WORK IN MATHEMATICS?			
Of those with instructor half time or more...			
Better	17%	14%	18%
Same	51	68	43
Not so good	32	18	39
No answer	*	-	*
Total	100%	100%	100%
Unweighted number of schools with instructor half time or more .	(86)	(37)	(49)
ADEQUACY OF STUDY AND WORK SPACE FOR UNDERGRADUATE MATHEMATICS STUDENTS?			
Of those with "large" departments.....			
Better	19%	15%	22%
Same	53	57	49
Not so good	28	28	28
No answer	*	-	1
Total	100%	100%	100%
Unweighted number of schools with "large" department	(61)	(30)	(31)
OVER-ALL QUALITY OF UNDERGRADUATE STUDENTS MAJORING IN MATHEMATICS?			
Of those with mathematics majors......			
Better	25%	21%	28%
Same	65	72	61
Not so good	8	7	8
No answer	2	-	3
Total	100%	100%	100%
Unweighted number of schools with mathematics majors	(84)	(35)	(49)

Q 37B. (35A) Considering the schools and colleges of the country, has any one had a particular influence on the curriculum and program in mathematics at (SCHOOL)? What is its name?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no program	4	-	6
Some mathematics instruction and a program	94	100	91
Named none at all	63	50	69
Named one school	12	21	8
Named more than one	20	17	21
Reported being influenced by schools this school feeds	1	4	-
Reported this school as influence . .	1	-	2
Reported being influenced by program but not a school: SMSG, U. of I., etc.	3	8	-
Total	100%	100%	100%
Unweighted number of schools . .	(89) (86)	(37) (37)	(52) (49)

Q 38. (36) Is there any research agency or business or industry or other activity in the vicinity of (SCHOOL) which provides paid work of a mathematical nature for advanced students or mathematics faculty members (for mathematics students or faculty members)?

Variable	Non-Ph.D. Granting Schools					
	Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction but no one instructor as much as half time	4		-		6	
Some mathematics instruction and instructors half time or more	94		100		91	
Source of work reported		29		24		31
No source of work reported but college located in large city		4		1		5
College itself a source of work		*		1		-
No source of work reported and college not located in large city		67		74		64
Total		100%		100%		100%
Unweighted number of schools	(89)	(86)	(37)	(37)	(52)	(49)

Q 39A,B. (37A,B) As far as you know, in the past year or two did anyone on the mathematics staff deal with (have any) mathematical problems either in his academic work or in outside consulting in which he used high- or medium-speed electronic computing equipment like an IBM 650 or IBM 1620 (or an analogue computer)? Whose equipment did he use? Has anyone in the mathematics department (in mathematics here) ever dealt with any problems like this as far as you know?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no instructors as much as half time	4	-	6
Some mathematics instruction and instructors half time or more	94	100	91
None used ever by staff	51	39	57
This school's used in recent past . .	8	13	5
Other's used in recent past	25	23	26
Equipment used in recent past but whose indeterminate	1	4	-
Equipment used but not recently . . .	15	21	12
Total	100%	100%	100%
Unweighted number of schools . .	(89) (86)	(37) (37)	(52) (49)

Q 40A. (38A) Do you know of any plans for (SCHOOL) to gain access to computing equipment or to acquire some of its own?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
School already owns computing equipment	14	22	9
School has access to computing equipment	22	14	27
School neither owns nor has access to such equipment and reports no plans in this direction	47	41	50
School neither owns nor has access to such equipment but reports some plans in this direction	10	22	4
School neither owns nor has access to such equipment and plans indeterminate	7	1	10
Total	100%	100%	100%
Unweighted number of schools . .	(89) (88)	(37) (37)	(52) (51)

Q 40A. 1. (Asked only of schools reporting plans to acquire or gain access to computers) Which division or departments are likely to use it (such equipment)?

	Total
Mathematics reported likely user	[76%]
Mathematics not reported likely user . . .	[5]
Likely user indeterminate	[19]
Total	100%
Unweighted number of schools reporting plans	(11)

Q 41. (39) Considering the research interests of the (mathematics) staff and the problems with which they deal, how important do you think it is for (SCHOOL) to have electronic computing equipment or to have access to some--very important, fairly important, or not really important at all?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no one instructor as much as half time	4	-	6
Some mathematics instruction and instructors half time or more	94	100	91
Very important	19	27	14
Fairly important	28	17	34
Not really important	53	56	52
Total	100%	100%	100%
Unweighted number of schools . . .	(89) (86)	(37) (37)	(52) (49)

Q.42. (Asked only for schools with "large" departments)
Does (SCHOOL) offer any regular credit courses in mathematics for degree candidates in the late afternoon or evening, either on campus or off campus but in town here?

Who teaches these courses--regular faculty members as part of their routine teaching load, regular faculty with this as an added assignment, or people hired specifically to teach these courses?

Variable	Non-Ph.D. Granting Schools					
	Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction but "small" department	50		38		55	
Some mathematics instruction and "large" department	48		62		42	
School offers no such courses		44		36		49
Courses offered and taught by regular faculty as routine load		14		17		11
Courses offered and taught by regular faculty as added load		15		18		14
Courses offered and taught by other than regular faculty		*		1		-
Courses offered and taught by combinations of above		19		19		19
Courses offered but faculty indeterminate		4		-		7
Indeterminate whether such courses offered or not		4		9		-
Total		100%		100%		100%
Unweighted number of schools . .	(89)	(61)	(37)	(30)	(52)	(31)

Q 43. (40) Last winter, i.e., late 1960-early 1961, the Mathematical Association of America published a set of recommendations for the training of teachers of mathematics. Do you happen to have seen a copy of these recommendations or heard anyone here talking about them?

As far as you know, has there been any discussion or action taken on these recommendations by the mathematics faculty?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but only business degrees	2	-	3
Some mathematics instruction and other degrees	96	100	94
Neither saw nor heard about recommendations	7	*	10
Saw or heard about them but no action reported	22	9	28
Saw or heard about them and reaction favorable or action taken to further them	54	73	44
Saw or heard about them and reaction unfavorable	3	8	1
Saw or heard about them but feels them inapplicable to his school	11	1	17
Saw or heard about them but reports nothing about consequences	1	3	*
Indeterminate whether saw or heard about recommendations	2	6	-
Total	100%	100%	100%
Unweighted number of schools . . .	(89) (87)	(37) (37)	(52) (50)

Q 44, 44A,B (41A,B) During the summer of 1960 or 1961, did (SCHOOL) offer any course, workshop, or institute in mathematics or mathematics teaching for secondary or elementary school teachers?

Who sponsored the program, (SCHOOL) as part of its regular summer academic program, or its own special summer program, or was it under outside sponsorship?

Variable	Non-Ph.D. Granting Schools					
	Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction but only business degrees	2		-		3	
Some mathematics instruction and other degrees	96		100		94	
No offerings in summer, 1960		66		37		81
No offerings in summer, 1961		54		29		67
No offerings either summer		49		23		64
Unweighted number of schools . .	(89)	(87)	(37)	(37)	(52)	(50)
Of those with summer, 1960, offerings:						
School sponsored offering		48%				
NSF sponsored offering		52				
Total		100%				
Unweighted number of schools . .		(41)				
Of those with summer, 1961, offerings:						
School sponsored offering		65%				
NSF sponsored offering		40				
Commercial sponsor of offering . . .		4				
Other public funds used		1				
Total[a]		110%				
Unweighted number of schools . .		(46)				

[a]Total is more than 100 per cent because some reported more than one.

Q 44D. (41D) Has anyone in mathematics ever applied to the National Science Foundation for funds to run a program of any kind? What kind of program?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no one instructor as much as half time	4	-	6
Some mathematics instruction and instructors half time or more	94	100	91
Summer institute(s) actually financed by NSF	23	41	13
Application made for NSF summer institutes	18	17	19
Application for NSF academic year or in-service for teachers	9	3	13
Application for work with high school students	2	-	4
Application for work of indeterminate nature	1	1	1
Report that no one from mathematics ever applied to NSF	51	39	58
Total[a]	104%	101%	108%
Unweighted number of schools . .	(89) (86)	(37) (37)	(52) (49)

[a]Total is more than 100 per cent because some reported more than one.

Q 45A. (42A) During the past five years, has the mathematics department (mathematics) done any of the following?

Variable	Non-Ph.D. Granting Schools Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction and instructors	98		100		97	
INTRODUCED A PROGRAM FOR OUTSTANDING UNDERGRADUATE (MATHEMATICS) STUDENTS?						
Did	29%		29%		29%	
Did not	68		65		70	
No answer	3		6		1	
EXPANDED COURSE OFFERINGS INTO NEW AREAS?						
Did	84%		98%		78%	
Did not	16		2		22	
INTRODUCED MATERIAL IN MATHEMATICS FOR STUDENTS IN BIOLOGICAL, PHYSICAL OR SOCIAL SCIENCES?						
Did	38%		35%		39%	
Did not	62		65		61	
INTRODUCED OR REVISED MATERIALS IN MATHEMATICS FOR ELEMENTARY OR SECONDARY TEACHERS?						
Did	62%		81%		52%	
Did not	34		19		41	
No answer	4		-		7	
INTRODUCED OR REVISED THE MAJOR?						
Did	61%		63%		60%	
Did not	37		37		37	
No answer	2		-		3	
Unweighted number of schools . .	(89)	(88)	(37)	(37)	(52)	(51)
INTRODUCED A NEW DEGREE PROGRAM? Of those with "large" department						
Did	33%		30%		36%	
Did not	67		70		64	
INTRODUCED A COURSE OR PROGRAM IN ELECTRONIC DATA PROCESSING OR COMPUTING?						
Did	31%		43%		23%	
Did not	69		57		77	
Unweighted number of schools with "large" department	(61)		(30)		(31)	

Q 45B. (42B) Are courses in physics required for a mathematics "major" at (SCHOOL)?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction but no major in mathematics	8	6	9
Some mathematics instruction and a major in mathematics	90	94	88
Physics course required	29	33	27
Physics course recommended, not required	38	38	37
Physics course not recommended for mathematics majors	32	25	36
Indeterminate whether or not physics course required	1	4	-
Total	100%	100%	100%
Unweighted number of schools .	(89) (84)	(37) (36)	(52) (48)

Q 46A. (43A) If you were considering a fairly basic change in the mathematics curriculum--for example, adopting new requirements for the "major" or instituting a new program in mathematics teaching--would (SCHOOL'S) administration have to approve such a change before it was made or not?

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Approval necessary	86	92	82
Approval not necessary	9	8	10
No answer	5	-	8
Total	100%	100%	100%
Unweighted number of schools .	(89) (88)	(37) (37)	(52) (51)

Q 46B. (43B) What would you consider your most recent basic change to be? (What would you consider the most recent basic change in mathematics here to be?)

Variable	Non-Ph.D. Granting Schools		
	Total	Public Control	Private Control
No mathematics instruction	2%	-%	3%
Some mathematics instruction and instructors	98	100	97
Introduced or revised program for graduate work	4	5	4
Introduced mathematics program for the bachelor's degree	7	2	9
Revised or modified requirements for already existing major	22	40	13
Introduced new course(s)	50	39	55
Revised, upgraded, modernized existing courses	30	39	25
Formalized or made initial requirements for mathematics stricter . . .	3	8	1
Miscellaneous but specific change . .	4	8	3
Nonspecific change	1	1	1
No answer	6	4	7
Total[a]	127%	146%	118%
Unweighted number of schools . .	(89) (88)	(37) (37)	(52) (51)

Q 46C. (43C) About when was it put into effect?

1961-62 academic year	13%	12%	14%
1960-61 academic year	23	33	19
1959-60 academic year	14	24	9
1958-59 academic year	16	20	15
1957-58 academic year	6	4	6
1956-57 academic year	8	-	12
1955-56 or earlier	3	*	4
Indeterminate when put into effect . .	7	5	8
Change scheduled for future	10	2	13
Total	100%	100%	100%
Unweighted number of schools . . .	(88)	(37)	(51)

[a]Total is more than 100% because some reported more than one.

Q 47. (44) Is your department thinking about making changes of any kind? What kind of changes?

(Are you thinking about making any changes in mathematics? What kind of changes?)

Variable	Non-Ph.D. Granting Schools: Total		Public Control		Private Control	
No mathematics instruction	2%		-%		3%	
Some mathematics instruction and instructors	98		100		97	
Report of no change anticipated . . .		19		22		18
Report of fairly specific change anticipated		70		66		72
Report of change in non-specific terms		11		12		10
Total		100%		100%		100%
Unweighted number of schools . .	(89)	(88)	(37)	(37)	(52)	(51)

APPENDIX B

APPENDIX B

Responses to Faculty Member Questionnaire

Q 1. List below each academic institution from which you obtained or are currently obtaining formal training beyond the high school level. Include summer school attendance and formal post-doctoral work. Enter also dates of attendance; degree, if any; year of degree; major subject; and minor subject, for each academic institution listed.

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other[a]
a. Highest level earned degree, end of Spring 1961 term					
Doctor's degree (Ph.D., Ed.D., Sc.D.)	44%	83%	44%	23%	[21%]
Master's degree	50	14	56	72	[29]
Bachelor's degree	5	3	-	4	[43]
Not classifiable above	1	-	-	1	[7]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members[b] . . .	(533)	(142)	(150)	(226)	(15)

[a]This group consists of 14 faculty members from colleges which have no academic ranks and one faculty member who taught but had an administrative rather than an academic title. Percentages based on this group are included because of their interest from the standpoint of the study as a whole, but should be viewed with caution because of the small size of the group involved.

[b]The data were derived from the responses given by the faculty of a random sample of colleges and universities. Since these schools were selected with unequal probabilities, it is necessary to weight the data bearing on the faculty members from any given school by the reciprocal of the probability that that school had of being selected. All of these percentages are based on the weighted distribution. But since the reliability of a given statistic is a function of the number of actual cases, the N's given are unweighted. Consequently one cannot combine subgroups by weighting the relevant distributions by the given N's, nor should one take the distribution of N's among the subgroups as being equivalent to the weighted distribution for the particular variable involved.

Q 1. Continued

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
b. Other certification reported by faculty member					
Other certification, qualification reported (certificate in meteorology, fellowship in actuarial society, etc.)	2%	1%	2%	1%	[7%]
No other certification, qualification reported	98	99	98	99	[93]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)
c. Year in which highest level earned degree was conferred					
1960 or 1961	7%	3%	3%	13%	[7%]
1956-59 inclusive	19	7	12	30	[28]
1951-55 inclusive	22	17	22	23	[28]
1941-50 inclusive	26	27	25	25	[30]
1931-40 inclusive	18	27	29	7	[7]
Before 1931	8	19	9	2	[-]
Year indeterminate	*	-	*	*	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

*Stands for less than one-half of one per cent throughout.

Q 1. Continued

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
d. Number of years elapsed between receipt of highest degree and bachelor's degree					
Bachelor's only; no subsequent study reported	2%	2%	-%	-%	[21%]
Bachelor's only; subsequent study but no higher degree	4	1	-	4	[28][a]
Higher degree with lapse of 2 years or less	14	2	11	26	[1]
Higher degree with lapse of more than 2 years but less than 5 . .	14	13	13	17	[7]
Higher degree with lapse of 5 or more years but less than 10 . .	35	40	34	35	[29]
Higher degree with lapse of 10 or more years but less than 15 . .	14	11	23	8	[14]
Higher degree with lapse of 15 or more years but less than 20 . .	7	17	5	4	[-]
Higher degree with lapse of 20 years or more	9	14	12	4	[-]
Higher degree with lapse of indeterminate length	1	-	2	2	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Includes one faculty member with an Associate degree and subsequent study.

Q I. Continued

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
e. Subject in which highest degree was received					
Mathematics, statistics	62%	67%	63%	66%	[15%]
Education	17	18	23	14	[-]
Engineering	5	4	3	7	[-]
Physics	6	7	4	7	[14]
Other science	5	4	5	5	[7]
Social science including psychology	1	*	1	*	[7]
Humanities, languages	1	*	*	*	[14]
Business, commerce, accounting	3	-	-	1	[43]
Not classifiable above	*	-	1	*	[-]
Subject indeterminate	*	-	-	*	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)
f. Major subjects studied in addition to subject in which highest degree was received					
Mathematics, statistics	20%	16%	26%	19%	[21%]
Education	11	4	13	14	[7]
Engineering	8	5	10	7	[7]
Physics	7	7	5	10	[-]
Other science	7	9	9	4	[14]
Social science including psychology	2	3	*	2	[-]
Humanities, languages	6	7	4	6	[7]
Business, commerce, accounting	*	-	-	1	[-]
Not classifiable above	4	6	3	4	[7]
Subject indeterminate	2	-	2	1	[7]
No major subject other than that in which highest degree was received	48	51	42	50	[51]
Total[a]	115%	108%	114%	118%	121%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100% because some reported more than one subject.

Q 1. Continued

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
g. Minor subjects studied					
Mathematics, statistics	8%	10%	7%	8%	[14%]
Education	9	6	14	8	[7]
Engineering	1	*	3	1	[-]
Physics	31	42	33	27	[8]
Other science	16	13	19	18	[7]
Social science including psychology	14	8	12	15	[42]
Humanities, languages	15	14	13	15	[28]
Not classifiable above	1	-	2	1	[-]
Subject indeterminate	1	-	3	1	[-]
No minor subject not also major subject or subject in which highest degree was received . .	12	15	10	13	[-]
No minor subjects reported	13	11	12	13	[21]
Total[a]	121%	119%	128%	120%	127%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)
h. Age at which highest level earned degree was received					
22 years old or less	5%	1%	3%	7%	[14%]
23, 24 years old	9	9	7	11	[14]
25-29 years old	35	29	30	41	[37]
30-34 years old	26	18	34	24	[28]
35-39 years old	12	19	12	9	[7]
40-44 years old	6	14	6	2	[-]
45-49 years old	4	5	5	3	[-]
50 years old or more	3	5	3	3	[-]
Age indeterminate	*	-	*	*	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some reported more than one.

Q 1. Continued

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
i. How many different schools awarded degrees to this faculty member					
One school; has undergraduate degree only	6%	3%	-%	4%	[50%]
One school; has undergraduate and graduate degrees	19	16	25	18	[8]
More than one school; has under-graduate and graduate degrees .	75	81	75	77	[42]
More than one school; has European degrees only	*	-	-	1	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)
j. Doctorate in mathematics or statistics					
Has doctorate in mathematics or statistics	28%	57%	25%	18%	[-%]
Has other doctorate	16	26	19	5	[21]
Has no doctorate	56	17	56	77	[79]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 1. Continued

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
k. Relationship between college(s) attended and college employing faculty member in 1960-61					
Faculty member had graduate degree(s) from college employing him 1960-61	6%	2%	5%	11%	[1%]
Faculty member had graduate work but no graduate degree from college employing him 1960-61 .	2	-	1	4	[-]
Faculty member had undergraduate degree but no graduate work or degree from college employing him	14	16	12	12	[21]
Faculty member had undergraduate work only from college employing him 1960-61	1	*	-	*	[7]
Faculty member had neither degrees nor academic work at any level from college at which he was 1960-61 faculty member	77	82	82	73	[71]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 1. Continued

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
1. Faculty member's continuing formal education through Summer 1961					
Has doctorate and reported post-doctoral fellowship or formal study	8%	16%	6%	5%	[7%]
Has doctorate but reported no post-doctoral study	36	67	38	18	[14]
Has no doctorate but attended school summer(s) sometime after receipt of highest degree . . .	13	3	14	21	[7]
Has no doctorate but attended school during academic year sometime after receipt of highest degree	3	1	3	4	[7]
Has no doctorate but attended school in summer and during academic year sometime after receipt of highest degree . . .	19	4	18	27	[28]
Has no doctorate but attended school in indeterminate term sometime after receipt of highest degree	7	3	5	11	[-]
Has no doctorate and reported no continuing formal study after receipt of highest degree	14	6	16	14	[37]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 2. Are you currently engaged in any activity of a research nature in mathematics or mathematics education (e.g., writing a textbook, a research paper, learning a new field of mathematics, experimenting with curricula, acting as a consultant, etc.)?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
No	43%	32%	36%	52%	[64%]
No answer	1	*	1	-	[-]
Yes	56	68	63	48	[36]
Writing, collaborating on book	27	31	26	27	
Writing, preparing paper or article	13	11	8	20	
Learning new field of mathematics	22	18	19	32	
Experimenting with, working on courses at college level . . .	35	45	40	19	
Acting as consultant	17	23	17	12	
Doing research in specified area	22	18	20	23	
Pursuing own formal education .	4	-	4	7	
Working with professional organization in field	2	6	-	-	
Activities of miscellaneous nature	4	2	4	5	
Activities of indeterminate nature	1	4	*	*	
Total[a]	147%	158%	138%	145%	
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some faculty members reported more than one activity.

Q 3. A. In what year did you join the staff of this college?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
1960-1961	12%	2%	9%	17%	[28%]
1956-57 to 1959-60 inclusive . . .	33	20	18	52	[37]
1951-52 to 1955-56 inclusive . . .	18	14	22	17	[21]
1941-42 to 1950-51 inclusive . . .	22	29	36	11	[7]
1931-32 to 1940-41 inclusive . . .	10	23	11	2	[-]
Before 1931	5	12	4	1	[7]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

B. At what rank were you appointed?

Variable	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Full professor	8%	31%	-%	-%	[-%]
Associate professor	11	13	26	-	[-]
Assistant professor	39	30	35	56	[-]
Instructor	33	23	35	43	[-]
Other: lecturer, tutor, etc. . .	2	1	4	1	[-]
No academic rank	7	-	-	-	[100]
Rank indeterminate	*	2	-	-	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 4. Do you hold any other position or engage in reimbursed work of any kind in addition to that as a faculty member of this college?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
No	70%	61%	68%	79%	[72%]
No answer	1	*	3	-	[-]
Yes	29	39	29	21	[28]
Teach at other college, university; summer term not specified	11	2	11	24	
Teach, participate in summer school or institute	15	16	21	11	
Teach in secondary, elementary school	4	4	-	4	
Consultant to, employed by business, industry	17	19	15	16	
Consultant to, employed by government	8	11	10	4	
Consultant to, employed by other type of agency	18	33	20	4	
Miscellaneous kinds of work of mathematical nature	11	9	12	16	
Position or work of non-mathematical nature	20	10	19	24	
Nature of work indeterminate . .	*	-	*	-	
Total[a]	104%	104%	108%	103%	
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum greater than 100 per cent because some faculty members reported more than one outside position.

Q 5. Where were you employed just before you were appointed to the staff of this college?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Employed by, teaching in other college, university but not as a teaching assistant	36%	46%	43%	29%	[7%]
Employed by, teaching in secondary, elementary school	21	15	26	25	[7]
Employed by business, industry, or government	16	19	12	14	[37]
Member of Armed Forces	4	3	4	4	[7]
Going to school, including work as teaching assistant	19	14	13	22	[35]
Self-employed	2	1	-	3	[7]
Prior status indeterminate	2	2	2	3	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Prior teaching experience

College, university teaching experience (other than as teaching assistant) sometime before . . .	42%	57%	47%	34%	[21%]
Secondary, elementary school teaching experience only before this appointment	24	16	30	28	[7]
Prior teaching experience but level indeterminate	9	8	7	7	[22]
No prior teaching experience as far as can be determined	25	19	16	31	[50]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 6. Since you received your bachelor's degree (and excluding employment as a teaching assistant or teaching fellow), how many years altogether have you been employed by an <u>academic</u> institution . . .

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
. . . <u>primarily</u> as a mathematician?					
None	13%	13%	8%	10%	[49%]
Less than one year	*	1	-	-	[-]
One through nine	34	6	23	57	[44]
Ten through nineteen	28	29	34	27	[-]
Twenty through twenty-nine	13	23	20	3	[7]
Thirty or more years	12	28	13	3	[-]
Number indeterminate	*	-	2	-	[-]
Total	100%	100%	100%	100%	100%
. . . <u>primarily</u> in a field other than mathematics?					
None	66%	67%	62%	76%	[22%]
Less than one year	1	-	-	1	[7]
One through nine	19	15	19	14	[57]
Ten through nineteen	9	8	12	7	[14]
Twenty through twenty-nine	4	7	5	2	[-]
Thirty or more years	1	3	2	*	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members[a]	(533)	(142)	(150)	(226)	(15)

[a]Includes two faculty members at the rank of Assistant Professor with European undergraduate degrees rather than bachelor's degrees and one Other faculty member whose highest earned degree was an Associate degree.

Q 7. Since you received your bachelor's degree, how many years altogether have you spent in a non-academic position . . .

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
. . . primarily as a mathematician?					
None	82%	79%	87%	79%	[92%]
Less than one year	2	1	1	4	[-]
One through nine	15	18	10	16	[8]
Ten through nineteen	1	1	2	1	[-]
Twenty through twenty-nine	*	-	-	*	[-]
Thirty or more years	*	1	-	-	[-]
Number indeterminate	*	-	*	*	[-]
Total	100%	100%	100%	100%	100%
. . . primarily in some other capacity?					
None	57%	60%	54%	63%	[36%]
Less than one year	1	1	1	1	[-]
One through nine	34	31	37	27	[57]
Ten through nineteen	6	6	5	6	[7]
Twenty through twenty-nine	1	1	3	1	[-]
Thirty or more years	*	-	-	1	[-]
Number indeterminate	1	1	*	1	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members[a]	(533)	(142)	(150)	(226)	(15)

[a]Includes two faculty members at the rank of Assistant Professor with European undergraduate degrees rather than bachelor's degrees and one Other faculty member whose highest earned degree was an Associate degree.

Q 8. Have you ever been offered employment as a mathematician with any of the following?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Business or industry?					
No	63%	63%	68%	58%	[78%]
Yes	36	37	30	42	[22]
No answer	1	*	2	*	[-]
Government, other than Armed Forces?					
No	80	80	80	79	[85]
Yes	19	20	18	21	[15]
No answer	1	*	2	*	[-]
Armed Forces?					
No	88	80	87	92	[92]
Yes	11	20	11	8	[8]
No answer	1	*	2	*	[-]
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 9. Do you have a special interest or competence in any non-mathematical field such as physics, biology, psychology, etc.?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
No	40%	40%	40%	45%	[7%]
No answer	*	*	*	*	[-]
Yes	60	60	60	55	[93]
Physics, engineering	58	62	59	64	
Other sciences	21	23	18	19	
Social sciences	11	12	11	11	
Education, teaching	7	10	5	5	
Humanities, art	6	7	2	7	
Languages, linguistics	2	1	4	1	
Business, commerce, advertising.	5	4	-	2	
Miscellaneous interests or competences	9	7	14	7	
Total[a]	119%	126%	113%	116%	
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some faculty members reported more than one special non-mathematical interest.

Q 10. Have you ever been called on to teach a specialized course in a mathematical subject with which you were not entirely familiar or felt yourself inadequately prepared?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
No	65%	64%	58%	65%	[93%]
No answer	1	*	3	*	[-]
Yes	34	36	39	35	[7]
Algebra	7	4	8	9	
Geometry	23	36	21	18	
Analysis	18	9	9	32	
Probability, statistics	26	23	39	16	
Other applied mathematics . . .	10	14	7	9	
Remedial or introductory course.	2	-	-	-	
Courses for students in other disciplines	10	11	12	8	
Other, miscellaneous	12	13	12	13	
Course area indeterminate . . .	3	1	1	8	
Total[a]	111%	111%	109%	113%	
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some faculty members reported more than one course.

Q 11. At this college have there been any faculty conferences, discussions, or study groups on the subject of long-range planning for mathematics here? If so, did you take part?

Responses not tabulated.

Q 12. Are there any courses in mathematics that you would like to see introduced into the curriculum at this school?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
No	30%	32%	22%	29%	[56%]
No answer	5	10	7	2	[-]
Yes	65	58	71	69	[44]
Algebra	22	16	20	29	
Geometry	12	15	10	9	
Analysis	32	19	33	38	
Probability, statistics	19	24	16	18	
Applied mathematics	4	8	1	5	
Computer programming, electronic data processing	14	18	18	10	
Set theory, topology, foundations of mathematics	19	16	19	16	
Courses for students in other disciplines	13	16	15	9	
Other, miscellaneous	17	12	24	13	
New degree program	2	5	1	1	
Total[a]	154%	149%	157%	148%	
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some faculty members suggested more than one course.

Q 13. Do you have any formally-recognized administrative responsibility such as course-coordinator, departmental adviser, department head, etc., at this college?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
No	51%	22%	48%	74%	[35%]
No answer	1	-	2	-	[-]
Yes	48	78	50	26	[65]
Department head, administrative officer of some department in college	48	75	31	14	
Department student adviser . . .	27	16	33	47	
Responsibility in area of courses, curriculum	12	11	9	21	
Responsibility for NSF program, other teacher training work .	5	3	4	11	
Responsibility for electronic computing equipment or program	2	2	3	2	
Responsibility in over-all college administration	9	2	15	9	
Miscellaneous responsibilities .	10	6	20	4	
Responsibility of indeterminate nature	3	1	1	6	
Total[a]	116%	116%	116%	114%	
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some faculty members reported having more than one such responsibility.

Q 14. A. As a college faculty member, which one of the three following facets of academic work do <u>you yourself</u> regard most highly? Which next most highly? Which least highly of all?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Teaching					
Regarded most highly	86%	85%	86%	85%	[85%]
Regarded next most highly . .	13	15	10	14	[15]
Regarded least highly	*	-	1	*	[-]
No answer	1	*	3	1	[-]
Research					
Regarded most highly	11%	14%	6%	12%	[8%]
Regarded next most highly . .	58	58	63	57	[50]
Regarded least highly	30	28	28	30	[42]
No answer	1	*	3	1	[-]
College administration					
Regarded most highly	2%	-%	4%	*%	[7%]
Regarded next most highly . .	23	24	20	24	[28]
Regarded least highly	74	76	73	75	[65]
No answer	1	*	3	1	[-]
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 14. Continued

B. As far as you know, which of these does your college regard most highly? Which does it regard next most highly? Which least highly of all?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Teaching					
Regarded most highly	67%	67%	60%	71%	[71%]
Regarded next most highly . .	22	26	22	19	[28]
Regarded least highly	7	5	8	9	[1]
No answer	4	2	10	1	[-]
Research					
Regarded most highly	9%	11%	11%	9%	[-%]
Regarded next most highly . .	30	38	27	29	[15]
Regarded least highly	57	49	52	61	[85]
No answer	4	2	10	1	[-]
College administration					
Regarded most highly	19%	16%	19%	18%	[29%]
Regarded next most highly . .	40	32	38	46	[43]
Regarded least highly	37	50	33	35	[28]
No answer	4	2	10	1	[-]
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 15. Academic institutions vary greatly in the areas in which, and the extent to which, they provide satisfaction to the members of their teaching staffs. Considering this college, which three aspects from the following list do you personally find most satisfactory?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Climate and/or geographic location	46%	40%	50%	50%	[22%]
Quality of the program in your field	41	41	43	36	[64]
Retirement provisions or benefits.	12	11	19	10	[-]
Housing available to faculty . . .	4	3	2	6	[-]
Quality of faculty in your field .	15	22	12	14	[7]
Cultural opportunities available .	10	9	8	14	[7]
General reputation of the college.	16	18	12	14	[28]
Quality of undergraduate students.	23	37	17	15	[42]
Salary scale	18	19	13	24	[-]
Research facilities	3	6	1	1	[8]
Relations between faculty and administration	34	36	41	28	[35]
Relations with colleagues	55	50	47	66	[42]
Intellectual stimulation	18	12	18	18	[44]
No answer	2	2	5	-	[-]
Total	297%	306%	288%	296%	299%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 16. In what year were you born?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
1932-1936 (25-29 years in 1961) .	6%	-%	-%	14%	[14%]
1927-1931 (30-34 years in 1961) .	12	2	7	22	[14]
1922-1926 (35-39 years in 1961) .	19	11	15	26	[28]
1917-1921 (40-44 years in 1961) .	16	9	15	19	[23]
1912-1916 (45-49 years in 1961) .	11	18	14	5	[14]
1907-1911 (50-54 years in 1961) .	12	20	18	5	[-]
1902-1906 (55-59 years in 1961) .	10	8	18	6	[7]
1897-1901 (60-64 years in 1961) .	8	17	9	2	[-]
1892-1896 (65-69 years in 1961) .	4	8	4	1	[-]
1891 or earlier (70 years or more in 1961)	2	7	-	*	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 17. What was your father's (or stepfather's) occupation about the time that you graduated from high school (e.g., grade school teacher, carpenter, farm owner, mailman, civil engineer)?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
~~Mathematician, mathematics~~ teacher or professor, specified	*%	*%	1%	-%	[-%]
Other (non-mathematics) teacher or professor	5	7	5	4	[-]
Professional (except teacher or professor), technical . .	12	10	12	13	[14]
Farm owner, farm manager[a] . .	23	26	26	19	[15]
Manager, official, proprietor.	24	22	22	22	[43]
Clerical	3	8	1	2	[-]
Sales	2	2	3	3	[-]
Craftsman, foreman, kindred worker	13	7	18	14	[7]
Operative, kindred worker . .	4	2	3	6	[7]
Service worker, including private household worker . .	2	4	2	1	[-]
Farm laborer, farm foreman[a] .	-	-	-	-	[-]
Laborer, except farm and mine.	5	6	1	6	[14]
Indeterminate	7	6	6	10	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members . . .	(533)	(142)	(150)	(226)	(15)

[a]Although the question suggested a distinction betweem "farm owner" and "farm not-owner," this distinction was not made by those responding to the questionnaire, many of whom answered simply "farmer." As a consequence these figures are probably an over-estimate of the percentage of faculty members whose fathers were farm owners or farm managers and an underestimate of those whose fathers were farm laborers or farm foremen.

Q 18. At about what age did you decide finally on a career in mathematics?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
13 years old or less or "grammar school age"	5%	10%	6%	2%	[-%]
14-17 years old or "high school age"	18	19	18	19	[7]
18-22 years old or "college age" .	32	34	36	32	[8]
23-25 years old	10	7	11	12	[7]
26-30 years old	5	7	3	6	[-]
31 years old or more	3	1	4	3	[7]
Age of decision indeterminate . .	2	3	2	1	[-]
Does not consider self as having a career in mathematics	25	19	20	25	[71]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 19. Has any mathematician, either in writings or in person, exercised a strong influence on your career? Who?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
No	36%	25%	27%	48%	[50%]
No answer	2	6	1	2	[-]
One influence named	30	36	31	23	[35]
Two or more influences named . . .	32	33	41	27	[15]
High school teacher(s)	13	8	14	17	
Individual(s) at undergraduate college attended	55	60	60	50	
Individual(s) at graduate college attended	40	42	37	42	
Colleague(s) at college employing him in 1960-61 . . .	3	1	3	4	
Individual(s) from college or university other than schools specified above	16	10	12	27	
Individual reported was listed in Combined Membership List but college affiliation indeterminate	2	*	3	-	
Individual reported was not listed in Combined Membership List and college affiliation indeterminate	2	*	6	-	
Specific individual indeterminate	3	-	2	3	
Total[a]	134%	121%	137%	143%	
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some faculty members mentioned more than one individual.

Q 20. Which one of these statements comes closest to the way that you feel about a career in mathematics?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
It is the only career that could really satisfy me	36%	42%	43%	30%	[15%]
It is one of several careers that I could find almost equally satisfying	53	48	51	60	[43]
I can think of other careers that would be more satisfying to me .	9	9	3	10	[28]
No answer	2	1	3	*	[14]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 21. In the <u>long run</u> would you rather be known and respected . . .

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Throughout the institution where you work?	52%	54%	53%	50%	[56%]
Among people in your own field in different institutions?	44	43	41	46	[44]
No answer	4	3	6	4	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Q 22. Mathematicians differ as to the aspects or characteristics of the field of mathematics which they find attractive. Which one of the following list of statements comes closest to describing your feelings?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Mathematics interests me chiefly because of the numerous applications which can be made of it	37%	33%	38%	36%	[51%]
I chiefly enjoy the purity and abstract quality of mathematics.	35	41	40	33	[7]
I prefer mathematics because it is unemotional, logical, and divorced from reality	3	2	4	3	[-]
Most of the courses I teach are tedious, but I enjoy certain topics because of their precision and beauty	4	1	4	6	[-]
I like mathematics because I find it easy	4	3	1	5	[14]
I chiefly enjoy the creative and intuitive aspects of mathematics	28	32	28	26	[21]
I don't really like mathematics .	1	-	-	1	[7]
No answer	1	1	1	2	[-]
Total[a]	113%	113%	116%	112%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some faculty members chose more than one statement.

Item a. Location of faculty member in 1961-62 academic year

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Still member of faculty of college employing him 1960-61 . . .	90%	97%	94%	87%	[72%]
Employed by another college or university	5	2	6	7	[-]
Employed by secondary or elementary school	1	-	-	2	[7]
Employed primarily by business or industry	*	-	-	1	[-]
Continuing own education; not planning to return to college employing him 1960-61	1	-	-	*	[7]
Employed but not as mathematician, statistician, or teacher	2	-	-	3	[7]
Retired from teaching	*	1	-	*	[-]
Out of labor force; below retirement age	1	-	-	-	[7]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Item b. Faculty member's self-conception

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Considers self mathematician, primarily	50%	63%	50%	50%	[15%]
Considers self mathematics teacher, specified	20	15	26	22	[7]
Considers self teacher, mathematics not specified	12	8	9	12	[43]
Considers self scientist	7	10	4	7	[14]
Considers self social scientist .	1	1	*	*	[7]
Considers self statistician, actuary	2	2	3	1	[-]
Considers self engineer	3	1	3	4	[-]
Considers self member of other profession; law, ministry, etc..	2	-	1	2	[14]
Considers self in some other category	2	*	4	1	[-]
Self-conception indeterminate . .	1	*	*	1	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Item c. Which memberships were reported for this faculty member in the 1961-62 Combined Membership List (of the AMS, MAA, and SIAM)?

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
American Mathematical Society . .	28%	45%	25%	24%	[7%]
Mathematical Association of America	50	67	53	48	[-]
Society for Industrial and Applied Mathematics	4	5	7	1	[-]
None of the above	42	26	38	45	[93]
Membership indeterminate	1	-	-	1	[-]
Total[a]	125%	143%	123%	119%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

[a]Sum is greater than 100 per cent because some faculty members belong to more than one of these three societies.

Item d. Was faculty member listed in the 20 Volume Author Index of Mathematical Reviews, 1940-59?

Not listed at all	89%	77%	88%	95%	[100%]
Listed with one entry	6	10	7	3	[-]
Listed with more than one entry .	5	13	5	2	[-]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

Item e. Sex of faculty member

Variable	Academic Rank, End of Spring 1961 Term				
	Total	Prof.	Assoc. Prof.	Asst. Prof.	Other
Male	87%	85%	86%	91%	[79%]
Female	13	15	14	9	[21]
Total	100%	100%	100%	100%	100%
Unweighted number of faculty members	(533)	(142)	(150)	(226)	(15)

APPENDIX C

APPENDIX C

Mathematics' Older and Newer Tools

Colleges and universities which did not grant the doctorate in mathematics were the concern of this study. During the data collection stage, however, information in two areas--the school library's facilities for and collections in mathematics, and the availability of electronic computing equipment--was gathered from all schools in the sample, doctorate-granting as well as non-doctorate-granting.[1]

The information thus obtained is summarized in the following pages to complete the picture of the setting of undergraduate mathematics teaching presented in the body of the report, and to supplement the data already available on doctorate-producing mathematics departments in the Albert report.

Location of Library Mathematics Collections

Most colleges and universities providing mathematics instruction housed mathematics materials in their general library collections; only eight per cent kept them in a separate room or building, either alone or together with other science materials. Institutions granting the mathematics doctorate, however, were more likely than not to house the collection in a special room or building (Table C-1).

For one school in five, one building held both the mathematics collection and the offices of some or all staff in mathematics. Ph.D.-granting institutions divided about half and half as to whether libraries and staff were housed in the same building or different ones, but, among the non-Ph.D.-granting schools, libraries and mathematics offices in separate buildings were much more likely. Generally speaking, in the doctorate-granting schools, staff offices and library holdings in the same building were due to the maintenance of a separate mathematics or science library housed in a classroom or office building. In the non-Ph.D.-granting schools this usually resulted from some mathematics offices being located in a building which also housed the general library (Table C-2).

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[1]These data were collected in mid-1961 by field representatives at each of the 135 colleges and universities cooperating in the study.

TABLE C-1

PERCENTAGE DISTRIBUTIONS OF SCHOOLS BY LOCATION OF LIBRARY MATHEMATICS MATERIALS ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[a]

Location of School Library's Mathematics Materials	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction.	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Materials in general collection	92	90	92	96	41
Materials in separate room or building	8	10	8	4	59
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]Based on Table 6, Page 1155, American Universities and Colleges, (8th ed., American Council on Education, 1960), and U.S. Office of Education, Earned Degrees Conferred 1958-1959, Bachelors and Higher Degrees, OE-54013 Circular No. 636 (Washington: U.S. Government Printing Office, 1961).

TABLE C-2

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LOCATION OF LIBRARY MATHEMATICS MATERIALS IN RELATION TO OFFICES OF MATHEMATICS FACULTY,[a] ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[b]

Location of School Library's Mathematics Materials in Relation to Offices of Mathematics Faculty	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[b]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Library mathematics materials and some or all mathematics faculty offices in same building . . .	22	17	25	20	48
Library mathematics materials and all mathematics faculty offices in different buildings	78	83	75	80	52
Total	100%	100%	100%	100%	100%
Unweighted number of schools . . .	(135)	(62)	(73)	(89)	(46)

[a]Based on responses to the question: "Are the library collection in mathematics and the offices of the mathematics department faculty in the same building or in different buildings?

[b]See footnote a, Table C-1.

Accessibility of Materials

The amount of access one had to a library mathematics collection depended primarily on whether one were a faculty member or an undergraduate student, and secondarily on whether the materials were to be used weekdays or weekends (Tables C-3a, C-3b, C-3c).

TABLE C-3a

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LOCATION OF LIBRARY MATHEMATICS MATERIALS AND AVAILABILITY OF MATERIALS[a] WEEKDAYS TO UNDERGRADUATE STUDENTS AND TO MATHEMATICS FACULTY, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[b]

Location of School Library's Mathematics Materials and Availability of Materials[c] Weekdays	All Schools	Type of Control: Public	Type of Control: Private	Ph.D. in Mathematics 1948-59[b]: None Granted	Ph.D. in Mathematics 1948-59[b]: One or More Granted
Availability to Undergraduate Students					
No mathematics instruction	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Materials in general collection	92	90	92	96	41
Available 2 periods per day	4	5	3	4	2
Available 3 periods per day	86	85	86	90	39
Available more than 3 periods (includes has key)	-	-	-	-	-
Availability indeterminate	2	-	3	2	-
Materials in separate room or building	8	10	8	4	59
Available 2 periods per day	1	2	1	-	12
Available 3 periods per day	7	8	7	4	47
Available more than 3 periods (includes has key)	-	-	-	-	-
Availability to Mathematics Faculty					
Materials in general collection	92	90	92	96	41
Available 2 periods per day	2	-	3	2	-
Available 3 periods per day	76	77	75	79	39
Available more than 3 periods (includes has key)	12	13	11	13	2
Availability indeterminate	2	-	3	2	-
Materials in separate room or building	8	10	8	4	59
Available 2 periods per day	-	-	-	-	-
Available 3 periods per day	3	5	2	2	16
Available more than 3 periods (includes has key)	5	5	6	2	43
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]Based on responses to the questions: "Where is this school's library collection in mathematics housed now?" and "During what hours is the library collection in mathematics available to undergraduate students? to the mathematics faculty?"

[b]See footnote a, Table C-1.

[c]A period of availability is defined as the library collection being accessible some hours at least in the morning or afternoon or evening.

TABLE C-3b

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LOCATION OF LIBRARY MATHEMATICS MATERIALS AND AVAILABILITY OF MATERIALS[a] SATURDAYS TO UNDERGRADUATE STUDENTS AND TO MATHEMATICS FACULTY, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[b]

Location of School Library's Mathematics Materials and Availability of Materials[c] Saturdays	All Schools	Type of Control: Public	Type of Control: Private	Ph.D. in Mathematics 1948-59[b]: None Granted	Ph.D. in Mathematics 1948-59[b]: One or More Granted
Availability to Undergraduate Students					
No mathematics instruction . . .	2%	-%	3%	2%	-%
Some mathematics instruction . .	98	100	97	98	100
Materials in general collection	92	90	92	96	41
Not available at all	2	-	3	2	-
Available less than 2 periods	27	48	15	29	5
Available 2 periods Saturday	55	41	62	56	36
Available 3 periods Saturday	6	1	9	7	-
Availability indeterminate .	2	-	3	2	-
Materials in separate room or building	8	10	8	4	59
Not available at all	1	2	*	-	12
Available less than 2 periods	4	5	4	3	16
Available 2 periods Saturday	2	3	3	*	28
Available 3 periods Saturday	1	-	1	1	1
Availability indeterminate .	*	-	*	-	2
Availability to Mathematics Faculty					
Materials in general collection	92	90	92	96	41
Not available at all	2	-	3	2	-
Available less than 2 periods	21	38	11	22	5
Available 2 periods Saturday	50	41	56	52	34
Available 3 periods Saturday	6	1	8	6	-
Available more than 3 periods (includes has key)	11	10	11	12	2
Availability indeterminate .	2	-	3	2	-
Materials in separate room or building	8	10	8	4	59
Not available at all	*	*	-	-	1
Available less than 2 periods	1	3	1	1	6
Available 2 periods Saturday	1	2	*	*	8
Available 3 periods Saturday	1	-	1	1	2
Available more than 3 periods (includes has key)	5	5	6	2	42
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-3a.

[b]See footnote a, Table C-1.

[c]See footnote c, Table C-3a.

*Less than one-half of one per cent.

TABLE C-3c

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LOCATION OF LIBRARY MATHEMATICS MATERIALS AND AVAILABILITY OF MATERIALS[a] SUNDAYS TO UNDERGRADUATE STUDENTS AND TO MATHEMATICS FACULTY, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[b]

Location of School Library's Mathematics Materials and Availability of Materials[c] Sundays	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[b]	
		Public	Private	None Granted	One or More Granted
Availability to Undergraduate Students					
No mathematics instruction . . .	2%	-%	3%	2%	-%
Some mathematics instruction . .	98	100	97	98	100
Materials in general collection	92	90	92	96	41
Not available at all	35	35	35	37	10
Available less than 2 periods	30	44	22	31	16
Available 2 periods Sunday .	23	11	29	24	15
Available 3 periods Sunday .	2	-	3	2	-
Availability indeterminate .	2	-	3	2	-
Materials in separate room or building	8	10	8	4	59
Not available at all	4	5	4	2	32
Available less than 2 periods	2	3	2	1	9
Available 2 periods Sunday .	1	2	1	-	16
Available 3 periods Sunday .	1	-	1	1	-
Availability indeterminate .	*	-	*	-	2
Availability to Mathematics Faculty					
Materials in general collection	92	90	92	96	41
Not available at all	29	30	28	31	7
Available less than 2 periods	26	39	19	27	16
Available 2 periods Sunday .	20	11	25	20	16
Available 3 periods Sunday .	4	-	6	4	-
Available more than 3 periods (includes has key)	11	10	11	12	2
Availability indeterminate .	2	-	3	2	-
Materials in separate room or building	8	10	8	4	59
Not available at all	1	1	1	1	7
Available less than 2 periods	1	3	-	*	6
Available 2 periods Sunday .	*	1	*	-	4
Available 3 periods Sunday .	1	-	1	1	-
Available more than 3 periods (includes has key)	5	5	6	2	42
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-3a.

[b]See footnote a, Table C-1.

[c]See footnote c, Table C-3a.

*Less than one-half of one per cent.

While _formal_ weekday library hours were often similar for both faculty and students, faculty members occasionally had keys to the library permitting its use off-hours. Undergraduate students seldom had this privilege. Library keys were likely to be issued for special collections only; if mathematics materials were included in the general library, the faculty member had less of an advantage over the undergraduate. Because many of the doctorate-granting institutions housed mathematics collections in special libraries, the situation there was somewhat more favorable for faculty than in the non-Ph.D.-granting schools. The reverse tended to be true for undergraduates in schools of the two degree types. Weekdays there was no particular advantage for faculty or for students from the standpoint of accessibility of the library in publicly-controlled schools as opposed to private ones.

In many colleges and universities formal library service was more restricted weekends than on weekdays. In general, for both teaching staff and undergraduates, hours for library use were more liberal in privately-controlled than in publicly-controlled institutions. For mathematics faculty members, from the standpoint of weekend library use, it was more advantageous to be on the staff of a Ph.D.-granting school; for the undergraduate student in mathematics it was somewhat less so.

Circulation of Periodicals

One college or university library in two, as a matter of policy, circulated new issues of periodicals to mathematics staff members before making them available for more general use. In one-sixth of the schools this was "usual" procedure, while for another third it was an "occasional" practice. Library policy on this varied considerably with the degree-granting status of the school. For half of the non-Ph.D.-granting institutions advance circulation was either "usual" or "occasional," but this was the case in only one out of five Ph.D.-granting schools. Two considerations help explain these differing practices--the relative sizes of the teaching staffs involved and the fact that faculty members in the Ph.D.-granting schools were more apt to subscribe as individuals to mathematical periodicals. Publicly-controlled schools and privately-controlled ones were quite similar in policy and practice in this area (Table C-4).

TABLE C-4

PERCENTAGE DISTRIBUTION OF SCHOOLS BY FREQUENCY WITH WHICH LIBRARY CIRCULATES MATHEMATICS PERIODICALS TO MATHEMATICS FACULTY,[a] ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[b]

School Library's Policy on Circulation of Newly-received Mathematics Periodicals to Mathematics Faculty	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[b]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Mathematics periodicals usually circulated to mathematics faculty . .	18	19	17	18	10
Mathematics periodicals occasionally circulated to mathematics faculty .	32	28	34	34	11
Mathematics periodicals never circulated to mathematics faculty . .	45	48	43	42	79
Policy indeterminate . . .	5	5	6	6	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]Based on responses to the question: "Are newly-received copies of mathematical periodicals ever circulated to the mathematics faculty before being placed in the library for more general use?"

[b]See footnote a, Table C-1.

Purchase of Duplicate Materials

College and university libraries were more likely to make a practice of purchasing multiple copies of a mathematics book so that it could be used by several people simultaneously than to purchase duplicates of a serial or periodical for the same purpose. Seven libraries in ten "occasionally" or "usually" bought more than one copy of the same mathematics book, but only one in four followed a similar practice in ordering periodicals. Among those schools purchasing multiple copies of any materials, the practice was more often "occasional" than "usual" (Tables C-5a and C-5b).

TABLE C-5a

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LIBRARY'S USUAL PROCEDURE ON PURCHASE OF DUPLICATE COPIES OF BOOKS TO ALLOW FOR MULTIPLE USE,[a] ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[b]

School Library's Usual Procedure on Purchase of Duplicate Copies of Mathematics Books	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[b]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction .	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Usually purchases duplicate copies to allow for multiple use	12	27	4	11	18
Occasionally purchases duplicate copies to allow for multiple use	59	61	59	60	58
Rarely or never purchases duplicate copies to allow for multiple use	27	12	34	27	24
Procedure indeterminate .	2	-	3	2	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]Based on responses to the question: "What is the library's usual procedure regarding the purchase of duplicate copies of mathematics books to allow for multiple use?"

[b]See footnote a, Table C-1.

TABLE C-5b

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LIBRARY'S USUAL PROCEDURE ON PURCHASE OF DUPLICATE COPIES OF PERIODICALS AND SERIALS TO ALLOW FOR MULTIPLE USE,[a] ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[b]

School Library's Usual Procedure on Purchase of Duplicate Copies of Periodicals and Serials	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[b]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Usually purchases duplicate copies to allow for multiple use	4	10	*	4	7
Occasionally purchases duplicate copies to allow for multiple use .	20	32	14	19	30
Rarely or never purchases duplicate copies to allow for multiple use .	69	58	75	69	63
Procedure indeterminate .	7	-	11	8	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]Based on responses to the question: "What is the library's usual procedure regarding the purchase of duplicate copies of mathematics periodicals and serials to allow for multiple use?"

[b]See footnote a, Table C-1.

*Less than one-half of one per cent.

Ph.D.-granting and non-Ph.D.-granting institutions were fairly similar in the procedures they followed in purchasing mathematics materials. More publicly-controlled than privately-controlled schools, however, made a practice of buying several copies of the same thing.

One school library in three had a policy of automatically replacing missing or lost books and periodicals in mathematics. For the remainder replacement was not a matter of course but depended on special requests from faculty, how much the material was used, the level of the course in which it was used, etc. Fewer Ph.D.-granting schools than others had a policy of automatic replacement; publicly-controlled schools were more apt than private ones to follow this practice, however (Table C-6).

TABLE C-6

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LIBRARY'S POLICY ON REPLACEMENT OF LOST OR MISSING MATHEMATICS BOOKS AND PERIODICALS,[a] ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[b]

School Library's Policy on Replacement of Lost or Missing Mathematics Books and Periodicals	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[b]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction .	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Automatic replacement of lost or missing mathematics books and periodicals	38	53	30	39	27
Replacement of lost or missing mathematics books and periodicals not automatic	60	47	67	59	73
Policy indeterminate . . .	2	-	3	2	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]Based on responses to the question: "What is the library policy with respect to replacing lost or missing books and periodicals in mathematics?"

[b]See footnote a, Table C-1.

That public schools were more inclined than private ones to make multiple purchases for any reason suggests that considerations of budget and funds might explain these differing practices. Comparison of the practices of "higher tuition" private schools with those of "lower tuition" private schools, however, did not bear this out. If anything, "higher tuition" schools were less likely than "lower tuition" ones to buy duplicate materials in mathematics.

The Nature of College Library Collections in Mathematics

College and university library collections in mathematics differ widely in size and content, and it is consequently difficult to compare the materials available to a mathematician at one school with those available to his colleague at another. To make a rough assessment of mathematics materials in library collections, holdings at each school were checked against lists suggested by the Committee on the Undergraduate Program in Mathematics (CUPM) of the Mathematical Association of America to indicate adequacy and level of materials in mathematics. Measured by this yardstick, book collections in mathematics appeared better, on the average, than collections of certain monographs, periodicals and serials. The findings are outlined below.

"Twenty-one Selected Books"

In mid-1961 ninety-five out of a hundred college and university libraries had one or more of the twenty-one books in mathematics suggested by CUPM as criterion items (Table C-7). All schools granting the Ph.D. in mathematics had at least one of them, as did 94 per cent of the non-Ph.D.-granting colleges. The libraries of all colleges and universities under public control and nine out of ten of those under private control contained one or more.

On the average, a library mathematics collection contained ten of the twenty-one books. The doctorate-granting school library averaged twenty and, in fact, nine of the twenty-one titles were found in the libraries of all Ph.D.-granting schools. Non-Ph.D.-granting institutions averaged half as many. Public school libraries included more of the titles, on the average, than private school libraries did. Distinct from the findings on the relation between tuition and purchase policies, "higher tuition" private school collections were as large, on the average, as those of publicly-controlled schools. The "lower tuition" private school collections were two-thirds as large, averaging eight of the twenty-one selected titles.

TABLE C-7

PERCENTAGE OF SCHOOL LIBRARIES WITH SELECTED BOOKS IN THE FIELD OF MATHEMATICS, AND MEAN NUMBER OF SELECTED BOOKS HELD, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[a]

Selected Books	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
Andree, R. V. Selections from Modern Abstract Algebra	50%	54%	48%	48%	73%
Banach, S. Theorie des Operations Lineaires (Poland)	23	33	17	16	100
Bell, E. T. Development of Mathematics	78	84	75	77	98
Birkhoff, G. and MacLane, S. Survey of Modern Algebra	79	92	72	77	100
Buck, R. C. Advanced Calculus	41	49	37	37	90
Cartan, H. and Eilenberg, S. Homological Algebra	24	38	16	18	99
Churchill, R. V. Modern Operational Math. in Engineering	53	68	45	49	100
Courant, R. and Robbins, H. What is Mathematics?	83	87	81	82	100
Cramer, H. Mathematical Methods of Statistics	41	57	33	36	100
Feller, W. Introduction to Probability Theory	65	64	66	62	100
Ford, L. R. Differential Equations	47	56	42	43	90
Friedman, B. Principles & Techniques of Applied Math.	36	48	30	31	94
Halmos, P. Measure Theory	41	56	34	37	100
Kaplansky, I. Infinite Abelian Groups	22	31	17	16	99
Kelley, J. L. General Topology	48	55	45	44	99
Kleene, S. Introduction to Mathematics	38	51	31	33	99
Kline, M. Mathematics in Western Culture	70	79	66	68	93
Manning, H. P. Geometry of Four Dimensions	50	53	49	48	81
Uspensky, J. V. Introduction to Mathematical Probability	50	56	46	45	100
van der Waerden. Moderne Algebra (Germany)	29	36	25	23	98
Wilder, R. L. Introduction to the Foundations of Math.	59	80	48	56	100
None of the selected books	5	-	8	6	-
Mean number of selected books	10	12	9	9	20
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

Courant and Robbins, What is Mathematics?, included in the collections of four schools in five, was the most frequently favored of the twenty-one books, while the specified titles by Banach, Cartan and Eilenberg, and Kaplansky were the most restricted in distribution. It should be mentioned that generality and specificity of subject matter, level of treatment, and date of publication, as well as intrinsic merit, were factors in the distribution of these books.

Each title was found more commonly in the collections of doctorate-granting schools than in the non-doctorate-granting, and, with the exception of Feller's Introduction to Probability Theory, each was more likely to be found in a publicly-controlled school than in a private one.

Carus Mathematical Monographs

Three out of four college and university library collections contained one or more of the Carus Mathematical Monographs, the series totaling thirteen at the time these data were gathered. All Ph.D.-granting schools had at least one of them while a quarter of the non-Ph.D.-granting school libraries had none at all. School libraries in publicly-controlled schools were more likely than those in privately-controlled schools to include one or more of the monographs (Table C-8).

The average collection of Carus Mathematical Monographs numbered five, with ranges from twelve among doctorate-granting schools to five among non-Ph.D.-granting, and from seven for the publicly-controlled school library to four for the private schools. Each of the monographs was found in the collection of nine out of ten Ph.D.-granting schools, but, unlike the "selected books," none was found in the libraries of all of them. The average holding in Carus Monographs of the "higher tuition" private school was slightly larger than that of the "lower tuition" school (five compared to four).

TABLE C-8

PERCENTAGE OF SCHOOL LIBRARIES WITH CARUS MONOGRAPHS AND MEAN NUMBER OF CARUS MONOGRAPHS HELD, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[a]

Carus Monographs	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
#1 Bliss, G. A. Calculus of Variations	57%	66%	52%	54%	97%
#2 Curtiss, D. R. Analytic Functions of a Complex Variable	36	51	28	31	96
#3 Rietz, H. L. Mathematics Statistics	43	55	36	38	97
#4 Young, J. W. Projective Geometry	46	55	41	42	97
#5 Smith, D. E. and Ginsburg, J. A History of Mathematics in America before 1900 . . .	42	57	34	38	94
#6 Jackson, D. Fourier Series & Orthogonal Polynomials .	39	55	30	34	96
#7 MacDuffee, C. C. Vectors and Matrices	44	63	34	39	97
#8 McCoy, N. H. Rings and Ideals	37	54	28	32	96
#9 Pollard, H. The Theory of Algebraic Numbers	37	60	25	32	97
#10 Jones, B. W. The Arithmetic Theory of Quadratic Forms	36	56	25	31	96
#11 Niven, I. Irrational Numbers	40	59	30	36	93
#12 Kac, M. Statistical Independence in Probability Analysis & Number Theory	28	39	22	22	92
#13 Boas, R. P., Jr. A Primer of Real Functions	36	49	29	31	90
No Carus Monographs	24	17	27	26	-
Mean number of Carus Monographs .	5	7	4	5	12
Unweighted number of schools . .	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

Monograph No. 1, Bliss's Calculus of Variations, was most common in library collections, being found in one-half of all school libraries. The least widely distributed, Kac's Statistical Independence in Probability Analysis and Number Theory, appeared in half as many collections. Without exception each of the Carus Mathematical Monographs was included in the collections of a greater proportion of Ph.D.-granting schools than non-Ph.D.-granting ones, and a greater proportion of public than of private schools.

The caution mentioned in connection with the distribution of the "selected books" applies equally to monographs.

Selected Periodicals and Serials

The preponderant majority of college and university libraries held issues of one or more of the seventeen mathematical periodicals which were suggested by CUPM as measures of collections. Like the situation regarding the "selected books" and Carus Mathematical Monographs, at least some of these periodicals were found in the mathematics library of every doctorate-granting institution. Some also were included in the holdings of every publicly-controlled college or university (Table C-9).

Average library holdings in mathematical periodicals were poorer in comparison to the CUPM checklist than were the average holdings of books and monographs. School library collections averaged some issues for five periodicals out of a total of seventeen, though there was a range from sixteen in the Ph.D.-granting to five in the non-Ph.D.-granting schools. Collections in publicly-controlled schools were larger, on the average, than those in the privately-controlled, but holdings in "higher tuition" private schools were equal in average number to those in publicly-controlled colleges and universities.

Two of the periodicals--American Mathematical Monthly and Mathematics Teacher--were found in four collections out of five. The periodical Matematičeskii Sbornik, common in doctorate-granting institutions, was rare in schools as a whole. This was generally true for foreign periodicals on the checklist.

TABLE C-9

PERCENTAGE OF SCHOOL LIBRARIES WITH ONE OR MORE ISSUES OF SELECTED PERIODICALS AND SERIALS IN THE FIELD OF MATHEMATICS, AND MEAN NUMBER OF DIFFERENT PERIODICALS AND SERIALS HELD, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-59[a]

Selected Periodicals and Serials	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
Acta Mathematica. Uppsala, Sweden	18%	23%	16%	12%	100%
American Journal of Mathematics. Baltimore	31	47	22	25	100
American Mathematical Monthly . .	80	93	73	78	100
American Mathematical Society, Colloquium Vols.	24	34	18	18	96
American Mathematical Society, Transactions	38	46	33	32	100
Annals of Mathematical Statistics. Baltimore	23	32	18	16	100
Annals of Mathematics. Princeton .	30	35	27	24	100
Bell System Technical Journal. N.Y. City	31	26	33	26	88
Journal of the London Mathematical Society	16	23	12	10	88
Matematičeskii Sbornik. Moscow .	9	14	6	2	92
Mathematical Reviews, Providence, R.I.	38	62	25	33	97
Mathematics Magazine	42	58	34	37	100
Mathematics Teacher	80	98	70	80	82
Mathematische Annalen. Berlin-Gottingen	18	28	12	11	100
Scripta Mathematica. N.Y.	38	59	28	33	98
The Mathematical Gazette. London.	20	20	19	14	84
"Bourbaki," in Actualities Sci. et Industrielles.	16	24	12	10	96
None of the periodicals and serials	9	-	14	10	-
Mean number of periodicals and serials	5	7	5	5	16
Unweighted number of schools . . .	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

As with the "selected books" and Carus Mathematical Monographs, it was more likely that a particular periodical would be found in the collection of a Ph.D.-granting school than that of a non-Ph.D.-granting one, and in the holdings of a college or university under public control than in one under private control.

Electronic Computing Equipment

Many of the 11,000 or so computer installations estimated[2] to have been in existence in the early 1960's were located on the campuses of universities and colleges. Many other schools, lacking on-campus equipment, had access to that of other academic institutions, business firms, government agencies, and the like.

Availability Over-all

Four schools in ten in the sample had either digital or analogue computers on their own campuses, shared computers off-campus with other institutions or agencies, or had informal access to the equipment of others. For some colleges and universities electronic computing equipment was available through more than one of the above means. The proportion of schools with computers accessible in any way at all did not vary with the type of control of the college or university but did vary considerably with the school's degree-granting status. While all Ph.D.-granting institutions had computers available by one or another of these three means, only about one-third of the non-Ph.D.-granting schools had access to computers in any way (Table C-10).

For schools as a whole, on-campus equipment and access to that of other institutions or organizations were equally frequent, but the sharing of off-campus computers by formal arrangement was fairly rare.

In 1961 two schools in ten had computers on-campus and the same proportion had informal access to the equipment of another agency or organization.

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[2] Employment in Professional Mathematical Work in Industry and Government, NSF 62-12, prepared by the Bureau of Labor Statistics, U.S. Department of Labor, p. 16.

TABLE C-10

PERCENTAGE DISTRIBUTION OF SCHOOLS BY REPORTED AVAILABILITY[a] OF ELECTRONIC COMPUTING EQUIPMENT, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[b]

Reported Availability of Electronic Computing Equipment	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[b]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction . .	2%	-%	3%	2%	-%
Some mathematics instruction .	98	100	97	98	100
School has own electronic computing equipment on own campus	20	31	15	14	100
School shares electronic computing equipment off-campus, with other institutions or agencies	3	2	3	2	10
School has access to electronic computing equipment off-campus, instead of, or in addition to, owned and/ or shared equipment . . .	20	13	24	21	9
Electronic computing equipment not reported available to school by any means . .	59	57	60	64	-
Total[c]	102%	103%	102%	101%	119%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]Based on responses to the questions: "Does the school have any high-speed or medium-speed electronic computing equipment--like the IBM 1620 or IBM 650--of its own or which it shares with other educational or research institutions in the vicinity, or does it have access to such equipment of some business or industrial concern?" and "At SCHOOL do you have access to equipment like this (high- or medium-speed electronic computing equipment like an IBM 650 or IBM 1620 or an analogue computer)?"

[b]See footnote a, Table C-1.

[c]The totals are greater than 100 per cent because some schools reported equipment available by more than one means or through more than one institution or agency.

Ph.D.-granting schools differed markedly from the non-Ph.D.-granting in the number of computers to which they had access and in the ways in which they had access to them. While every doctorate-granting school had at least one computing installation on-campus, this was true for only one non-Ph.D.-granting school in seven. In addition, ten per cent of the doctorate-granting formally shared computers off-campus, and nine per cent had informal access to some computing equipment. Few colleges and universities not granting the Ph.D., on the other hand, shared computers in a formal way, though two in ten had access to those of another institution or agency. Publicly-controlled schools were more likely to have on-campus equipment than to have access to the computers of some other agency, while the reverse held for colleges and universities under private control.

On-campus Installations--The Primary Installation[3]

In 1961 the school with more than one on-campus electronic computing installation was a rarity, only one college or university in a hundred falling into this category. Multiple installations were then found only among the Ph.D.-granting schools. While two or three installations were usually the maximum, one school reported having seven separate ones (Table C-11).

More often than not the individual in charge of the "Primary Installation" had been employed by the college or university in some other capacity earlier, and had not been hired specifically for work with the computer. This was the case about three times out of four, and was the prevailing situation regardless of whether the school was publicly- or privately-controlled, Ph.D.-granting or not (Table C-12).

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[3]To facilitate description in those instances in which a school had more than one computing installation, the unit with the closest relationship to the mathematics department was arbitrarily designated "Primary." If a school had only one on-campus unit, that, of course, was designated "Primary."

TABLE C-11

PERCENTAGE DISTRIBUTION OF SCHOOLS BY NUMBER OF SCHOOL'S OWN ELECTRONIC COMPUTING EQUIPMENT INSTALLATIONS, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[a]

Number of School's Own Electronic Computing Equipment Installations	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
School has one installation	19	29	14	14	83
School has more than one installation .	1	2	1	-	17
School has no electronic computing equipment	80	69	85	86	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools . .	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

TABLE C-12

PERCENTAGE DISTRIBUTION OF SCHOOLS BY BACKGROUND REPORTED[a] FOR PERSON IN CHARGE OF SCHOOL'S PRIMARY ELECTRONIC COMPUTING EQUIPMENT, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[b]

Background Reported for Person in Charge of School's Primary Electronic Computing Equipment	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[b]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Employed specifically to be in charge of equipment	4	7	2	2	30
Employed by school in other capacity previously	14	24	9	3	70
Background indeterminate	2	-	4	9	-
School has no electronic computing equipment	80	69	85	86	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools . . .	(135)	(62)	(73)	(89)	(46)

[a]Based on responses to the question: "Did this person join the staff of this school specifically to be in charge of this equipment, or was he employed here before but in another capacity?"

[b]See footnote a, Table C-1.

In two-thirds of the colleges and universities having on-campus computers, the "Primary Installation" as a separate entity was responsible for its own money budget and work schedule. In the remaining cases responsibility was allocated to any one of a number of different units--academic departments or combinations of departments, research institutes, or the over-all school administration. Among Ph.D.-granting schools where the computer complex was more elaborate, the "Primary Installation" was even more likely to be responsible for budgeting its funds (three-quarters of the cases) and for scheduling work (four-fifths of the cases). In the non-Ph.D.-granting schools with on-campus computers the "Primary Installation" itself assumed these responsibilities in about half of the cases.

Sole responsibility for money budget and work schedule of the "Primary Installation" fell to the lot of the mathematics department fairly rarely, in fact no more frequently to mathematics than to any of the others (Tables C-13 and C-14).

Among schools with an on-campus unit one-fifth had more than one computer in the "Primary Installation" and had acquired these at various dates. Of the remainder more than half had acquired their computer as recently as 1960 or 1961 (Table C-15).

Publicly-controlled schools more than private ones, and Ph.D.-granting more than the non-Ph.D.-granting had several computers in the "Primary Installation." About one-fourth of the public compared to one-seventh of the private, and four in ten of the doctorate-granting compared to less than one in ten of the non-doctorate-granting had this much equipment.

The IBM 1620 and IBM 650 were the most common types of computers in "Primary Installations." In addition to these, but less numerous, were a variety of others, including "homemade" computers. These latter (for example, Mark IV, Mistic, Pennstac) were found only in the doctorate-granting institutions, 12 per cent of which included one in the "Primary Installation" equipment (Table C-16). An analogue

TABLE C-13

PERCENTAGE DISTRIBUTION OF SCHOOLS BY UNIT RESPONSIBLE FOR BUDGET OF PRIMARY ELECTRONIC COMPUTING EQUIPMENT INSTALLATION, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[a]

Unit Responsible for Budget of "Primary Installation"	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction . .	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
"Primary Installation" itself	13	19	9	7	76
General administration . .	1	2	*	*	8
Mathematics department alone	1	1	1	*	6
Engineering department alone	*	1	*	*	4
Commerce or business department alone	*	1	-	*	-
Science department(s) other than social science	2	6	1	2	6
Other departments	1	1	-	2	-
"Research Institute" . . .	*	*	-	*	-
Responsible unit indeterminate	2	-	4	3	-
School has no electronic computing equipment . . .	80	69	85	86	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

*Less than one-half of one per cent.

TABLE C-14

PERCENTAGE DISTRIBUTION OF SCHOOLS BY UNIT RESPONSIBLE FOR SCHEDULING USE IN PRIMARY ELECTRONIC COMPUTING EQUIPMENT INSTALLATION, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[a]

Unit Responsible for Scheduling Use of Equipment in "Primary Installation"	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction .	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
"Primary Installation" itself	13	19	9	7	80
Mathematics department alone	1	1	1	1	7
Engineering department alone	*	1	-	*	2
Science department(s) other than social science	2	6	1	2	4
Committee from several non-social sciences	*	-	*	-	2
Committee from all departments	*	1	-	-	3
"Research Institute" . . .	*	*	-	*	-
No single unit responsible	*	-	*	-	2
Responsible unit indeterminate	4	3	4	4	-
School has no electronic computing equipment . .	80	69	85	86	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

*Less than one-half of one per cent.

TABLE C-15

PERCENTAGE DISTRIBUTION OF SCHOOLS BY DATE OF ACQUISITION OF ELECTRONIC COMPUTING EQUIPMENT IN "PRIMARY INSTALLATION," ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[a]

Date of Acquisition of Equipment in "Primary Installation"	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction .	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
1961	3	5	2	2	16
1960	7	6	7	6	19
1959	4	9	1	4	7
1958	1	2	1	1	7
1957	1	1	*	-	7
1956 or earlier	*	-	1	-	5
Indeterminate date	*	-	1	*	-
More than one piece of equipment and acquired at various dates	4	8	2	1	39
School has no electronic computing equipment . .	80	69	85	86	-
Total	100%	100%	100%	100%	100%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

*Less than one-half of one per cent.

TABLE C-16

PERCENTAGE DISTRIBUTION OF SCHOOLS BY TYPE OF ELECTRONIC COMPUTING EQUIPMENT IN "PRIMARY INSTALLATION," ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[a]

Type of Equipment in "Primary Installation"	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction . . .	2%	-%	3%	2%	-%
Some mathematics instruction .	98	100	97	98	100
IBM 650	6	11	3	2	44
IBM 1620	3	5	2	2	21
Other IBM computer	2	2	2	-	21
Remington Rand computer . . .	2	1	2	*	19
Bendix computer	2	5	1	2	4
Royal-McBee computer	2	4	*	2	2
Control Data Corp. computer .	*	1	-	-	3
"Homemade" computer	1	2	*	-	12
Miscellaneous digital computers	1	-	2	*	12
Analogue computer	7	9	6	7	4
School has no electronic computing equipment	80	69	85	86	-
Total[b]	106%	109%	103%	101%	142%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

[b]The totals are greater than 100 per cent because some installations have more than one type of equipment.

*Less than one-half of one per cent.

computer was included in the equipment of one school in three. Among schools having on-campus equipment these were more likely to be found in the private than in the publicly-controlled colleges and universities and among the non-Ph.D.-granting than in the Ph.D.-granting.

Formally-shared Equipment

Sharing of off-campus computers through some formal arrangement with another institution or agency was infrequent. Only two per cent of all colleges and universities did so. Most often, over-all, the other party in the sharing arrangement was another school in the same state but in a different city. For schools granting the doctorate, however, the most common arrangement was the sharing of equipment with business or industry, or with a non-commercial research agency, off-campus but in the same city. Publicly-controlled schools were more likely than private, and Ph.D.-granting more likely than non-Ph.D.-granting, to share equipment in more than one way (Table C-17).

Other Access to Computers

In addition to on-campus computers and formally-shared off-campus equipment, schools may have informal occasional access to the facilities of others. One college or university in five, more often private schools than public and more often non-Ph.D.-granting than Ph.D.-granting, reported this. Access to the equipment of an academic institution in another city of the same state was most common, with access to the computers of other bodies both in and out of the city less usual. Doctorate-granting schools were as likely to have access to the computers of colleges and universities in other states as in their own state. Since all Ph.D.-granting schools also had their own on-campus computers, access to those of other agencies was important only if equipment of a different capacity was needed (Table C-18).

TABLE C-17

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LOCATION AND TYPE OF BODY WITH WHICH ELECTRONIC COMPUTING EQUIPMENT WAS REPORTED SHARED, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[a]

Location and Type of Body with which Equipment Was Reported Shared	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction .	2%	-%	3%	2%	-%
Some mathematics instruction.	98	100	97	98	100
Shared equipment in same city or town					
Sharer is non-commercial, non-industrial research agency	*	1	*	-	5
Sharer is business or industry	*	*	*	-	4
Shared equipment in same state, other city or town					
Sharer is another school.	2	1	2	2	-
Shared equipment in another state					
Sharer is non-commercial, non-industrial research agency	*	*	-	-	2
Sharer is another school.	*	1	-	-	2
Equipment reported available but not by sharing . .	39	41	38	34	90
Equipment not reported available	59	57	60	64	-
Total[b]	100%	101%	100%	100%	103%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

[b]Some schools reported equipment shared with more than one institution or agency.

*Less than one-half of one per cent.

TABLE C-18

PERCENTAGE DISTRIBUTION OF SCHOOLS BY LOCATION AND TYPE OF BODY REPORTED PROVIDING ACCESS TO ELECTRONIC COMPUTING EQUIPMENT, ACCORDING TO TYPE OF CONTROL OF SCHOOL AND NUMBER OF PH.D.'S IN MATHEMATICS GRANTED, 1948-1959[a]

Location and Type of Body Reported Providing Access to Equipment	All Schools	Type of Control		Ph.D. in Mathematics 1948-59[a]	
		Public	Private	None Granted	One or More Granted
No mathematics instruction . .	2%	-%	3%	2%	-%
Some mathematics instruction	98	100	97	98	100
Accessible equipment in same city or town					
Owner is another school.	*	-	*	-	1
Owner is business or industry	4	*	6	4	-
Accessible equipment in same state, other city or town					
Owner is another school.	15	11	18	16	5
Owner is business or industry	1	-	2	1	1
Accessible equipment in another state					
Owner is another school.	1	1	1	1	6
Accessible equipment but location indeterminate . .	*	1	-	*	-
Equipment reported available by owning or sharing but not otherwise accessible	21	30	16	15	91
Equipment not reported available	59	57	60	64	-
Total[b]	101%	100%	103%	101%	104%
Unweighted number of schools	(135)	(62)	(73)	(89)	(46)

[a]See footnote a, Table C-1.

[b]Some schools reported access to the equipment of more than one institution or agency.

*Less than one-half of one per cent.

APPENDIX D

APPENDIX D

The Conduct of the Study

The Samples

The sample of colleges and universities on which this study was based is the same as the first stage of the sample used in the National Opinion Research Center study of career plans and aspirations of June, 1961 college graduates. That sample has been described in detail in NORC Report No. 90, by James A. Davis: Great Aspirations: Volume One: Career Decisions and Educational Plans During College, 1963.

Briefly, it is a random sample of colleges and universities drawn from the universe of all accredited schools granting the bachelor's degree and all unaccredited schools granting the bachelor's degree and having enrollments of 500 or more students. On the basis of data from the National Academy of Sciences-National Research Council, schools in the universe were stratified according to their productivity, in absolute numbers, of baccalaureates who, in the period 1957 through 1959, were granted the Ph.D. in the physical sciences, biological sciences, social sciences, humanities, engineering, and education, or who, in specified years, enrolled as freshmen in American medical and dental schools. Within "productivity strata," schools were further grouped according to type of control. The sample of schools was drawn from within these strata with probability proportional to the number of bachelor's degrees awarded in 1958-59. One hundred thirty-six[1] colleges and universities were drawn; these constituted the sample for the first phase of the study.

The drawn sample of schools included both colleges and universities having a Ph.D. program in mathematics and/or statistics which had awarded such degrees in the past decade and a half, and schools not

[1] One school with a newly-established and completely autonomous branch, which had conferred virtually no baccalaureates when the sample was drawn, was counted as one school in the College Senior study but as two separate schools in the study of Mathematical Environments since both branch and trunk had mathematics departments.

having such programs or not awarding these degrees during that period. Because much was already known about the mathematics departments, programs, facilities, and staffs of the schools granting the mathematics or statistics Ph.D. and little systematic information was available on the remaining schools, data in detail on these various topics were sought only from the latter group. Classification of schools into the categories "Ph.D.-Granting" and "Non-Ph.D.-Granting" was determined by the academic degrees actually conferred in the preceding decade by each school. Information on degrees conferred by each school in the sample was obtained from the American Council on Education's <u>American Universities and Colleges</u>, 8th edition, for the period 1948-58 and from the U.S. Offices of Education's <u>Earned Degrees Conferred 1958-59, Bachelor's and Higher Degrees</u>, for the 1958-59 academic year. Forty-six colleges and universities in the drawn sample were classed as "Ph.D.-Granting" and 90 as "Non-Ph.D.-Granting." (Some schools in this second category had master's programs in mathematics and had awarded the master's degree, however.) These 90 schools made up the second phase sample and provided the data for the major portion of this report.

The third phase sample, a sample of individual faculty members, was derived from rosters of mathematics staff members which were compiled at each school during the first phase. This sample of teachers included all who, as faculty members of these sample schools, taught or were responsible for teaching mathematics from July, 1960 through June, 1961, and who held the rank of assistant professor or higher at end of the spring, 1961 term. Included also were all mathematics teachers in colleges which had no academic rank system. The drawn sample consisted of 623 faculty members from the "Non-Ph.D.-Granting" colleges and universities.

<u>Data Collection</u>

Each phase of the study focused on a different major component--the school as a whole, the department, the staff--of Mathematical Environment and different techniques and instruments of data collection were appropriate to each. Phase by phase, this is the way the study was conducted:

Phase 1

In Phase 1, carried out in the summer and fall of 1961, general background information relating to mathematics instruction was collected by a field representative in person. In many instances the field representative was affiliated with the college or university in some way.

Information was gathered on the school library's mathematics collection, accessibility of the collection to mathematics staff and students, electronic computing equipment, and number of baccalaureates awarded in mathematics in 1960-61. In addition, rosters were compiled of mathematics courses given from July, 1960 through June, 1961, and of all faculty members responsible for teaching mathematics during the same time period. This background information was provided by librarians, departmental personnel, registrars and others competent to furnish it at the various schools.

Phase 2

Phase 2, conducted in December, 1961 and January, 1962, consisted of interviews carried out by nine members of the National Opinion Research Center's regular field staff with individuals identified in Phase 1 as mathematics department heads or as officials responsible for the administration of mathematics instruction. Detailed data were gathered on a number of topics, including departmental program, facilities available to the department, teaching load and other conditions of work, evaluations of professional and non-professional staffs and of students, and problems of staffing. Two questionnaire versions--identical in content but with differences in wording in a few questions--were used since departments differed in size of staff and complexity of program, and thus question wording appropriate to departments of one size might be inappropriate to those of another. A "large" department version was used in 70 per cent of the departmental interviews; a "small" department version was used in the remainder.

Because many of the schools in the sample were too distant from any member of the NORC field staff to permit in-person interviews, it was necessary to employ two different procedures. Interviews with department heads in schools within approximately forty miles of a staff interviewer were conducted face-to-face; interviews in schools at greater distances were conducted by means of long-distance telephone calls.

Shortly before the interviewing phase began each chairman or department spokesman was sent a copy of the questionnaire to be used and covering letters outlining the purpose of the study and the interviewing procedure to be followed in his case. Departmental spokesmen scheduled for interview over the telephone were asked to indicate on a postcard to be returned the most convenient time for them for the interview. Appointments for face-to-face interviews also were arranged beforehand.

Almost all interviews were completed in one personal visit or one telephone call. In most instances the respondent was interviewed in his office at the school and in the daytime. Three-quarters of the interviews were conducted by means of long-distance telephone calls, one-fifth were face-to-face, and the remainder were carried out by means of a combination of techniques.

Having the questionnaire in advance of the interview facilitated the process by permitting the respondent to familiarize himself with the questions and to determine answers in areas in which he was uncertain or uninformed, and enhanced communication between respondent and interviewer. As a result of this interviews were smoothly and expeditiously completed. Interviews conducted by means of long-distance telephone calls averaged just short of an hour in length; face-to-face interviews, with greater likelihood of interruptions, averaged about one and one-half hours.

The following tables present greater detail on this phase of the study:

TABLE D-1

TYPE OF INTERVIEW EXECUTED

	Per cent (Based on Unweighted Distribution)
"Telephone" interview	75
"Face-to-face" interview	21
"Self-administered" questionnaire interview	2
Combination of types	1
No mathematics instruction; no interview conducted.	1
Total	100
Unweighted number of schools	(89)

TABLE D-2

TIME OF DAY IN WHICH INTERVIEW WAS BEGUN

	Per cent (Based on Unweighted Distribution)
Begun before 11:30 a.m.	39
Begun from 11:30 a.m. up to 1:00 p.m.	11
Begun from 1:00 p.m. up to 5:00 p.m.	37
Begun from 5:00 p.m. up to 7:00 p.m.	1
Begun 7:00 p.m. or later	9
Indeterminate, self-administered questionnaire interview	2
No mathematics instruction; no interview conducted.	1
Total	100
Unweighted number of schools	(89)

TABLE D-3

LOCATION OF RESPONDENT AT TIME OF INTERVIEW

	Per cent (Based on Unweighted Distribution)
Respondent was at his school	87
Respondent was at his home	10
Indeterminate, self-administered questionnaire interview	2
No mathematics instruction; no interview conducted	1
Total	100
Unweighted number of schools	(89)

TABLE D-4

ROLE IN SCHOOL OF DEPARTMENTAL RESPONDENT

	Per cent (Based on Unweighted Distribution)
Chairman or head of independent mathematics department or division	76
Chairman or head of joint department or division, mathematics named specifically as part	10
Chairman or head of department or division, mathematics not named as part	7
Other mathematics staff member	1
Other school official	5
No mathematics instruction; no interview conducted	1
Total	100
Unweighted number of schools	(89)

TABLE D-5

NUMBER OF TELEPHONE CALLS NECESSARY TO ARRANGE AND CARRY OUT INTERVIEW

	Per cent (Based on Unweighted Distribution)
"Telephone" interview requiring only one phone call for appointment and interview	33
"Telephone" interview requiring more than one phone call but interview itself completed in one call .	37
"Telephone" interview with interview itself requiring more than one phone call	4
"Face-to-face" interview with only one phone call necessary to arrange appointment	6
"Face-to-face" interview with more than one phone call necessary to arrange appointment	15
Combination of interview techniques	3
Assigned self-administered questionnaire	1
No mathematics instruction; no interview conducted .	1
Total	100
Unweighted number of schools	(89)

TABLE D-6

EFFECT ON INTERVIEW OF RESPONDENT HAVING QUESTIONNAIRE AT HAND

	Per cent (Based on Unweighted Distribution)
Respondent had questionnaire and its effect was to help only	61
Respondent had questionnaire and its effect was to hinder only	14
Respondent had questionnaire and its effect was to help and hinder, both	8
Respondent had questionnaire and its effect was indeterminate	4
Respondent had no questionnaire at hand	10
Self-administered questionnaire interview	2
No mathematics instruction; no interview conducted .	1
Total	100
Unweighted number of schools	(89)

Phase 3

Phase 3 of the study, the collection of data from individual faculty members by means of self-administered questionnaires, was begun in January, 1962. Individual questionnaires, each identified with the name of the teacher, were sent to all Phase 2 mathematics department spokesmen for distribution to the individual teachers. Included with each questionnaire was a postage-paid return envelope to permit the individual faculty member to return his completed form directly to the National Opinion Research Center and thus to ensure confidential treatment of his replies. Forms designated for faculty members who had left a school permanently or temporarily were returned to NORC along with the teacher's current address if it were known. These forms were then sent on to the individual at his new address when possible.

Between January and May, 1962 all faculty members not responding to the initial distribution were written to directly with a second request that they participate in the study, duplicate copies of the questionnaire being enclosed in the letters. A few teachers were reached by telephone as well. In June, 1962 those who had not returned a completed questionnaire received a third request for cooperation from the study's sponsor. Phase 3 of the study was concluded in July, 1962.

Reliability of the Estimates

Response Rate

Each of the three phases in which data were gathered was characterized by a high response rate, as the summary below indicates. Consequently, bias due to non-response is small throughout. Only one school--a small, privately-controlled girls' college--declined to participate in the study. Findings, therefore, understate slightly the part played in college-level mathematics by colleges of this type.

Unit Sample	Drawn Sample (Unweighted Number)	Obtained Sample (Unweighted Number)	Response Rate (Based on Weighted Distribution)[a]
Phase 1 - colleges and universities	136	135	98%
Phase 2 - departments, other instructional units in "Non-Ph.D.-Granting" schools	90	89	98%
Phase 3 - individual faculty members from "Non-Ph.D.-Granting" schools	623	533	89%

[a]Because schools were selected with unequal probabilities it was necessary in all tabulations to weight the data relating to any given school by the reciprocal of the probability that the school had of being selected. All tables in this report except those relating directly to the conduct of the Phase 2 interviews are based on weighted distributions.

Few non-responding faculty members refused explicitly to take part in the study, but about one-half of the non-responders did so by implication. These latter, in 1962, still employed by the school which had employed them a year earlier, apparently had received their questionnaires but never returned them. Another one-third of the non-responding teachers were permanently or temporarily away from school and may or may not have received their questionnaires. A small number of non-responding mathematics faculty members was deceased or seriously ill in 1962 when the study was under way. The reactions of non-respondents to the study were as follows:

Reactions of Non-responders	Per cent (Based on Unweighted Distribution)
Still on campus at school employing in 1960-61; made no response of any kind	48
No longer on campus at school employing in 1960-61; made no response of any kind	33
Outside U.S. during period of survey; made no response	3
Deceased or seriously ill during period of survey	7
Refused explicitly to participate	3
Miscellaneous	6
Total	100
Unweighted number of faculty members	(90)

Faculty members who participated in the study constituted such a high proportion of the drawn sample that the drawn and obtained samples are very similar in a number of respects. There are, on the other hand, some differences between responding and non-responding teachers. Compared to responding faculty members, those who did not participate in the study were less likely, in 1962, to be employed by the college which had employed them a year earlier, less likely to have an earned doctoral degree, more likely to be at the assistant professor rank, more likely to be women, and more likely to have been faculty at publicly-controlled schools and on the staffs of schools in the northeastern region of the United States. In sum, mathematics teachers at career extremes--younger, geographically mobile teachers at the start of an academic career and older individuals at retirement age or approaching it--are slightly underrepresented.

Comparisons of certain characteristics of faculty members in the drawn, obtained, and not-obtained samples follow as measures of the nature and extent of bias due to non-response in this phase of the study.

TABLE D-7

CHARACTERISTICS OF FACULTY MEMBERS IN SAMPLE: OBTAINED AND NOT-OBTAINED SAMPLES

Characteristics	Per cent (Based on Weighted Distribution)		
	Drawn Sample	Obtained Sample	Not-obtained Sample
Highest Level Earned Degree, End of Spring, 1961 Term[a]			
Doctor's degree (Ph.D., Ed.D., Sc.D.)	43	44	36
Master's degree	51	50	59
Bachelor's degree	5	5	5
Not classifiable above	1	1	-
Total	100	100	100
Unweighted number of faculty members	(623)	(533)	(90)
Academic Rank, End of Spring, 1961 Term			
Full professor	23	24	17
Associate professor	29	30	21
Assistant professor	40	39	50
Other or no academic ranks for faculty at college	8	7	12
Total	100	100	100
Unweighted number of faculty members	(623)	(533)	(90)
Sex of Faculty Member			
Male	86	87	74
Female	14	13	26
Total	100	100	100
Unweighted number of faculty members	(623)	(533)	(90)

[a]These data on faculty members from a random sample of colleges and universities were derived from various sources such as official school records, published reports, etc.

TABLE D-7--Continued

Characteristics	Per cent (Based on Weighted Distribution)		
	Drawn Sample	Obtained Sample	Not-obtained Sample
Listing in Mathematical Reviews 20-volume Author Index			
Faculty member not listed at all . .	88	89	85
Faculty member has one entry	6	6	4
Faculty member has more than one entry	6	5	11
Total	100	100	100
Unweighted number of faculty members	(623)	(533)	(90)
Memberships Reported for Faculty Member in 1961-1962 Combined Membership List (of the AMS, MAA, and SIAM)			
American Mathematical Society	28	28	25
Mathematical Association of America	49	50	41
Society for Industrial and Applied Mathematics	4	4	5
None of the above	43	42	49
Membership indeterminate	1	1	-
Total[b]	125	125	120
Unweighted number of faculty members	(623)	(533)	(90)

[b]The total is greater than 100 per cent because some faculty members belong to more than one of these three societies.

TABLE D-7--Continued

Characteristics	Per cent (Based on Weighted Distribution)		
	Drawn Sample	Obtained Sample	Not-obtained Sample
Location in 1961-62 Academic year			
Still member of faculty of college employing him 1960-61	87	90	58
Employed by another college or university	5	5	6
Employed by secondary or elementary school	2	1	12
Employed primarily by business or industry	*	*	1
Self-employed primarily	*	-	1
Continuing own education: not planning to return to college employing him 1960-61	*	1	-
Employed but not as mathematician, statistician, or teacher	1	2	*
Retired from teaching	1	*	3
Out of labor force; below retirement age	1	1	*
Deceased	1	-	6
No longer member of faculty: 1961-62 location indeterminate	2	-	13
Total	100	100	100
Unweighted number of faculty members	(623)	(533)	(90)

*Less than one-half of one per cent.

TABLE D-7--Continued

Characteristics	Per cent (Based on Weighted Distribution)		
	Drawn Sample	Obtained Sample	Not-obtained Sample
Characteristics of College of which They Were Faculty Members 1960-61			
Publicly controlled	46	45	54
Privately controlled	54	55	46
1959 graduating class small (less than 500)	73	73	69
1959 graduating class medium (500-1,499)	25	25	26
1959 graduating class large (1,500 or more)	2	2	5
Tuition less than $900	41	42	36
Tuition $900 or more	13	13	10
Publicly controlled	46	45	54
In northeastern region of U.S. (plus Delaware and Maryland) . . .	35	33	46
In north central region of U.S. . . .	24	26	16
In south and south central region of U.S.	27	27	27
In western region of U.S., including state of Hawaii	14	14	11
Unweighted number of faculty members	(623)	(533)	(90)