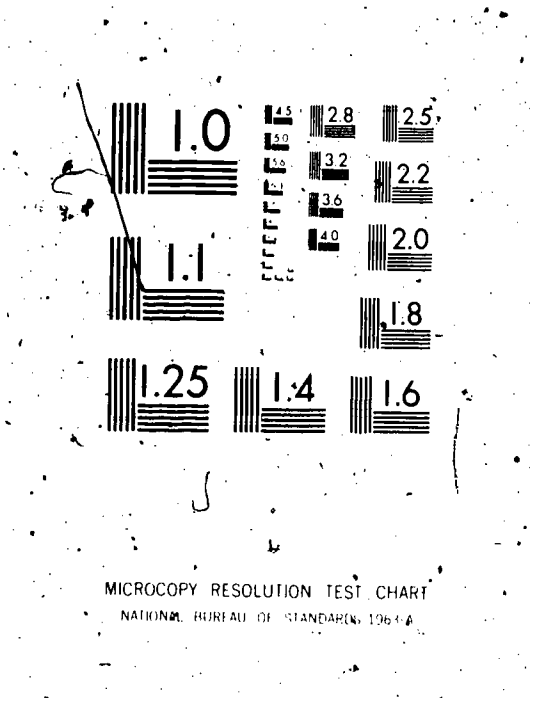
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ABSTRACT

About 10% of the approximately 6,000 two-year college mathematics teachers were surveyed to assess their views on graduate training needs in their field. A profile of these teachers revealed that two-thirds were less than 45 years of age, all but 6% held masters degrees, 22% were women, and over 60% had high school teaching experience; typically they spent 16 hours per week in the classroom and an additional 15 hours per week on other professional activities. They expressed considerable interest in applied mathematics and felt their teaching background was least adequate in that area. They felt their outstanding problem to be teaching unmotivated students. In terms of desirable professional qualities, the teachers believed it to be essential to think of oneself primarily as a teacher, to be able to move into new areas of teaching as the curriculum evolves, and to be willing to take on remedial courses. This can be contrasted with their perceptions of which activities were being rewarded by their colleges; these included administration, taking courses, and obtaining advanced degrees. Recommendations for the content of graduate programs included teaching internships, problem solving, and courses on methods for remedial mathematics. Continuing education interests included attending short courses and studying math applications to science and engineering. The survey instrument is included. (MB)

AN INQUIRY INTO THE GRADUATE TRAINING NEEDS OF TWO-YEAR COLLEGE TEACHERS OF MATHEMATICS

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THE SURVEY: ANALYSIS AND PERSPECTIVES

In October, 1977, the Rocky Mountain Mathematics Consortium under an NSF-RISE grant, initiated an inquiry into the graduate training needs of two-year college mathematics teachers, based on an examination of their own views and perceptions.

The research team was made up of a two-year college teacher who is editor of a leading two-year college mathematics journal, a university professor who is closely associated with a graduate program for training undergraduate college mathematics teachers, and a mathematics education professor who works with both college and secondary teachers.

Prior to constructing a formal survey document, the team conducted extensive interviews with 25 teachers from eight two-year colleges across the country. Those interviewed were remarkably candid about their professional lives, and the interviews were of great assistance in formulating the survey questionnaire. A larger group of teachers worked through early drafts of the questionnaire, and their critiques greatly improved the final version.

The questionnaire was then distributed to a carefully drawn sample of about 10% of the two-year college mathematics teachers in the United States. Of these, 79% responded. Their answers to a wide variety of questions provide a portrait of the teaching environment in two-year colleges, the professional lives of the teachers, and their views on graduate programs and continuing education.

I. PORTRAIT OF TWO-YEAR COLLEGE MATHEMATICS TEACHERS

The two-year college mathematics faculty numbers 6,000 and is young. Two-thirds of the faculty is less than 45 years of age; more than 25% of the faculty is under 35. (See Table 2 for details on age distributions.) Thus, two-thirds of the faculty can look forward to at least twenty more years of teaching. If enrollments do not grow and if technology continues its steady advance, then continuing education for this group of teachers will take on added importance. All but 6% of the teachers hold the masters degree, and

TABLE 1

DISTRIBUTION OF TYC FACULTY AMONG FIELDS, BY EDUCATIONAL LEVEL

FIELD	Highest Degree Attained(*) DR	Master's + 1	Master's	Bachelor
Mathematics	4.6%	29.6%	26.1%	1.1%
Other Math Sci	1.5	5.3	3.3	0.2
Math Educ	4.4	8.8	8.6	0.4
Non-Math	4.0	5.7	5.1	0.9
% With Degree:				
Our Sample	14.0%	43.6%	37.9%	2.4%(‡)
CBMA '75	10.8	34.8	47.4	7.0

(*) 12% of the respondents listed more than one "most advanced degree."
(‡) Bachelor + "Other Degree" = 4.6%.

TABLE 2

AGE DISTRIBUTION OF TYC FACULTY
BY EDUCATIONAL LEVEL AND SEX

Age	Highest Degree Attained			Sex	
	DR	Master's + 1	Master's	Male	Female
<35	33%	26%	41%	31%	45%
36-45	44	42	35	40	30
>45	23	31	24	28	25

58% have at least one year of additional course work beyond the masters. Fourteen percent hold the doctorate. Contrary to common belief, the doctorates are not the youngest group in a classification according to highest degree attained. The fraction of TYC mathematics teachers with the doctorate has been growing, but many new PhD's and EdD's are long-time faculty members who have been steadily upgrading their education.

Not all two-year college mathematics teachers have their most advanced professional training in mathematical sciences or mathematics education--in particular, some 28% of those who hold the doctorate received that degree in some other field--a scattering from business education, economics, physics, chemistry, biology, engineering and others. In some cases, always identified, data are reported separately for the math and math education subgroup.

Twenty-two percent of the faculty are women. As a group they are younger than their male colleagues. When the profile of their responses to the questionnaire is compared with that of men of the same age, comparatively few significant differences are apparent. Similarly, there is surprisingly little difference in the profiles of those whose degrees are in subject matter math and those whose degrees are in math education.

Over 60% have High School Experience

Sixty-one percent of TYC math faculty have previously taught in high schools. The average number of years of high school experience is five (Table 3). In many areas of the country, two-year faculties were built by raiding high school departments, often grabbing up the best and brightest of the high school teachers. It thus is to be expected that the influence of secondary schools on two-year colleges is substantial.

Moves from the high schools seem to be closely tied to the prominence of NSF Institutes in the 60's and early 70's. Some 52% of all TYC math teachers have participated in NSF Institutes--the average is for 2.4 summers and .5 academic year. Of those who participated, 59% said the Institutes "were a factor in my move from teaching in high school to teaching in the two-year college." Fifty-eight percent said the Institutes "were a factor in my decision to get a master's degree."

The typical two-year college mathematics teacher spends 16 hours per week in the classroom and an additional 15 hours per week on other professional activities. Apart from time spent on teaching, class preparation, and

TABLE 3

PROFESSIONAL EXPERIENCE OF FACULTY, BY EDUCATIONAL LEVEL

Experience:	Highest Degree Attained DR	Master's + 1	Master's
Teaching:			
in TYC	7 yrs	10 yrs	8 yrs
in H.S.	5	4	4
Other	4	3	2
TOTAL	16	17	14
Non-Teaching	1	1	1

(Median nº of years)

working with students, faculty reported on other professional activities (Table 4). Nearly three-fourths said they attend at least one conference per year; about one in five reported speaking at a conference. Better than half reported that they read journals and work on challenging problems unrelated to their classes, and nearly half reported having taken a university course for credit within the last two years. Comparatively few are active in research or write articles for professional journals.

TABLE 4

PROFESSIONAL ACTIVITIES OF TYC FACULTY, BY EDUCATIONAL LEVEL

Activity (Brief Description)	DR	Master's + 1	Master's
Attended professional conference annually	85%	85%	64%
Regularly examine 3 or more journals	74	60	49
Work on challenging problems unrelated to class	67	54	41
Have taken credit course within two years	28	53	40
Participate in professional seminars	54	40	32
Active in professional organizations	43	33	19
Give math talks to community, student groups	41	28	17
Speak at professional conferences	43	20	13
Work on research	56	15	12
Have written a textbook	19	14	17
Have obtained advanced degree within two years	17	4	4

(Reported for those whose most advanced degree is in mathematical sciences or education).

Professional Activity Related To Educational Level

The most stunning aspect of the data on professional lives of two-year faculty is that the intensity of professional activity, of almost all categories, is directly related to educational level. Holders of the doctorate are the most active, not only in research and journal writing but also in giving talks, working in professional organizations, and writing textbooks. Those with a year or more of course-work beyond the master's are substantially more active professionally than those who have not undertaken the additional schooling. One may interpret the association as a "chicken or egg" phenomenon, but either way the correlation is most striking.

Weaknesses in Applied Mathematics

Two-year college math teachers expressed considerable interest in applications and feel their background for teaching is least adequate in the areas of application--business math, linear programming, statistics, computer programming, etc. (Table 5). Of course, it is precisely the applied areas that

TABLE 5

CONFIDENCE TO TEACH SPECIFIC COURSES, BY EDUCATION LEVEL

Course	Doctoral A	Doctoral B	Master's Plus One A	Master's Plus One B	Master's A	Master's B
Intermediate Algebra	96%	4%	99%	1%	100%	0%
Elementary Algebra	94	4	99	1	100	0
Arithmetic	85	7	89	9	91	8
Calculus	91	7	86	14	85	13
Math for Liberal Arts	93	6	81	16	81	16
Probability	82	15	62	33	59	38
Technical Mathematics	56	28	58	30	53	38
Use of hand-held calculator	57	35	54	37	52	39
Linear algebra	81	13	53	35	45	42
Business Mathematics	44	44	51	38	45	41
Differential Equations	67	24	51	36	50	34
Statistics	74	22	46	44	42	43
Linear Programming	51	34	32	43	24	47
Computer Programming	34	26	18	30	20	21

(Reported for those whose most advanced degree is in the math sciences or math educ).

A. I feel entirely secure about my qualifications to teach this course.

B. I can handle this course, but would do it better if I had an opportunity to study some appropriate background material (either mathematical, scientific or pedagogical).

are becoming most important in post-secondary mathematics education, and nowhere more so than in the two-year colleges with their emphasis on "career-oriented" programs. Overwhelmingly, the present two-year college math teachers, like their colleagues in the four-year colleges and universities, were trained in pure mathematics (See Table 1)--and this includes those with degrees in mathematics education.

There is some concern expressed by the faculty about the teaching of arithmetic. Many TYC faculty have been prepared for remediation courses at the high school level, but few have received formal training in the teaching of arithmetic. (See Section II).

With the exception of remedial courses, those with doctorates feel much more secure to teach the two-year college curriculum than do those in the MA+1 and in the Master's groups. There is little discernible difference between confidence levels of the MA+1 and Master's groups.

II. THE TWO-YEAR COLLEGE ENVIRONMENT

Problems in the Colleges

The outstanding problem of the two-year college mathematics teacher is teaching unmotivated students.

The explosive growth of two-year colleges in the sixties, coupled with open-door admission policies, has changed the complexion of these institutions in significant ways. Gone are the days of the nearly exclusive junior college transfer role. Many two-year colleges, particularly in the West and Southwest, have greatly expanded their scope to include a host of vocational programs. The great growth in part-time and female enrollments has also changed their clientele in a significant way (CBMS "75).

In preliminary interviews, many teachers recalled the "good old days," ten to fifteen years ago, when many of their students were enrolled in calculus courses. Today the bulk of two-year college enrollments are in remedial courses. Arithmetic alone has grown from 4% of all enrollments in Fall 1966 to 11% of all enrollments in Fall 1977 (CBMS '75, AMS '77). Moreover, most two-year college faculty had no formal training to teach remedial courses like arithmetic: They were trained to teach the standard college transfer curriculum (college algebra and trigonometry, calculus, etc). The majority (61%) of two-year college faculty previously taught in high schools. Many of them left high schools to "step up" in some sense and now find themselves teaching courses that are more elementary than the high school courses they previously taught. Most of them say that today's students are less well prepared than they were ten years ago (CBMS '75). They tell of students who have serious reading problems in their mathematics courses. Many find teaching today to be a difficult challenge. The list of problems in the college (Table 6) points up their concern in bold terms.

Certainly these problems are interrelated; but in view of the recent clamor about remediation, it is surprising to see remediation on the bottom of the list. Women ranked remediation higher (3rd) than did men. Except for covering too much material in the time alloted, doctorate holders were again more intense about each of these problems than their colleagues in the MA+1

TABLE 6

PROBLEMS IN THE COLLEGES

PROBLEM	MEN		WOMEN	
	Major and Continuing Problem	Minor Irritant	Major	Minor
1. Teaching unmotivated students	38%	51%	46%	44%
2. Having to cover much more material than students can absorb	35	52	40	44
3. Too little time and energy for professional activities outside classroom	22	37	22	41
4. Lack of incentives for professional growth	22	37	19	27
5. Coping with the deluge of remedial mathematics	16	40	34	30

and MA groups. Women were more intense about the three closely related problems (1,2,5). Nearly half (47%) of faculty over 45 regard teaching unmotivated students as a major problem. It is likely that members of this group have the largest average number of years of two-year college experience and are more able to remember the "good old days." Interestingly, faculty in the 36 to 45 age range are less troubled by unmotivated students and remediation than faculty outside the 36 to 45 range. An explanation for those over 45 has been offered. For faculty under 35, their time proximity to the atmosphere of graduate school may help to account for their intensity of feeling about problems in the college.

Image of the "Ideal Teacher"

Two-year college teachers have well-defined views on what constitute desirable professional qualities in a teacher (Table 7). Of most importance are attributes directly tied to classroom teaching: It is essential to think of oneself primarily as a teacher, to be able to move into new areas of teaching as the curriculum evolves, and specifically to be willing to take on remedial courses. It is also very important to continue to learn new mathematics, to have some contact with real-world applications, and to enjoy hard problems.

Toward some kinds of professional activity, many teachers display ambivalence and even downright disapproval (Table 8). Least approved is campus administrative work, but publication, research or obtaining a standard doctorate (PhD or EdD) are thought of as "inappropriate" by a significant group, and are considered to be "unimportant" by an actual majority.

TABLE 7

PROFESSIONAL QUALITIES TYC FACULTY REGARD AS IMPORTANT IN A TEACHER

Brief Description	Essential	Very Important
Regarding oneself primarily as a teacher	63%	27%
Being able to move into new areas of teaching as curriculum evolves	42	42
Being willing to teach remedial math, including arithmetic	36	37
Learning new math through reading or attending lectures	17	44
Having experience in applying math to the 'real world'	15	42
Maintaining an interest in mathematical problem solving	8	35

TABLE 8

TYC FACULTY ATTITUDES TOWARD PROFESSIONAL ACTIVITIES

Brief Characterization	Essential	Very Important	Desirable	Unimportant	Inappropriate
Being involved in work of professional organization	4%	17%	62%	15%	2%
Obtaining Dr. degree in especially designed new program	2	15	51	24	4
Engaging in professional public service activities	2	12	56	26	3
Obtaining Ed D or Dr Arts in existing program	1	8	41	44	6
Publishing articles related to classroom teaching	1	6	53	39	2
Obtaining a PhD in mathematics	1	3	32	54	9
Publishing papers in research journals	1	2	31	57	8
Accepting administrative work on campus	0	6	36	41	15

Advancement Criteria in Two-Year Colleges - A Paradox

Contrasting ironically with teachers' perceptions of worthwhile qualities and activities are their perceptions of which activities are being rewarded by the colleges, through salary increases and promotions. (Compare Tables 8 and 9). Administration, taking courses, obtaining advanced degrees, none of which ranked high on the teachers own list of professional activities, all are believed to be very important in advancement decisions. Public service, textbook and journal writing, and research are low on both lists. Simple longevity--years of service--tops the list, but classroom performance is second. (Note that, in Tables 9 and 10, to achieve a consistency of perspective, we have reported the responses of the MA and MA+1 groups, excluding those who hold doctorates).

TABLE 9

FACULTY ADVANCEMENT CRITERIA

Activity	A	B
Years of service	59%	25%
Classroom teaching performance	47	19
Taking additional courses for credit	41	35
Obtaining a doctoral degree	31	42
Campus administration and committee work	15	34

A. Very important for most faculty; very heavily weighted in advancement decisions.

B. While not essential for all faculty, this activity can have significant impact for some.

Geographical Variations Among Two-Year Colleges

Responses from the survey group revealed several interesting geographical variations:

1. Faculty in Eastern colleges are much younger than faculty in Western colleges (Table 10a).
2. The percentage of faculty holding doctorates increases steadily as one moves from West to East (Table 10a).
3. Professional activities of most kinds, except doing additional graduate work, seem to count more heavily toward advancement as colleges in the East than at schools in the West (Table 10b).

Respondents' reports on their own actual professional activities, as opposed to their perceptions of the colleges incentives, do not show the same strong geographical trend noted in Table 10b. There does, however, seem to be an increase in publication and research among the MA+1 and MA groups as one moves from west to east.

TABLE 10A

SOME REGIONAL VARIATIONS AMONG TYC FACULTY

	West	Southwest	Midwest	Southeast	Northeast
Per cent holding doctorates	8%	9%	12%	16%	24%
Per cent under age 35	33%	22%	34%	25%	50%

TABLE 10b

GEOGRAPHICAL PATTERNS IN INCENTIVES

Activity	A plus B (%)				
	W	SW	MW	SE	NE
Classroom teaching performance	44	56	60	64	80
Campus administration and committee work	30	38	44	64	68
Participating in work of professional organization	16	16	30	37	27
Public service in a professional capacity	18	19	23	36	27
Attending lectures and seminars	18	16	25	34	25
Community service	12	18	19	35	23
Journal publication on classroom activity	13	9	15	28	27
Textbook writing	10	7	13	30	40
Giving talks at math meetings	12	7	15	29	25
Research	9	7	9	20	24

TABLE 10c

INCENTIVES FOR ADDITIONAL SCHOOLING

Activity	A/(A + B) (%)				
	W	SW	MW	SE	NE
Taking additional courses	48/82	52/75	36/76	45/76	32/74
Obtaining doctoral degree	33/66	39/69	24/70	33/76	35/79

A. Very important for most faculty; very heavily weighted in advancement decisions.

B. While not essential for all faculty, this activity can have significant impact for some.

III. RECOMMENDATIONS FOR CONTENT OF GRADUATE PROGRAMS

Those interviewed expressed satisfaction that their opinion was being sought on the design of graduate programs for two-year college faculty. Several suggested that university mathematicians who are involved in such programs could learn a great deal from more direct and continuing contact with two-year colleges. No one need fear a revolution, but there are certainly important differences in emphasis from current orthodoxy, especially in post-master's education.

Basic Preparation--The Master's Program

A large amount of agreement exists among all subgroups of faculty, independent of field of training, level of education, teaching background, etc. Faculty overwhelmingly endorsed the usual dose of courses in advanced calculus and abstract algebra (Table 11). Next on their list of recommendations was teaching experience or an internship. (Nearly 90% of the respondents regard these two elements as being either essential or very important.)

TABLE 11.

RECOMMENDED BASIC PREPARATION OF TYC TEACHER

Brief Description	Essential	Very Important	Of some value	Unimportant or Inappropriate
Courses in pure math to adv cal, abst alg	59%	30%	10%	1%
Teaching experience of internship	47	40	11	1
2 yr-long sequences: applied math sci	13	47	38	2
Supporting courses in physical sciences	10	49	37	4
Course in history of math	10	38	46	6
Courses in math ed	10	24	46	24
Course in TYC current issues	6	24	46	24
Supporting courses in biol, social sci	3	30	55	11
Master's thesis	7	11	42	40
Seminar on math writing	2	14	46	37

Applications Stressed

The importance of applications stands out next on their list, with 60% of the faculty saying that two, year-long sequences in applied mathematics and supporting courses in physical sciences are very important. Some faculty remarked that efforts to take courses in the areas of applied mathematics and the physical sciences are difficult because such courses are often not labeled as "graduate level." This can be especially frustrating to the individual who

receives advancement increments only for graduate courses. Courses in the history of mathematics follow applications in importance. About half of the respondents think course work in the history of mathematics is very important. Math [illegible] es rank somewhat lower.

Master's Thesis Unpop[illegible]

[illegible]nk a Master's thesis is ver[illegible]cant. Forty percent regard it [illegible]mpor[illegible]ant or inappropriate (Table 1.

RECOMMENDATIONS FOR THE IDEAL DOCTORAL PROGRAM

Doctorates among two-year college mathematics teachers have grown recently at more than 1% per year from 4.5% in 1970 to 14% in 1977. Since the source of new doctorates is in the main from within two-year college ranks, typically after several years on the job, recommendations for doctoral programs take on added importance. A large degree of agreement on recommendations exist among most subgroups of our respondents. Those already holding a doctorate disagree somewhat with their colleagues on details of a program but not nearly so much as one might have expected. The most prominent differences have to do with the nature of the doctoral dissertation.

Course Work Recommendations (Doctoral Level)

More than two-thirds of all respondents stressed the importance of pure mathematics at the level of introductory graduate course. Beyond that they favor diversity in the course curriculum, which should range widely across the mathematical sciences and beyond (Table 12). Additional pure math, math education, computer science and statistics, math history, classical applied math and physical sciences all should be included, more or less on a par. Those holding a doctorate would put slightly more emphasis on pure math courses and on math education.

TABLE 12

COURSE DISTRIBUTION IN IDEAL DOCTORAL PROGRAM

Subject matter area	Fraction of the total program				
	0	1/10	2/10	3/10	4/10+
Introductory graduate level pure math	11%	22%	36%	20%	11%
Math education	23	49	20	5	4
Advanced pure math courses, seminars	34	36	20	7	1
Computer Sciences	16	67	15	1	0
Statistics, operations research	17	66	15	2	0
Math history	19	76	5	1	0
Physical and earth science courses using math	32	56	11	1	0
Classical applied math	36	50	12	2	1
Biological and social science courses using math	42	53	5	0	0

Internship Strongly Favored

A clear majority (69%) of respondents felt that practical teaching experience should be required as a condition for receiving an advanced degree. Respondents feel so strongly about teaching experience that 42% said that a meaningful internship could be devised for advanced degree candidates who are already experienced teachers! Only 23% said no to the idea of internships for experienced teachers. The remaining 35% maintained an open mind.

Mathematics Education Component of a Doctoral Program

What should be the nature of the mathematics education component of the doctoral program? Again recommendations were fairly uniform across subgroups of respondents. Two-year faculty with degrees in mathematics education were only mildly more favorable to traditional mathematics education courses than were the others. Table 13 points up their mathematics education recommendations in order: teaching problem solving à la Pólya, teaching techniques, and methods courses for remedial mathematics.

TABLE 13

MATH ED COURSES IN IDEAL DR PROGRAM

In order of decreasing approval: Course Description	Favorable A	Favorable B	Unfavorable C	Unfavorable D
Teaching problem solving (Polya's heuristic approach)	43%	37%	15%	2%
Teaching techniques (e.g. discovery, expository, heuristic)	43	34	16	4
Methods courses for remedial math	36	30	28	4
Testing and evaluation with TYC applications	30	39	35	3
Use of technology (e.g. computer assisted instruction)	27	44	25	2
Use of math history in classroom	26	40	30	2
Learning theories, psychological aspects of teaching	21	37	33	6
Curricular design and textbook evaluation	21	38	36	5
Seminar on TYC teaching with video taping	19	35	36	6

The courses were graded as:
A. Should definitely be included.
B. Optional but strongly encouraged.
C. Acceptable, but should not displace more important topics.
D. Not acceptable.

The Doctoral Thesis

With regard to the thesis there is a wider spectrum of views than for the other components. In general, the traditional dissertation is not held in high esteem by those who already hold a doctorate (Table 14). Among those

in the MA+1 group, the standard dissertation fares even worse, with only 14% rating it as the best type of thesis. For both groups, designing a learning module is ranked above the traditional dissertation (Tables 14, 15). The MA+1 group is probably the most likely source of new doctorates in two-year colleges, and for them designing a learning module is far and away their first choice.

TABLE 14

KIND OF THESIS FOR IDEAL PROGRAM--VIEW OF HOLDERS OF DOCTORATE

Thesis Description	Favorable A	Favorable B	Unfavorable C	Unfavorable D
Expository survey	35%	37%	20%	6%
Designing a learning module	32	30	28	9
Standard research Ph D in math	26	17	33	22
Standard educational research thesis	22	32	32	13
Writing textbook for TYC use	13	26	35	22
Historical survey	11	24	43	19

TABLE 15

KIND OF THESIS FOR IDEAL PROGRAM--VIEW OF MA+1 GROUP

Thesis Description	Favorable A	Favorable B	Unfavorable C	Unfavorable D
Designing a learning module	51%	24%	18%	5%
Expository survey	17	28	42	10
Writing a textbook for TYC use	14	29	40	15
Standard research Ph D in math	14	16	35	33
Standard educational research thesis	8	28	41	21
Historical survey	9	23	52	13

A. Best (or tied for best) -- of greatest value.
B. Second best (or tied for second).
C. Acceptable, but of lesser value.
D. Not really useful for a TYC teacher.

The Doctor of Arts Degree

The most popular name among respondents for the ideal doctoral program is Doctor of Arts. Those in the MA+1 group favor it by a 2 to 1 margin over either the name Ph.D. or Ed.D. Doctor of Arts programs also seem to be gaining increased acceptability in the graduate schools (see Dressel and Thompson, 1977).

How Can Graduate Schools Facilitate Participation in New Doctoral Programs?

In designing new doctoral programs for two-year college faculty, it is important to bear in mind that most of the candidates will already be full-time or part-time experienced faculty. There will probably be few new full-time positions available; hence, a program designed for students fresh from undergraduate school would miss the market. Courses in summer are most convenient for working TYC faculty.

A large fraction of TYC faculty teach in major metropolitan areas. There have been suggestions for establishing two-year college advisory groups to assist neighboring universities with new doctoral programs. The dividends from such interaction appear.

IV. CONTINUING EDUCATION INTERESTS

The Case for Continuing Education

The general case for continuing education is easy to make. More than two-thirds of the faculty is under 45 and can expect to teach for at least another 20 years. An increasing use of part-time faculty (CBMS '75, AMS '77) is likely to reduce the number of young, newly trained faculty. A general slowing of enrollment growths in two-year colleges has been noted. The curriculum is likely to continue to change as a result of rapid growth and change in technology. All of these factors point to the clear need for a regular and sustained program of continuing education for two-year college mathematics faculty.

Do Faculty Participate in Existing Continuing Education Programs?

Nearly half (45%) of the faculty have taken university credit courses within the last two years. Fifty-one percent have attended NSF institutes with an average of 2 to 3 summers and one academic year. Each year upwards of 50 or more two-year college mathematics faculty acquire a doctorate, often after years on the job. Since 1970, doctorates on the faculty have increased at more than 1% per year from 4.5% in 1970 to 14% in 1977.

For a complex of reasons, ranging from desires to update their knowledge to gaining prestige and promotions, faculty have more than a passing interest in continuing education.

RECOMMENDATIONS TO GRADUATE SCHOOLS

Given the strong interest of faculty in continuing education, how can graduate schools best respond to the immediate interests which are not necessarily degree directed?

Respondents were asked to indicate their degree of interest in several forms of continuing education. As previously observed, their strongest interest is in short intensive courses of 3 to 5 days' duration (Table 16). A full one-third expressed strong interest in sabbatical year formats. A quarter expressed strong interest in summer session programs. Evening courses elicited strong interest by only one-fifth of respondents.

Many two-year colleges recognize and reward additional course work short of a degree, but, of course, completing a degree is especially noteworthy, and is a long-term goal for many. Twenty-five percent of the respondents expressed strong interest in obtaining a doctorate--provided this could be done mainly in summers and would not require returning to campus for two or more academic years.

TABLE 16

TYC INTEREST IN CONTINUING EDUCATION

Description of Activity	A	B
Attending a short course	46%	33%
Spending a sabbatical at a university	33	30
Attending summer session	25	42
Obtaining an advanced degree (if this is possible in one AY plus summers)	25	21
Participating [illegible] exchange	24	28
Attending an evening course at a nearby university	20	36
Attending successive summer sessions with independent study in AY	11	26
Obtaining advanced degree (if two or more AY's required)	5	7

A. Best (or tied for best) -- of greatest value.
B. Second best (or tied for second).

Areas of Interest for Summer Study

Respondents were asked how they might use a summer's study at a university. (It is not known if their areas of interest would shift markedly for other formats.) The dominant theme is to broaden the base of knowledge, especially toward applications (Table 17).

TABLE 17

SUMMER STUDY INTERESTS

Summer Activity	1st, 2nd or 3rd Choice All	DR
Applications to science, engineering	56%	43%
Unfamiliar areas of the math sciences	49	49
Innovation in subject matter, classroom technique	42	26
Courses in related sciences which have strong math basis	32	37
Practical pedagogical issues, e.g. remediation	27	22
Real-world applications	25	45
Elementary math topics from advanced standpoint	24	17
Advanced math related to professional interests	18	19
A teaching experiment	10	12
Research	7	22

Federally Funded Continuing Education Programs

NSR Institute Lauded

In the 50's and 60's, National Science Foundation institutes were very common. More than half of all two-year college faculty have participated in such institute programs, and 87% of the participants characterized the institutes as having "had a significant influence on my mathematical development." Fifty-eight percent said the institutes "were a factor in my decision to get a Master's degree." Only 21% characterized the institutes as "only of modest importance to me in my subsequent career." It thus is clear that NSF institutes have played a prominent role in shaping two-year college mathematics programs.

The institutes were part of the government's response to what was perceived as a technological gap between the U.S. and the Soviet Union, manifested by Sputnik. The challenges of the 80's, though no less compelling, are entirely different from those of the 60's; we are not advising a simple return to the practices of those days. What we would like to see though is some revival of the strong sense of national purpose that led then to a concerted response to clearly defined needs. Todays needs, for mathematics at the two-year colleges, seem equally clear.

REFERENCES

[AMS 77] "Twenty First Annual AMS Survey" Notices of the American Mathematical Socity, Vol 24, No 6, Oct. 1977.

[CBMS 76] Fey, James T., Donald J. Albers, and John W. Jewett: "Undergraduate Mathematical Sciences in Universities, Four-Year Colleges, and Two-Year Colleges, 1975-76." Washington, D.C., Conference Board of the Mathematical Sciences, 1976.

[Dressel and Thompson]: Paul L. Dressel and Mary Magdala Thompson: "A Degree for College Teachers: The Doctor of Arts." 1977, Berkeley, Carnegie Council on Policy Studies in Higher Education.

THE INTERVIEWS: TWO-YEAR TEACHERS TALK ABOUT THE COLLEGES AND GRADUATE EDUCATION

From October 1977 to January 1978, we interviewed 25 teachers from [illegible] two-year colleges across the United States. The purpose of the interviews was to obtain assistance [illegible] questionnaire which subsequently was sent to more than 600 faculty. These interviews provided tremendous assistance to us in drafting the questionnaire and many insights into the colleges. We would like to share with you nearly literal excerpts from the many hours of taped interviews with these teachers. To protect their privacy we've changed their names and removed all explicit reference to schools and places.

CONTENTS

1. THE VALUE OF ADVANCED TRAINING IN MATHEMATICS

Q: Do you think grad courses in such areas as abstract algebra, topology, to name a few, make any difference in your teaching performance and that of your colleagues?

BILL A: Yes, I do, because I think [illegible] know these things. [illegible] would kind of like to know these things. I think it's important that teachers, whether they're teaching freshman or sophomore calculus, or even lower than that, that the instructor be very competent in his or her field. I think a lot of people feel not as competent and kind of wish they could learn more.

Q: When there's an opening in some of the two-year colleges around here, do you think a person with a Ph.D. will be most likely to get the job?

BILL A: I really don't. I really don't. I could be wrong, this is just my opinion. Somehow the people here who hired me were just more receptive to talking to a Ph.D. and I do know that since being here I've had my colleagues ask me, I think I sense from the way they ask me, am I happy here? am I going on soon? ...as soon as I can get a job in a four-year school.

Q: Do you think that this is one of the principal failings of two-year college faculty, that they have a very narrow perspective because they've never seen the variety of advanced courses?

JOE A: Yeah, I'm not sure about the perspective, but I think it has a lot to do with the motivation. I know that if I had stopped taking graduate courses when they did, this would be a boring job. I wouldn't be reading journals. I think I would be pretty stagnant; I think that's what happens. I must sound like a braggart. I tried to get a Ph.D. but I didn't.

Q: I think you're being very honest.

JOE A: I think I would be in exactly the same boat they are if I stopped taking math courses too soon.

Q: What about a degree beyond the master's? Do you see any purpose or usefulness to that?

SAM A: Not for myself. I've debated it several times and decided not to.

Q: Is it because you don't find any existing degrees which are attractive to you?

SAM A: I don't see it as useful or necessary to teaching the courses. I don't think that it would improve them that much to do a degree.

Q: Even if you could tailor a program to your own specifications?

SAM A: What kind of degree are you talking about now? Teaching? Mathematics?

Q: Whatever you li[illegible] It wouldn't be [illegible]ree at al[illegible]u've already said you'd like t[illegible] learning [illegible]. Were there oth[illegible] really be helpful to teaching [illegible]athematics?

SAM A: No math courses.

In another institution responses to similar questions were different.

TOM A: The minimum criteria to get in here and obtain tenure is having the Ph.D. Now what you've got here is a situation with people coming in with Ph.D.s who have a very high level of expectations and anticipation and they're teaching on the lower levels course or lower level grades. And that's like having someone go to medical school to become a surgeon and constantly removing splinters.

Q: Could it be that the system is making a mistake when it hires people whose interest is in research? Is it really appropriate for a person with a research motivation to be involved in two-year college teaching?

TOM A: Well, I think to some extent it is. The ideal was that people interested in research could get to institutions where they could do it. Unfortunately, this is not the case. But I would also say that many people who do research enjoy teaching. I, for one, would not give up teaching just to do research, and I love to do research.

MIKE A: I think the traditional math Ph.D. degree for us is something which we're not concerned with. I can see some people in an institution like mine saying, well, why do I need to know a lot about math, when all I'm teaching is arithmetic and elementary geometry. Fortunately, my faculty doesn't feel like that, but I can see a lot of people having that kind of sentiment.

Q: You came from a high school background, which, of course, is very prominent among two-year teachers--better than half of them have such backgrounds--and many thought that that really was a distinct advantage in dealing with two-year colleges in that they have a better philosophy than someone straight out of graduate school, and then, of course, on the other side....

RICK A: I've always thought it was a real advantage to have had experience in high school teaching. If I hired someone, and although I've only hired one person, I would consider that to be more important than a Ph.D., but I think a department has to be balanced. We have five people in the department who have doctorates, and only one of them has an honest-to-God Ph.D., and that's probably enough.

RON A: I think mathematically we're all probably overprepared, though it would depend upon the courses we've taken, but in terms of what we teach and what we have--the requirement today is that we have a master's degree--I guess one could have a master's degree in education, though it would have to be Math. Ed. to be teaching in this department--most people have either an M.A. in math or an M.S. in math and I think are far more prepared than is necessary for the courses they teach.

NAN A: I would not be interested in getting a Ph.D. in mathematics. I simply don't think that would intrigue me. I don't think that the kinds of courses I would be taking would have much impact in terms of what I would be sharing with students.

Q: Do you believe, that getting a Ph.D. in math may actually spoil a person for two-year college teaching?

RICK A: I would like to see a more general degree. It bothers me that there are some Ph.D.s that have never taken a physics course. I would rather see a broader background rather than research.

Q: If you could choose your own doctoral program, would you like people here to get such a degree?

RICK A: It would be severe to take people away for two years. I would rather like to see it done part time on an in-service basis.

Q: Do you think people would have some kind of stimulus to attend non-credit courses or do you think the credit is important?

RICK A; Yes, the credit is important.

2. CONTINUING EDUCATION

Our interviews with two-year college mathematics faculty rapidly brought us to understand the importance of an active program of continuing education for two-year college mathematics faculty, continuing education, which need not be degree-directed. Many faculty recalled with fondness the NSF institutes of the fifties and sixties. The present day Chautauqua courses of AAAS also were mentioned several times.

Q: How did you happen to get into statistics?

MAX A: I don't know, it just grew like Topsy. I had some background in it, in my math educational training. That was NSF stuff--part of the greatest boon to education for mathematics--science too. It is so true. In fact, such a thing should be done again, because that carte blanche situation that they had was tremendous. Due to that I was able to pick up some more math training and statistical training.

Q: Did you enjoy the NSF institute?

TAB A: Oh, sure, it was one of the best things that ever happened for secondary math teachers. When I look back at my math background... kids coming out of high school had more math than I did and I had a bachelor's degree in math.

Q: It probably wouldn't be too hard to concoct summer institutes that would run summer session courses for which you pay tuition--but to find an NSF type of support might be difficult. Do you think people would do it without that support?

TAB A: No

Q: Especially if they once had had support.

TAB A: If there was a requirement that you had to go back and get so many hours, then people would go back without support.

3. THE IMPORTANCE OF APPLICATIONS

Due to the popularity of NSF institutes and other forms of continuing education, what might be prominent content areas for such programs? Our interviews quickly revealed that the area of applications was extremely important to nearly everyone interviewed.

Q: Is it useful to know something about economics, something about biology, something about physics, for the guy who is going to teach math?

JACK A: It is. As a matter of fact, that's why I went to many of the Chautauqua short courses.

Q: You said some of your students were engineering students. How about knowing something about the background of the engineering subject? the physical science background?

MARY A: I have a minor in physics. My physics background is more helpful to me here than a course in Fourier analysis, complex variables, or topological spaces.

Q: There are physical applications in Fourier analysis.

MARY A: The math teacher teaching it proved only abstract theorems. I remember proving Green's theorem and then I took a physics class here, it was an in-service physics class just for some extra points. He explained the physical significance of Green's theorem. I thought, 'my gosh, here it is a beginning physics class and I did not learn it in a graduate math class.'

RON A: The problem is that since those are things I don't know about; I'm blind to my own deficiencies.

Q: Do you feel deficient? Do you feel any problem from time to time with such applications?

RON A: I did in physics. I had, as a freshman in college, two semesters of college physics--and I still felt in some of the applications in the calculus course very uncomfortable. So did a lot of the other members of the department. About four or five years ago we did have an in-service course for the department in physics. I found that useful. I had taught some of it (physics) to myself, by yanking out my old Sears and Zemansky but that and as far as engineering, my background is completely deficient.

Q: Do you know anything about game theory, linear programming?

RON A: Very little. There's a course that emphasizes those ideas called finite math. And that's one of the few courses that I've avoided teaching.

Q: How about decision theory, Markov chains? Are they familiar to you?

RON A: They were years ago when I took probability and statistics in graduate shcool but I wouldn't teach that course. I don't feel uncomfortable about not teaching certain courses in the department, but I wouldn't want to teach the traditional statistics course. That would not appeal to me.

Q: Why would it not appeal to you?

RON A: Because by teaching the social statistics course I do, the applications I really know about. The applications in sociology and psychology, I feel strong about, I know about experimental design, but if I got into things like applications in business, statistical applications in economics, I'd be really outside of my realm. So I'd rather stick to things that I know about.

BILL A: I began to realize that to get jobs in teaching, that even if I went into industry, I need to know some applications because my background is very pure. I took a couple of applied math courses, but not the kind of thing that is going to help me teach at a community college level--maybe a p.d.e. course and a modelling course--so what I did, I started learning statistics, and I started learning computer programming, and I basically learned it on my own... Took a couple of courses in the computer science department there, and I sat in on a stat course. And then when I came down here to interview for this job, I feel sure that that's the reason I got this job. One of my recommendations would be to encourage Ph.D. students or other types of programs even at the master level, to learn statistics, computer programming, to learn applications, to learn business applications, because there's a big push for math departments at college levels to teach business students, to communicate with business--in terms of what the business people want students to know. I think it would be a very good idea, a good thing for a lot of community college teachers to know.

Q: Do you find that your industrial experience has been useful for you?

JOE A: Oh, yes! When I start talking about my experiences--problems I had to solve on the job--you could hear a pin drop! A lot of the students will take me for a course because I tell them about problems encountered on the job. I just wish I had more (industrial) experience than I do.

Another faculty member pointed to the reasons why one of the graduate instructors had been so immensely popular with students.

BOB A: I try to do what he did, that is to make a math course interesting by showing the many kinds of applications.

The same instructor then went on to describe the kind of additional course work that he would like to take to improve his teaching.

BOB A: Instead of doing more course work, which I don't think would help me that much, some of it would, if I had to go take chemistry or physics, that might help some--which you can relate to mathematics. Some of my students are taking chemistry and physics at the same time.

4. THE VALUE OF MATHEMATICS EDUCATION COURSES

Many who have been involved in the preparation of teachers of two-year college mathematics have suggested from time to time that what really is needed is more mathematics education courses. Those interviewed varied in their opinions. By and large they labeled the traditional education and math education courses as useless or of very little value. They expressed, however, interest in less traditional courses, especially in teaching problem solving (Polya's heuristic approach) and teaching techniques with direct applications to two-year college mathematics courses.

Q: How about education courses?

RON A: Perhaps some background in education, although education courses are just so terrible that they're sort of self-defeating, but if they weren't so terible, and if they were taught well...

Bob got his Master's degree in pure mathematics but completed all the required courses for high school teaching certificate except student teaching. We asked him if the education courses he took were useful to him.

BOB A: No, absolutely worthless. I've been unable to use anything I learned from education classes, including our own methods course, taught by the math department.

Q: Do you think that they could be designed so that they would be useful to you?

BOB A: One thing that would be very useful would be a calculus-methods course. Testing is very important, I don't know enough about it.

Q: What about classes like educational psychology, classroom technique?

JACK A: I've never found them to be of much esteem or much use.

Q: Have you had considerable number of such courses?

JACK A: I've had a few, and I never thought they did very much.

Q: If the government decided to start sponsoring institutes again, what kind of courses would you recommend?

DAVID A: Most two-year college teachers have plenty of math background. You need courses in Polya's problem solving, discovering how to work with things.

The response of a faculty member in another institution who got his undergraduate education abroad (with a very strong math background) is particularly interesting:

MIKE A: I got a B.S. in pure math and a B.S. in applied math. Here you had to get a Master's so I went to a NSF institute and got a Master's in mathematics education. There were really Mickey Mouse courses. I learned far more for my B.S. degrees.

Later in the interview Mike told us more about his interests.

MIKE A: My interest is in teaching techniques rather than subject matter. If a person is going to be short of something I prefer him to be short on depth of subject matter. Because at a two-year college if a person is short on, say, some background in calculus then he should not be assigned to teach a calculus course. If a person is deficient in teaching techniques and does not care about each student as an individual, then he should not be assigned to any course.

Q: Do you feel that it is easier to pick up the math when you need it rather than to pick up the teaching techniques?

MIKE A: Teaching techniques are much more difficult to pick up. You see if we had a choice here for an in-service course, I would prefer an in-service course in teaching techniques, exchanging ideas about teaching. We don't exchange enough ideas about teaching.

5. PROFESSIONAL LIFE IN THE COLLEGES

Q: What about the stimulation factor here? You said you're not getting turnout for your seminar. What if the turnout doesn't improve over time?

BILL A: My feeling is I would still want to do something even if there are only two or three people and we have fun doing it, but if it gets down to no one then I'll do something else. The other two or three enjoy it as much as I do, it just happens that the other seven or eight in the math department don't. Part of the trouble is, as I've said before, not enough people here have enough of a math background. Some people have never even taken a course like linear algebra. They haven't been that far. They've been to calculus and that's essentially it.

Q: How about within the faculty itself? Is there interaction? Do you talk about mathematics very much? Do you talk about curriculum problems?

JOE A: No. That was one of the surprising things to me. I didn't even know where other teachers lived for years. I knew nothing about their personal lives. That has changed now--after Bill arrived. He invited people over to his home and they in turn invited others.

He went on to describe increased socialization of late among the mathematics faculty.

Q: Do you think that this emergence of socializing among the faculty is having a beneficial effect on campus? Are you doing mathematical things together?

JOE A: It's purely social.

Q: Do you discuss at all some problems you are having in the classroom?

JOE No, we don't do that at all. Isn't it terrible! In fact, I've been complaining about that too. We have a math department meeting today at 1:00 and we will talk about budget, grades, courses... but we won't talk about math.

Q: What can be done to stimulate the mathematics faculty to get them more interested in teaching--I don't mean research mathematics.

JOE A: We try to have seminars and nobody attends. I don't know. It just seems like it's impossible.

At another institution we inquired about the faculty activities during the summer months.

CARL A: Some work in construction, some of them travel. Very few carry out professional activities. I think during the days when NSF used to fund us, it (continuing education) was both more popular and easier.

Q: Do you think there's time given 15 hour loads and the work that goes with it to carry out a serious research program?

TOM A: Well, there's time if you want there to be time. It depends on what it's going to cost you. I just finished a book that took me four years to do. It was tough--studying, writing, teaching myself, after coming home from work each day. The question is, what is the alternative to not doing it? You become a zombie or atrophy. I mean, you're teaching intermediate algebra and you had abstract algebra. They don't go together. You've got to make a decision. As I look around at a lot of the faculty in my department they opted for the easy was out. Water moves out the easiest exit. So, when you say, is there time for it, there is not time, but you've got to make time for it unless you want to go to a certain level.

The same individual told us about his early dreams when he'd left graduate school to teach in a community college.

TOM Q: Somewhere along the line, something goes wrong--where young people come out, are coming to the community colleges. I'm one of them. I'm certainly not an old man. I've been teaching here fifteen years and I came out and said to myself, "Oh man, this is going to be phenomenal. I'd like to have a seminar, all different kinds of mathematics, I'd like to do this, let's have a math club, let's have a math team." But it doesn't go and the question is why. A lot of the older faculty feel threatened. Why? They've got master's degrees. Some where along the line they began to take the easy way out and perverted themselves. It's hard to do extra work when you are there fifteen hours teaching. The commitment to prepare lessons is minimal, it's true, but you're teaching fifteen hours and you've got breaks between your classes and you've got other committee assignments and observations to do.

Q: What can one do to keep from becoming deadened?

MARY A: Whew! I really don't know, I really don't. If you don't teach it, you just end to back off and you get lazy. As long as you're getting your paycheck, and things are going okay... you turn away from your job, which is a thing you shouldn't be doing. I feel guilty about it. But it's the kind of thing you had in junior high, where you come in, throw your books on the table and try to find something else to do. It's discouraging. I was with one of the English teachers the last day of

classes and we were just both in tears. It is so frustrating, to kind of project ahead and think, well this is what I'm going to be doing for the next 20 years. You don't even think about that, that you'll be doing this till you retire. And you feel so disappointed in yourself. Once you had some pride in your ability and some intellectual curiousity about math problems. Someone might throw out a math problem today and people just walk by. You know, who cares?

Q: What do your colleagues do outside the classroom professionally?

SAM A: Not much, I think we are all sort of sinking intellectually.

Q: Most people at the universities do not rely exclusively on their classes for their intellectual gratification in math. The thing that seems to be generally true among two-year college teachers is that very few rely on anything but the classes for that. For instance, the MAA has an elaborate program of visiting lectureships. Most two-year colleges never invite people to give these lectures. These traditions have never been established.

SAM A: I would say that part of the problem here is leadership. The chairman is so overwhelmed with paper work that there is no time for leadership. We have universities in the area and I don't understand why we don't even articulate with them directly.

Q: What should the professional life of a two-year college teacher encompass?

RUTH A: I don't know. I think in terms of putting together a viable course. To help students to do better, through counseling and so forth. That is about it.

Q: Can you do that without outside activities? Do you have to be renewed from time to time in order to do that?

RUTH A: I think yes. We will be better off to take some graduate courses in certain selected areas. I don't know much about computer programming, probability and statistics would be useful. But if the students will get much benefit out of it is not clear.

Q: Do you switch around and teach different courses?

RUTH A: No. The chairman's policy is to more or less keep people in certain area for a long time.

Q: Do you like that arrangement?

RUTH A: It makes it easier to become better in what you are doing.

6. INCENTIVES FOR PROFESSIONAL GROWTH

Q: One thing that occurred to me that makes this a little different from some other colleges is that it is very close to a major university so that people who are interested in research, for instance, or advanced study, have that outlet.

Q: Are people doing it though?

BILL A: Here? In mathematics? No. I've done very little myself since coming here. I've finished up one little paper and I've worked on a couple of other little things that I haven't even written up yet.

Q: Are activities like writing for the Two-Year College Math Journal encouraged here?

BILL A: I would say that they are not encouraged at all.

Q: It doesn't affect rank or salary?

BILL A; No, neither salary nor rank. Everything here is in the instructor rank. Everyone here is an instructor.

CARL A: You're not required here to do any course work at all. I think it's wrong, but nothing is required.

Q: Even if you get a higher degree?

CARL A: No, there are only two salary levels. We have level one and level two and beyond level two you only have a master's in the subject--no plus 40. There's no incentive to go back to school. I'm basically interested in going back to school, but I've got three kids and I need a little bit of incentive and I don't have it--and I don't go back.

Q: Is there any kind of financial incentive for people to go back and take more courses?

CARL Q: No. No.

Another institution required the faculty to be involved in some well defined professional activities. The requirement, however, was not to the faculty liking.

Q: Does the college require you to do something for professional growth?

MAX A: In order for us to maintain a continuous contract, we must every year submit some kind of a program under staff development. The choices are in the contract. One choice is to go to a university and get 3 hours credit, I don't recall if every term or 3 a year. They don't apparently care what you take, it just must be university credit. That is one concept for which there is no financing at all, no free-time given, it is strictly on your own time at your own expense. Another possibility is to get involved with administrative O.K.'d seminars or study of some kind with a group of colleagues getting together. They would want then to know in detail what you are going to do and have some evaluative program for it, which I find difficult. The whole thing is a fake. Another thing is a publishing kit. If you publish, O.K., they will let you go for another year. If you write a textbook, O.K., we will hire you for another year.

Q: What do people do then?

MAX A: Seminars

Q: What kind of seminars are going on?

MAX A: I am not sure right now. Last year there was a seminar. I don't know for this year if there are any yet. Right now we are conducting an informal seminar, unbeknownst to anyone else because we don't want to have any jabs coming in from the administration or any control. We are voluntarily doing it on Fridays. We took our lunch time and we just sit in a little room and talk.

Q: You mean you have to hide this, the fact that you are doing this?

MAX Q: Well, yeah, I guess that's what it amounts to because if we wanted to formalize it, that would kill it, and this is one of my biggest bitches about the two-year program--that the aura of professionalism is still maintained as it is at the secondary level. We are not college teachers of mathematics!

In one very active department we found institutional-based incentives for additional course work to be substantial. It may be that a ranking system of the sort found in that institution, i.e., a ranking system with real teeth is important to the vitality of any department. The college has an excellent set of financial rewards tied to its ranking system, which may possibly contribute to the activity observed.

JACK A: If you're going to school and if you have done previous work and you start taking 3, 6 credits and are enrolled in a program you're guaranteed a sabbatical. An instructor here starts out with 14,800 as of '77. Full professor goes up to 36,500.

Q: How long does it take to get up there (to professor)?

JACK A: As of now, it's four years to here, to assistant from instructor, six years to here, and six years to full. Four years from instructor to assistant, before you're eligible for promotion. That doesn't mean you are going to get it. Minimum time. Six years to associate and six years to full.

Q: Are there any activities that can speed you through this? Can you skip steps?

JACK A: No. Unless you get a presidential dispensation, which I don't know--I don't know anyone who has.

JACK A: Assistant goes from 17.3 to 24.3. An associate goes from 28 to 29.8.

Q: How do you go from one step to another?

JACK A: Every year. That's automatic. What is not automatic is going from one rank to another and that's where your activities count.

We then went on to ask further details how one advances through the ranking system.

Q: Is it tough to advance here?

JACK A: Yes, it's tough to advance. I shouldn't say it is tough. It is not tough--if you are doing your job.

Q: And what is conceived of as the job?

JACK A: Well, you're dealing with the job in the classroom first of all. Then, have you been writing books, articles? Have you been attending courses? Summer institutes? Have you been taking graduate courses to pursue a degree? Have you served on the college committees which are important? Have you done work on your departmental committees? What are your liaison activities with other departments?

Q: Are you expected to be active in all these areas?

JACK A: Absolutely. You're expected to be active in each area. I should get a copy of our application for you. It's a lengthy application and it has these areas. College service, departmental service...

Q: Another faculty member at the same institution cited more personal reasons for wishing to advance.

HAL A: The Ph.D. lets you in the door for a promotion and it's also very personal. Maybe you will get a grant, and your mother will be pleased and she'll call you doctor and you'll impress your neighbors and your colleagues--all in one shot.

7. REMEDIATION PROGRAMS - CHANGING STUDENT POPULATIONS

There are, of course, other complication factors which bear heavily on the professional lives of an ever growing number of two-year college mathematics faculty. Most prominent among these factors is the tremendous growth of remedial programs.

Q: At the other extreme, do you have bright kids who are somehow misfits?

BOB A: You're not kidding and I try to get them out of here as quickly as possible.

TOM A: Whether I'm out skiing or dancing, I've always been a teacher and I've always enjoyed what I was doing... I enjoy teaching anybody if the juices are there, if it's something you are capable of teaching.

Q: Do you enjoy teaching elementary courses?

TOM A: To answer your question. If students are learning, and you're getting feedback, and they are asking you interesting questions, that's one thing, but if you walk in and give a lecture and five percent of the class is capable of understanding it, it's very difficult, and if you don't have

something else to do, if you don't have research, or you don't have a journal, you don't have articles, you don't give talks; it's very easy to--you know, a brain is like a muscle... if you don't use it, if it's not flexed, you sink.

Q: And you don't get much reward from teaching because the students don t have the juices?

TOM A That's right.

Q: Are the students different than they were ten years ago?

TOM A: Yeah, sure. When I first came in here, it was much better. I've been here fifteen years and can compare.

Q: Were you more highly motivated toward teaching than you are now?

TOM A: Oh, sure. I was teaching a course in differential equations That's not esoteric particularly, but second- or third- term calculus. And the students were good. Sometimes they would ask question, and I wouldn't know the answer. I remember one night in particular. It was a weird question. I had no idea, we started to derive it, it took the whole period. Got an answer and the whole class broke out in applause. We were working together on something. But the students were definitely better. Nowadays students have a different mentality.

Q: You said you were teaching differential equations. Does that mean you no longer teach differential equations?

TOM A: No, I haven't taught differential equations in ten or twelve years.

Q: Does it still exist?

TOM A: I'm not sure it does. I think we have one course in differential equations. The core of my classes to a large extent would be intermediate algebra, trigonometry, geometry, precalculus, maybe differential calculus course--and that's the plum. Calculus is the plum.

MIKE A: Assuming it is the best of all possible worlds, what do we do for students who come in unprepared. Do we teach them in one semester four years of high school math, or do we say you can't learn that anyway, disguise it, are we going to teach you something which is going to be useful to you, life skills type of course, something like that? Our college has changed substantially in the last few years

Q: Is your college an inner-city college?

MIKE A: It's actually a county college but by its size has become essentially an inner-city college, by location and by the fact that people from the suburbs refused to come.

Q: How has this changed the population?

MIKE A: The population has, well... become more minority. It's very much a black college. It's about 75% black.

Q: Does this imply less prepared student?

MIKE A: Not necessarily. It's just that most of the good students from the inner cities go elsewhere. It's a premium for a four-year college to get someone from the inner cities. When we started ten years ago, I would say that we were the typical community college, in that a third of our work was remedial. Maybe about half was college level. And the rest was technical--career-oriented kind of stuff. We've swung much more to the remedial. Right now, I'd say 70% of our course work is remedial.

Q 70%! What do you mean by remedial?

MIKE A: Arithmetic, elementary algebra. To be excluded from having to take arithmetic we use about the 35th percentile on the GGP on the computation part, which isn't a very high cutoff. We get about 75% of our students need arithmetic based on the cutoff.

Q: Do you feel prepared to teach remedial courses?

MARY A: There is no way my college preparation could envision what we would be doing, you know, the people who were setting up programs then. I trained to be a secondary school teacher. But there wasn't any such thing as a junior college back in the old days. First of all, they couldn't envision that there would be junior colleges; and secondly, I don't think anyone dreamed we would be teaching arithmetic even at a high school level, much less at a college level, and I don't know how those people could ever have envisioned that this was going to happen. I think this is always going to be a problem--you can't foresee what the difficulties will be. I feel rather ill-equipped to deal with our students, in a sense that I feel like I'm almost in a situation where I'm in special education. I think it takes special kinds of people and special kinds of training, personality-wise, perhaps, to deal with some of the problems we have here. And if at the time I was going to college someone could have said this is what you'll be doing in fifteen years, I maybe would have been doing something else. What do you do with someone who is twenty years old who basically has no educational training? You can't treat them as you would a seven-year-old. Socially, they're not going to accept it. They are not going to accept flash cards

Q: Do you think you are wasting money on them? Is this the wrong kind of choice for them?

MARY A: I don't know. It is a duplication of effort and waste of money. Once they are at this age, I don't know what you do. Maybe they can get something out of being here.

Q: You seem to be saying, at least in the beginning, that there are some talented people here and that they are completely ignored.

MARY A: They are not completely ignored in the sense that we have calculus and analytical geometry, but they tend to be ignored in the sense that we could be doing more for them. Most of our money and effort is going towards remedial courses.

Q: Has it changed much since you've first been here?

RICK A: It's changed quite a bit because the preparation of students had declined. I taught in high school for a while. I find better students in high school.

Q: Does it bother you at all? Is it unsettling in any way?

RICK A: No.

RON A: Now for students who cannot read, they should be screened prior to getting into general education programs. There are students who can't read, can barely write, or who are reading at the third and fourth grade level. They can't multiply or divide natural numbers.

Q: What do you think you will be doing five or ten years from now?

ED A: Probably the same thing. I don't use the same technique year after year.

Q: Will you move to teaching other subjects?

ED A: I don't think so. I don't care that much about teaching terminal courses. I like to see someone come in, begin math, and get turned on to it. So that they will go through it and become a science or math major.

Q: How about arithmetic? Do you like that as much?

ED A: No, I don't.

Q: Why don't you?

ED A: I don't like to work with unmotivated failures.

NOTES ON THE SAMPLING PROCEDURE

A list of approximately 1200 two-year colleges and their 1976 enrollments was obtained from the National Center for Educational Statistics in Washington, D.C. Schools were divided into 10 zones (strata) on the basis of enrollment and whether they were public or private. The strata were as follows:

Zone	Control	1976 Enrollment
1	Public	20,000 or more
2	Public	15,000-19,999
3	Public	10,000-14,999
4	Public	7,500- 9,000
5	Public	5,000- 7,499
6	Public	3,000- 4,999
7	Public	1,000- 2,999
8	Public	Less than 1,000
9	Private	1,000 or more
10	Private	Less than 1,000

A random sample of schools was drawn from each zone. Sample sizes were not directly proportional to the total enrollments in each zone. Sampling was slightly heavier in Zone 1, the largest schools. Each Mathematics Department chair (or equivalent) was contacted to see if his department would participate and to find out the number of full-time mathematics teachers on the staff. When a school agreed to participate, enough questionnaires were mailed to the department for all full-time mathematics faculty members.

One hundred and forty-seven schools were originally contacted and 91 agreed to participate in the study. Eighty-five schools actually did participate in the survey. The 85 schools were fairly well distributed among the zones given in the earlier table and were also fairly well distributed geographically around the country. After each school was originally contacted, mail and then telephone followups were used to encourage participation.

Six hundred and ninety questionnaires were mailed to the 85 schools that participated and 544 (79%) were completed and returned. Again, mail and telephone followups were used to obtain this rate of return. Further information is summarized in the following table.

Zone	Total 1976 Enrollment	Number of returned Questionnaires	Total number of Schools in zone
1	370,482	120	15
2	434,618	72	25
3	595,881	66	48
4	587,443	66	68
5	510,837	73	83
6	477,011	41	123
7	644,011	69	354
8	130,981	17	187
9	55,871	16	29
10	75,644	4	198
	5,883,321	544	1,130

The sampling plan that was used can be characterized as follows: The population was stratified into 10 strata and cluster random sampling was used within each strata, a cluster being a single two-year college. Once a school was drawn, all full-time mathematics faculty members at that school were included.

When analyzing all 544 questionnaires, appropriate cluster estimates were computed within each zone and these were combined into single population estimates using weights developed for each zone. For zone i

w_i = fraction of the total 2 year college enrollment in 1976 falling in zone i.

An assumption made is that the number of full-time mathematics faculty members in each zone is roughly proportional to the total enrollment in the zone. Analysis of special subgroups of the 544 respondents was done by selecting the individuals in the subgroup of interest. No weights were used when doing the analysis of a special subgroup.

The 544 persons in the sample should be approximately 10% of all full-time mathematics teachers at two-year schools according to the latest CBMS* study. Some analysis was done on the first 364 questionnaires that were returned (for a preliminary report). The results were nearly identical with those obtained for all 544 questionnaires, indicating that the sample size was very adequate.

*Undergraduate Mathematical Sciences in Universities, Four-Year Colleges, and Two-Year Colleges, 1975-76, J. T. Fey, D. J. Albers, J. Jewett, Conference Board of the Mathematical Sciences.

Final Results (based on 544 questionaires)
Weighted

AN INQUIRY INTO THE GRADUATE TRAINING NEEDS OF TWO-YEAR COLLEGE TEACHERS OF MATHEMATICS

General Instructions

The purpose of this questionnaire is to elicit the views of two-year college mathematics teachers on the graduate training needs of the profession--both in advanced degree programs and in continuing education such as summer institutes and short courses. The project is sponsored by the National Science Foundation and the Rocky Mountain Mathematics Consortium. Its results will be widely disseminated through the professional organizations, with the hope of encouraging reforms in existing graduate programs and enhancing opportunities for continued training.

For the survey results to be truly representative, it is essential that there be a high percentage return of the questionnaires. Please fill yours out. Though the questionnaire may appear formidable, it will require only about 20 minutes of your time.

To insure the privacy of your answers, please put your completed questionnaire in the envelope, seal it, and turn it in.

I. Continuing Education

Coding (*)

Indicate your degree of interest in each of the following as:
(A) Strong, (B) Moderate, (C) Slight, or (D) None (E) No Reply

Percentages*

		(A)	(B)	(C)	(D)	(E)	Coding (*)
____	1. Attending a "short course" (3 to 5 days) giving an intensive survey of some topic of interest to you professionally.	46	33	14	7	1	___ 1
____	2. Attending an evening course at a nearby university.	20	36	33	11	0	___ 2
____	3. Attending a summer session at a university.	25	42	22	10	0	___ 3
____	4. Attending successive summer sessions requiring a period of independent study during the intervening academic year.	11	26	36	26	1	___ 4
____	5. Spending an academic year (sabbatical) at a university.	33	30	22	14	0	___ 5
____	6. Undertaking an advanced degree, if the work could be completed in one academic year plus a number of summer sessions.	25	21	26	26	2	___ 6
____	7. Undertaking an advanced degree, if this required returning to graduate school for two or more academic years.	5	7	25	60	2	___ 7
____	8. Participating in a faculty exchange program among two-year colleges.	24	28	26	21	0	___ 8
	9. Other ideas for continuing education?						

* May not sum to 100% due to rounding.

(*) The spaces in the right hand column of each page are for the use of the coder in processing the questionnaires. Please do not write in this column.

Suppose you were offered the opportunity to spend a summer attending lectures at a university, and that external difficulties--financial problems, family conflicts, etc.--had been resolved so that you might go.

10. We've listed 12 alternative ways of using the summer. Please give a preference ordering (1st, 2nd, and 3rd choices only) of how you would like to spend the time.

choices 1 2 3 First choice ___ Second choice ___ Third choice ___ 9 10 11 12 13 14

22	11	9	a.	Getting ideas on innovations in subject matter content and classroom technique directly applicable in your own classes.
9	8	10	b.	Attending lectures and seminars that deal with some of the practical pedagogical issues in two-year college teaching, e.g., the problems of remediation.
7	7	10	c.	Taking mathematics courses which treat from an advanced standpoint some of the topics which you have been teaching on a more elementary level.
18	22	16	d.	Taking courses designed to show how the mathematics you teach may be applied to science and engineering fields which are of interest to your students.
16	16	17	e.	Taking courses in areas of the "mathematical sciences" which are unfamiliar to you, (statistics, computer science, or operations research may be in this category).
6	14	12	f.	Taking courses, not in mathematics but in related sciences with a strong mathematical basis, e.g., physics, population biology, theoretical economics, management science.
7	5	6	g.	Taking advanced mathematics courses related to your professional mathematical interests, though not necessarily relevant to courses you teach.
2	4	4	h.	Taking part in a teaching experiment.
7	8	10	i.	Taking part in a project which will involve applying mathematics in some "real world" problem-solving effort.
3	2	2	j.	Working on research (thesis or post-doctoral).
1	1	2	k.	Doing something only remotely related to mathematics.
1	1	1	l.	Other (specify)
1	1	2		MISSING

→ Read percentages in each column

11. Would you prefer (check one):

☐ Formal courses, with examinations and college credit toward a degree, 49

or

☐ Lectures and seminars attended informally without college credit. (With the award of a certificate of having completed the program). 48 15

3 No Reply

II. **Basic Preparation of a Two-Year College mathematics teacher.**

Fully 5/6 of two-year college mathematics faculty hold Master's degrees. Of course the content of various programs can differ vastly.

Please indicate the relative importance to a minimal program of inclusion of the items below.

Characterize each as:

A. Essential--every two-year college teacher should have this in his background.

B. Very important.

C. Of minor importance, though of some value.

D. Unimportant.

E. Inappropriate.

F. MISSING

		A	B	C	D	E	F	
____	1. Teaching experience or a teaching internship.	47	40	11	1	0	1	16
____	2. Courses in pure mathematics through advanced calculus and abstract algebra.	59	30	10	1	0	0	17
____	3. At least two year-long sequences of courses in applied mathematical sciences (e.g., statistics and computer science).	13	47	38	1	1	4	18
____	4. Courses in mathematics education.	10	26	46	16	1	1	19
____	5. A course which examines the development of and current issues in the two-year colleges.	6	24	46	21	3	0	20
____	6. A course in the history of mathematics.	10	38	46	6	0	0	21
____	7. Supporting courses in physical sciences.	10	49	37	4	0	1	22
____	8. Supporting courses in biological and social sciences.	3	30	55	10	1	0	23
____	9. Seminar on mathematics writing.	2	14	46	32	5	2	24
____	10. Master's thesis.	7	11	42	35	5	1	25

11. Other items which you consider to be important in a minimal program? (please specify)

III. Characteristics of a Professional Two-Year College Mathematics Teacher.

How important do you consider each of the following professional activities or qualities (for the profession in general and not necessarily for your self as an individual). Rank each as:

(A) Essential; (B) Very important: (C) Desirable; (D) Unimportant; and (E) Inappropriate. (F) No Reply

____	1. Regarding oneself primarily as a teacher.	63	27	6	1	1	1	26
____	2. Being willing to teach remedial mathematics, including arithmetic.	36	37	22	3	1	1	27
____	3. Being able to move into new areas of teaching as the curriculum evolves.	42	42	13	1	1	1	28
____	4. Publishing papers in research journals.	1	2	31	57	8	1	29
____	5. Publishing articles on matters related to classroom teaching.	1	6	53	39	2	1	30
____	6. Publishing textbooks.	0	2	34	59	5	1	31
____	7. Learning new mathematics through reading or attending lectures.	17	44	35	3	0	1	32
____	8. Working outside class with students; for example, giving special talks or acting as faculty advisor for a student mathematics club.	8	30	54	7	1	1	33
____	9. Having experience in applying mathematics to "real world" problems.	15	42	39	3	0	1	34
____	10. Maintaining interest in mathematical problem-solving (such as difficult problems from textbooks or mathematics magazines, or problems posed by colleagues).	8	35	50	6	1	1	35
____	11. Periodically attending university summer session or evening classes.	9	26	57	7	0	1	36
____	12. Engaging in professional "public service" activities.	2	12	56	26	3	2	37
____	13. Obtaining a Ph.D. in mathematics.	1	3	32	54	9	1	38
____	14. Obtaining an Ed.D. or Dr. of Arts in one of the existing programs designed for two-year college teachers.	1	8	41	44	6	1	39
____	15. Obtaining a doctoral degree in an especially designed new program--a program not presently available, but one which would address the real needs of two-year college faculty.	2	17	51	24	4	2	40
____	16. Accepting administrative work on the campus.	0	6	36	41	15	1	41
____	17. Being involved in the work of professional organizations.	4	17	62	15	2	1	42
	18. Other activities or qualities that you think are important? (specify)							

IV. Characteristics of an Ideal Doctoral Program. 41

Suppose you are being asked to recommend the design on an "ideal" doctoral degree program for the training of two-year college mathematics teachers. Such a program presumably would involve course work, perhaps an internship and some kind of thesis. In your answers to the following questions we ask you to specify the kind and amount of each of these elements.

Means

Course Work -- Distribution

Estimate the fraction of the course work which should be devoted to each of the listed areas. State each to nearest tenth: 0, 1/10, 2/10, etc.

		0	1/10	2/10	3/10	4/10	5/10	6/10	7/10 – 8/10	9/10	
		Frequency distribution									
.203	1. Pure mathematics at the level of introductory graduate courses.	11	22	36	20	8	3	0	0	0	43
.112	2. Pure mathematics at the level of advanced courses and research seminars.	34	36	20	7	1	2	0	0	0	44
.089	3. History of mathematics.	19	76	5	1	0	0	0	0	0	45
.120	4. Mathematics education (for possible courses see below).	23	49	20	5	2	2	0	0	0	46
.083	5. Physical and earth science courses which use mathematics.	32	56	11	1	0	0	0	0	0	47
.064	6. Biological and social science courses which use mathematics.	42	53	5	0	0	0	0	0	0	48
.103	7. Statistics, operations research.	17	66	15	2	0	0	0	0	0	49
.102	8. Computer science.	16	67	15	1	0	0	0	0	0	50
.084	9. Classical applied mathematics.	36	50	12	2	1	0	0	0	0	51
.012	10. Other (specify)	43	6	1	0	0	0	0	0	0	52
.028	(Not accounted for. There were problems with people following directions for these questions.)										

Course Work - Specifics

There follows a list of several courses (mainly mathematics education) which some have advocated incorporating into the program. Please categorize each as:

A. Should definitely be included.

B. Optional but strongly encouraged.

C. Acceptable, but should not displace more important topics.

F. Not acceptable.

G. NO REPLY

____	11. Methods course in the teaching of remedial mathematics. (including arithmetic)	36	30	28	4	3	53
____	12. A course or seminar on mathematical writing.	4	18	65	10	3	54
____	13. History of mathematics and the use of historical information in the classroom.	26	40	30	2	3	55
____	14. Course on the use of technology in mathematics teaching. (e.g., computer assisted instruction)	27	44	25	2	3	56
____	15. Teaching of problem solving. (Polya's heuristic approach, which emphasizes the motive and purpose of the various steps in a solution to a problem).	43	37	15	2	3	57
____	16. Teaching techniques (like discovery, expository and heuristic approaches with direct applications to teaching two-year college mathematics courses).	43	34	16	4	3	58

(Continued on next page)

___ 17. Curricular design and textbook evaluation for two-year colleges. ___59
21 36 36 5 3

___ 18. Testing and evaluation (with concrete applications to two-year college mathematics courses). ___60
30 39 25 3 3

___ 19. Learning theories and psychological aspects of teaching mathematics. ___61
21 37 33 6 3

___ 20. A seminar in two-year college teaching in which classroom teaching is videotaped and discussed. ___62
19 35 36 6 4

21. Other suggestions? (specify)

Teaching Internship

22. As a condition for receiving a graduate degree should a person be required to have a practical teaching experience (either in high school, two-year college or as a teaching assistant)?

Yes 69 No 29 (circle one) MISSING 2 ___63

23. Do you think that a meaningful internship could be devised for a person who is already an experienced teacher:

Yes 47 No 23 Don't know 34 (circle one) MISSING 1 ___64

Thesis

We have listed below a number of thesis project areas--some traditional, some more novel. We would like your judgement: which of these are the most valuable and appropriate experiences for a two-year college mathematics teacher? Mark each as:

A. Best (or tied for best)--of greatest value.

B. Second best (or tied for second).

C. Acceptable, but of lesser value.

F. Not really useful for a two-year college teacher.

G. MISSING

___ 24. Standard research Ph.D. thesis in mathematics or applied mathematics. ___65
14 15 32 35 4

___ 25. Standard educational research doctoral thesis (e.g., an Ed.D. dissertation emphasizing educational statistics). ___66
11 23 42 20 5

___ 26. The so-called expository survey, in which an area of the mathematics research literature is reworked, and arranged in a connected account. (A common type of thesis for Dr. of Arts, and for some special Ed.D. and Ph.D. programs). ___67
16 25 41 13 5

___ 27. An historical survey (as sometimes found in Dr. of Arts programs, etc.) ___68
6 23 50 16 5

___ 28. Designing a learning module, or a segment of a two-year college course, and testing this with students. ___69
51 24 17 4 4

___ 29. Writing a textbook for two-year college use. ___70
14 29 37 15 4

30. Other (specify)

31. What do you think is the most appropriate name for the degree program which you have outlined?

☐ Ph.D. (20) ☐ Ed.D. (26) ☐ Dr. Arts (37) ☐ Other (specify) (6) MISSING (11)

32. General comments on doctoral program?

V. Professional Incentives

Faculty Advancements

Below are listed some professional activities which colleges commonly evaluate in making decisions on faculty advancement--for both salary increases and promotion to higher rank or to higher salary scale. Please give your own view of how important each of the following is at your institution, rating as:

A. Very important for most faculty; very heavily weighted in advancement decisions.

B. While not essential for all faculty, this can have significant impact for advancement of some.

C. Taken into account, but relatively small impact on advancement.

D. Little or no effect on advancement.

E. MISSING

		A	B	C	D	E
____	1. Years of service.	57	24	12	4	3
____	2. Classroom teaching performance.	45	18	20	14	4
____	3. Textbook writing.	1	19	31	46	3
____	4. Giving talks at mathematics meetings.	1	18	40	38	4
____	5. Journal publications on classroom activities. (e.g., Two-Year College Mathematics Journal, MATYC Journal, etc.)	1	18	40	38	4
____	6. Research.	2	14	31	50	3
____	7. Campus administration and committee work.	15	34	28	19	4
____	8. Participating in work of professional organizations.	3	24	41	29	4
____	9. Public service in a professional capacity.	4	22	39	32	4
____	10. Community service.	3	19	37	38	3
____	11. Attending lectures and seminars.	4	20	42	30	4
____	12. Taking additional courses for credit.	40	33	16	7	4
____	13. Obtaining a doctoral degree.	30	40	17	9	4
	14. Other (specify)					

All other possibilities were coded by -1st two checked. Missing were coded d.

Time Constraints.

16.17 15. How many class-hours per week do you teach mathematics. (include overloads, night courses, etc.) ___14 ___15

15.33 16. How many hours per week do you spend outside of the classroom on professional mathematics activities. ___16 ___17

17. How do you spend summers? ☐ a Teach; ☐ b Work; ☐ c Attend summer courses; ☐ d Other (check one or more) ___18

a 35
b 5
c 2
d 18
a-b 9
a-c 14
a-d 7
b-c 4
b-d 1
c-d 5

Problems in the college

Below are some commonly cited problems of some two-year college faculty. Please rank each as follows:

A. This has been a major and continuing problem for me.
B. This is a minor irritant.
C. This is no problem for me.
D. MISSING

___	18. Coping with the deluge of remedial mathematics.	21	37	41	1	___19
___	19. Teaching un-motivated students.	39	48	13	1	___20
___	20. Having to cover much more material than most students can absorb.	29	49	21	1	___21
___	21. Lack of stimulation, due to the elementary level and repetitiveness of courses.	11	40	48	1	___22
___	22. Lack of stimulation from colleagues.	7	21	70	1	___23
___	23. Having too little time and energy available for professional activities outside the classroom.	23	37	39	1	___24
___	24. Lack of incentive or reward for professional growth.	22	33	43	2	___25
	25. Other (specify)					

VI. Identification

Circle those of the following journals which you regularly examine.

a. Mathematical Monthly 31	i. Math Magazine 11	___26	___27
b. MATYC Journal 54	j. Math Gazette 1	___28	___29
c. Two-Year College Math Journal 51	k. Math Teacher 52	___30	___31
d. SIAM Review 8	l. School Science and Mathematics 3	___32	___33
e. Bulletin of AMS 8	m. Mathematics Teaching 5	___34	___35
f. Proceedings of AMS 4	o. Science News 6	___36	___37
g. Science Magazine 6	p. Other (specify) 15	___38	___39
h. Scientific American 34		___40	

2. Circle those of the following activities in which you are involved: 45

a. Attend at least one professional conference per year. 73 41

b. Speak at professional conferences. 18 42

c. Give talks on math to community and student groups outside of class. 24 43

d. Write journal articles. 12 44

e. Have written a textbook. 12 45

f. Participate in professional seminars at your school or at a nearby college or university. 39 46

g. Have taken a university course for credit within the last two years. 45 47

h. Have obtained an advanced degree within the last two years. 7 48

i. Work on challenging math problems unrelated to classes you are teaching. 51 49

j. Work on a research project. 18 50

k. Active in a professional organization. 30 51

l. Other professional activities outside of classroom and ~~administrative responsibilities?~~ (specify) 13 52

3. Some faculty in two-year colleges bemoan the fact that they are called upon to teach statistics and yet have never formally studied statistics. They cite the fact that few graduate programs in mathematics even require course work in statistics. Others complain that teaching remedial courses such as arithmetic can be very difficult and wish that they had been exposed to meaningful methods courses in the teaching of remedial mathematics.

Below is a list of mathematics courses which are sometimes taught in two-year colleges. Please categorize each as follows:

A. I feel entirely secure about my qualifications to teach this course.

B. I can handle this course, but would do it better if I had an opportunity to study some appropriate background material (either mathematical, scientific, or pedagogical).

C. I don't feel qualified to teach this subject.

D. None of the above (explain briefly in space below).

E. MISSING

The courses:

60	34	6	0	1	___	Elementary probability	53, 37, 7, 2, 2	___	Use of hand-held calculators	53	54
46	43	10	1	1	___	Statistics	20, 23, 55, 1, 1	___	Computer programming	55	56
62	31	4	1	1	___	Finite math	57, 31, 10, 1, 2	___	Technical mathematics	57	58
27	43	27	1	2	___	Linear programming	81, 15, 2, 1, 1	___	Math for liberal arts	59	60
31	48	18	1	2	___	Mathematics for finance	81, 15, 3, 0, 1	___	Calculus	61	62
49	39	10	0	1	___	Business mathematics	49, 32, 17, 1, 1	___	Differential equations	63	64
49	35	14	0	2	___	Linear algebra	97, 2, 0, 0, 1	___	Elementary algebra	65	66
88	8	2	1	1	___	Arithmetic	97, 2, 1, 0, 1	___	Intermediate algebra	67	68

51 48 1

4. Have you ever participated in NSF institutes? Yes ☐ No ☐ MISSING ___ 69

Number of summers? 2.66 * Frequencies below — Number of academic years? 2.79 ** Frequencies below ___ 70 ___ 71

5. If you have attended NSF institutes, please appraise the impact:

0% for those who answered each of these questions. Approximately 49% of all questionnaires.

Yes ☐ 59	No ☐ 41	The NSF institutes were a factor in my move from teaching high school to teaching in the two-year colleges.	___ 72
Yes ☐ 58	No ☐ 42	The institutes were a factor in my decision to get a Master's degree.	___ 73
Yes ☐ 87	No ☐ 13	The institutes had a significant influence on my mathematical development.	___ 74
Yes ☐ 21	No ☐ 79	The institute program has proved to be of only modest importance to me in my subsequent career.	___ 75

Other comments:

* 1-29%
2-20
3-21
4-19
5-7
6-4
7-1

2% zeroes in this group

** 0's excluded
1-89
2-7
3-3

OR
0-30
1-63
2-5
3-2

___ 76
___ 77
___ 78
___ 79
___ 80

6. Your name (optional) _____

7. Institution at which you teach _____

8. Teaching full-time ☐ or part-time ☐ Male Female Missing 8

9. 41.00 Age 10. ___ Sex 71 21 ___ 1 ___ 2 ___ 3

11. Years of teaching experience: 9.05 at two-year college level
5.25 at high school level
3.63 Other (specify)

___ 4 ___ 5
___ 6 ___ 7
___ 8 ___ 9
___ 10 ___ 11

12. 3.69 Years of professional non-teaching experience (specify type of work).

9's in each column are for all individuals.

13. Most advanced degree earned: (Fill in each relevant column)

Highest degree	In Math	In Applied Math	In Stat	In Computer Science	In Math Ed	In Operations Research	In Other (specify)
Ph.D.	3.8	.4	.2	0	2.2	.2	2.3
Ed.D.	1.0	.7	0	0	2.6	.5	1.7
Dr. Arts	.2	0	0	0	0	0	0
Master's plus at least one year of course-work	30.6	2.3	1.3	1.1	9.2	.7	5.3
M.A. or M.S.	25.2	2.6	.8	.4	8.5	.2	5.0
Special Master's e.g., MAT, MST	4.8	.2	0	0	2.7	0	1.3
B.A. or B.S.	6.8	.6	0	.1	2.6	.1	4.9
Other	.1	.8	.9	3.0	1.2	.2	1.2
	27.4	92.3	96.7	95.4	71.0	98.0	78.2

___ 12
___ 13
___ 14
___ 15
___ 16
___ 17
___ 18
___ 76
___ 77
___ 78
___ 79
___ 80

Highest Degree Doctorate - in Math Field
Unweighted (54 cases)

AN INQUIRY INTO THE GRADUATE TRAINING NEEDS OF TWO-YEAR COLLEGE TEACHERS OF MATHEMATICS

General Instructions

The purpose of this questionnaire is to elicit the views of two-year college mathematics teachers on the graduate training needs of the profession--both in advanced degree programs and in continuing education such as summer institutes and short courses. The project is sponsored by the National Science Foundation and the Rocky Mountain Mathematics Consortium. Its results will be widely disseminated through the professional organizations, with the hope of encouraging reforms in existing graduate programs and enhancing opportunities for continued training.

For the survey results to be truly representative, it is essential that there be a high percentage return of the questionnaires. Please fill yours out. Though the questionnaire may appear formidable, it will require only about 20 minutes of your time.

To insure the privacy of your answers, please put your completed questionnaire in the envelope, seal it, and turn it in.

I. Continuing Education

Coding (*)

Indicate your degree of interest in each of the following as:
(A) Strong, (B) Moderate, (C) Slight, or (D) None

percentages:

___ 1. Attending a "short course" (3 to 5 days) giving an intensive survey of some topic of interest to you professionally. ___ 1

59 20 11 7 2

___ 2. Attending an evening course at a nearby university. ___ 2

9 33 41 15 2

___ 3. Attending a summer session at a university. ___ 3

28 43 15 13 2

___ 4. Attending successive summer sessions requiring a period of independent study during the intervening academic year. ___ 4

13 33 20 32 2

___ 5. Spending an academic year (sabbatical) at a university. ___ 5

52 26 11 9 2

___ 6. Undertaking an advanced degree, if the work could be completed in one academic year plus a number of summer sessions. ___ 6

15 7 9 63 6

___ 7. Undertaking an advanced degree, if this required returning to graduate school for two or more academic years. ___ 7

6 7 9 72 6

___ 8. Participating in a faculty exchange program among two-year colleges. ___ 8

26 37 13 19 2

9. Other ideas for continuing education?

* May not seem to 100% due to rounding

(*) The spaces in the right hand column of each page are for the use of the coder in processing the questionnaires. Please do not write in this column.

Suppose you were offered the opportunity to spend a summer attending lectures at a university, and that external difficulties--financial problems, family conflicts, etc.--had been resolved so that you might go.

10. We've listed 12 alternative ways of using the summer. Please give a preference ordering (1st, 2nd, and 3rd choices only) of how you would like to spend the time.

Choices

1 2 3 First choice ____ Second choice ____ Third choice ____ 9 10 11 12 13 14

13 2 11 a. Getting ideas on innovations in subject matter content and classroom technique directly applicable in your own classes.

9 7 6 b. Attending lectures and seminars that deal with some of the practical pedagogical issues in two-year college teaching, e.g., the problems of remediation.

2 4 11 c. Taking mathematics courses which treat from an advanced standpoint some of the topics which you have been teaching on a more elementary level.

13 19 11 d. Taking courses designed to show how the mathematics you teach may be applied to science and engineering fields which are of interest to your students.

19 17 13 e. Taking courses in areas of the "mathematical sciences" which are unfamiliar to you, (statistics, computer science, or operations research may be in this category).

7 13 17 f. Taking courses, not in mathematics but in related sciences with a strong mathematical basis, e.g., physics, population biology, theoretical economics, management science.

4 11 4 g. Taking advanced mathematics courses related to your professional mathematical interests, though not necessarily relevant to courses you teach.

2 6 4 h. Taking part in a teaching experiment.

19 11 15 i. Taking part in a project which will involve applying mathematics in some "real world" problem-solving effort.

1 9 2 j. Working on research (thesis or post-doctoral).

2 2 24 k. Doing something only remotely related to mathematics.

0 0 2 l. Other (specify)

0 0 4 Missing

→ Read percentages in each column

11. Would you prefer (check one):

30 ☐ Formal courses, with examinations and college credit toward a degree,

or

67 ☐ Lectures and seminars attended informally without college credit (With the award of a certificate of having completed the program). 15

4 No reply

II. Basic Preparation of a Two-Year College mathematics teacher.

Fully 5/6 of two-year college mathematics faculty hold Master's degrees. Of course the content of various programs can differ vastly.

Please indicate the relative importance to a minimal program of inclusion of the items below.

Characterize each as:

A. Essential--every two-year college teacher should have this in his background.

B. Very important.

C. Of minor importance, though of some value.

D. Unimportant.

E. Inappropriate.

F. Missing

___	1. Teaching experience or a teaching internship.	44	44	7	2	0	2	___16
___	2. Courses in pure mathematics through advanced calculus and abstract algebra.	76	17	4	2	0	2	___17
___	3. At least two year-long sequences of courses in applied mathematical sciences (e.g., statistics and computer science).	11	59	28	0	0	2	___18
___	4. Courses in mathematics education.	19	26	39	13	2	2	___19
___	5. A course which examines the development of and current issues in the two-year colleges.	7	20	46	22	2	2	___20
___	6. A course in the history of mathematics.	7	32	44	13	2	2	___21
___	7. Supporting courses in physical sciences.	9	43	44	0	0	4	___22
___	8. Supporting courses in biological and social sciences.	0	32	57	9	0	2	___23
___	9. Seminar on mathematics writing.	2	17	44	30	6	2	___24
___	10. Master's thesis.	17	13	37	24	6	4	___25
	11. Other items which you consider to be important in a minimal program? (please specify)							

III. Characteristics of a Professional Two-Year College Mathematics Teacher.

How important do you consider each of the following professional activities or qualities (for the profession in general and not necessarily for your self as an individual). Rank each as:

(A) Essential; (B) Very important: (C) Desirable; (D) Unimportant; and (E) Inappropriate. (F) No reply

___ 1.	Regarding oneself primarily as a teacher.	50	37	7	2	2	___ 26
___ 2.	Being willing to teach remedial mathematics, including arithmetic.	32	39	30	0	0	___ 27
___ 3.	Being able to move into new areas of teaching as the curriculum evolves.	43	52	4	0	0	___ 28
___ 4.	Publishing papers in research journals.	7	7	43	41	2	___ 29
___ 5.	Publishing articles on matters related to classroom teaching.	6	13	60	22	0	___ 30
___ 6.	Publishing textbooks.	4	2	44	44	6	___ 31
___ 7.	Learning new mathematics through reading or attending lectures.	13	63	24	0	0	___ 32
___ 8.	Working outside class with students; for example, giving special talks or acting as faculty advisor for a student mathematics club.	9	41	43	4	4	___ 33
___ 9.	Having experience in applying mathematics to "real world" problems.	15	48	37	0	0	___ 34
___ 10.	Maintaining interest in mathematical problem-solving (such as difficult problems from textbooks or mathematics magazines, or problems posed by colleagues).	7	39	43	9	2	___ 35
___ 11.	Periodically attending university summer session or evening classes.	6	24	61	6	4	___ 36
___ 12.	Engaging in professional "public service" activities.	0	17	56	22	4	___ 37
___ 13.	Obtaining a Ph.D. in mathematics.	6	9	48	32	6	___ 38
___ 14.	Obtaining an Ed.D. or Dr. of Arts in one of the existing programs designed for two-year college teachers.	2	20	41	33	4	___ 39
___ 15.	Obtaining a doctoral degree in an especially designed new program--a program not presently available, but one which would address the real needs of two-year college faculty.	4	17	41	32	4	___ 40
___ 16.	Accepting administrative work on the campus.	2	13	33	43	9	___ 41
___ 17.	Being involved in the work of professional organizations.	6	26	56	11	2	___ 42
18.	Other activities or qualities that you think are important? (specify)						

IV. Characteristics of an Ideal Doctoral Program.

Suppose you are being asked to recommend the design on an "ideal" doctoral degree program for the training of two-year college mathematics teachers. Such a program presumably would involve course work, perhaps an internship and some kind of thesis. In your answers to the following questions we ask you to specify the kind and amount of each of these elements.

Course Work - Distribution

Estimate the fraction of the course work which should be devoted to each of the listed areas. State each to nearest tenth: 0, 1/10, 2/10, etc.

Means ↳ Frequency distribution ↘

	0	1/10	2/10	3/10	4/10	5/10	6/10	7/10	8/10	9/10	
1. Pure mathematics at the level of introductory graduate courses.	15	19	39	13	13	2					43
2. Pure mathematics at the level of advanced courses and research seminars.	26	44	20	6	2	2					44
3. History of mathematics.	20	76	4								45
4. Mathematics education (for possible courses see below).	22	41	26	7	4						46
5. Physical and earth science courses which use mathematics.	39	54	6	0	0	2					47
6. Biological and social science courses which use mathematics.	54	46									48
7. Statistics, operations research.	17	59	22	2							49
8. Computer science.	13	70	15	2							50
9. Classical applied mathematics.	43	50	4	2	2						51
10. Other (specify)	94	6									52

(Not accounted for. There were problems with people following directions for these questions)

Course Work - Specifics

There follows a list of several courses (mainly mathematics education) which some have advocated incorporating into the program. Please categorize each as:

A. Should definitely be included.
B. Optional but strongly encouraged.
C. Acceptable, but should not displace more important topics.
F. Not acceptable.
G. No reply

	A	B	C	F	G	
11. Methods course in the teaching of remedial mathematics. (including arithmetic)	30	30	28	7	6	53
12. A course or seminar on mathematical writing.	9	26	50	9	6	54
13. History of mathematics and the use of historical information in the classroom.	22	30	44	0	4	55
14. Course on the use of technology in mathematics teaching. (e.g., computer assisted instruction)	22	39	35	0	4	56
15. Teaching of problem solving. (Polya's heuristic approach, which emphasizes the motive and purpose of the various steps in a solution to a problem).	50	30	13	4	4	57
16. Teaching techniques (like discovery, expository and heuristic approaches with direct applications to teaching two-year college mathematics courses).	44	32	15	6	4	58

(Continued on next page)

___ 17. Curricular design and textbook evaluation for two-year colleges. 19 89 33 6 1 ___59

___ 18. Testing and evaluation (with concrete applications to two-year college mathematics courses). 33 19 33 11 4 ___60

___ 19. Learning theories and psychological aspects of teaching mathematics. 24 39 22 11 4 ___61

___ 20. A seminar in two-year college teaching in which classroom teaching is videotaped and discussed. 22 35 28 11 4 ___62

21. Other suggestions? (specify)

Teaching Internship

22. As a condition for receiving a graduate degree should a person be required to have a practical teaching experience (either in high school, two-year college or as a teaching assistant)?

Yes 78 No 20 (circle one) Missing 2 ___63

23. Do you think that a meaningful internship could be devised for a person who is already an experienced teacher:

Yes 43 No 30 Don't know 26 (circle one) Missing 2 ___64

Thesis

We have listed below a number of thesis project areas--some traditional, some more novel. We would like your judgement: which of these are the most valuable and appropriate experiences for a two-year college mathematics teacher? Mark each as:

A. Best (or tied for best)--of greatest value.

B. Second best (or tied for second).

C. Acceptable, but of lesser value.

F. Not really useful for a two-year college teacher.

G. Missing

___ 24. Standard research Ph.D. thesis in mathematics or applied mathematics. 26 17 33 22 2 ___65

___ 25. Standard educational research doctoral thesis (e.g., an Ed.D. dissertation emphasizing educational statistics). 22 32 32 13 2 ___66

___ 26. The so-called expository survey, in which an area of the mathematics research literature is reworked, and arranged in a connected account. (A common type of thesis for Dr. of Arts, and for some special Ed.D. and Ph.D. programs). 35 37 20 6 2 ___67

___ 27. An historical survey (as sometimes found in Dr. of Arts programs, etc.) 11 24 43 19 4 ___68

___ 28. Designing a learning module, or a segment of a two-year college course, and testing this with students. 32 30 28 9 2 ___69

___ 29. Writing a textbook for two-year college use. 13 36 35 22 2 ___70

30. Other (specify)

53

31. What do you think is the most appropriate name for the degree program which you have outlined?

71

☐ Ph.D. (22) ☐ Ed.D. (30) ☐ Dr. Arts (35) ☐ Other (specify) (4) Missing (9)

32. General comments on doctoral program?

74
75
76
77
78
79
80

V. Professional Incentives

Faculty Advancements

Below are listed some professional activities which colleges commonly evaluate in making decisions on faculty advancement--for both salary increases and promotion to higher rank or to higher salary scale. Please give your own view of how important each of the following is at your institution, rating as:

A. Very important for most faculty; very heavily weighted in advancement decisions.

B. While not essential for all faculty, this can have significant impact for advancement of some.

C. Taken into account, but relatively small impact on advancement.

D. Little or no effect on advancement.

E. Missing

		A	B	C	D	E	
___	1. Years of service.	70	13	11	2	4	1
___	2. Classroom teaching performance.	48	20	13	13	6	2
___	3. Textbook writing.	2	28	35	30	6	3
___	4. Giving talks at mathematics meetings.	0	24	41	30	6	4
___	5. Journal publications on classroom activities (e.g., Two-Year College Mathematics Journal, MATYC Journal, etc.)	2	35	33	24	6	5
___	6. Research.	7	22	30	35	6	6
___	7. Campus administration and committee work.	24	33	22	13	7	7
___	8. Participating in work of professional organizations.	4	33	39	17	7	8
___	9. Public service in a professional capacity.	2	22	48	20	7	9
___	10. Community service.	0	30	43	22	6	10
___	11. Attending lectures and seminars.	4	22	37	30	7	11
___	12. Taking additional courses for credit.	24	44	15	18	4	12
___	13. Obtaining a doctoral degree.	35	46	11	4	4	13
	14. Other (specify)						

All other possibilities were coded by 1st two checked.

Time Constraints

median → 13 15. How many class-hours per week do you teach mathematics. (include overloads, night courses, etc.)

18 16. How many hours per week do you spend outside of the classroom on professional mathematics activities.

17. How do you spend summers? (check one or more) ☐ a Teach; ☐ b Work; ☐ c Attend summer courses; ☐ d Other

Problems in the college

Below are some commonly cited problems of some two-year college faculty. Please rank each as follows:

A. This has been a major and continuing problem for me.

B. This is a minor irritant.

C. This is no problem for me.

D. Missing

		A	B	C	D
____	18. Coping with the deluge of remedial mathematics.	20	32	46	2
____	19. Teaching un-motivated students.	33	50	15	2
____	20. Having to cover much more material than most students can absorb.	33	39	26	2
____	21. Lack of stimulation, due to the elementary level and repetitiveness of courses.	17	35	44	4
____	22. Lack of stimulation from colleagues.	17	24	57	2
____	23. Having too little time and energy available for professional activities outside the classroom.	35	41	22	2
____	24. Lack of incentive or reward for professional growth.	24	35	35	6
	25. Other (specify)				

VI. Identification

Circle those of the following journals which you regularly examine.

a. Mathematical Monthly 41
b. MATYC Journal 54
c. Two-Year College Math Journal 57
d. SIAM Review 15
e. Bulletin of AMS 20
f. Proceedings of AMS 13
g. Science Magazine 15
h. Scientific American 24
i. Math Magazine 13
j. Math Gazette 2
k. Math Teacher 54
l. School Science and Mathematics 7
m. Mathematics Teaching 7
o. Science News 11
p. Other (specify) 26

7 14 ___15
___16 ___17
___18
a 37
b 6
c 0
d 22
a-b 13
a-c 4
a-d 13
b-c 0
b-d 2
c-d 4 19
___20
___21
___22
___23
___24
___25
___26 ___27
___28 ___29
___30 ___31
___32 ___33
___34 ___35
___36 ___37
___38 ___39
___40

55

2. Circle those of the following activities in which you are involved:

a. Attend at least one professional conference per year. 85 — 41
b. Speak at professional conferences. 43 — 42
c. Give talks on math to community and student groups outside of class. 41 — 43
d. Write journal articles. 44 — 44
e. Have written a textbook. 19 — 45
f. Participate in professional seminars at your school or at a nearby college or university. 54 — 46
g. Have taken a university course for credit within the last two years. 28 — 47
h. Have obtained an advanced degree within the last two years. 17 — 48
i. Work on challenging math problems unrelated to classes you are teaching. 67 — 49
j. Work on a research project. 56 — 50
k. Active in a professional organization. 43 — 51
l. Other professional activities outside of classroom and administrative responsibilities? (specify) 11 — 52

3. Some faculty in two-year colleges bemoan the fact that they are called upon to teach statistics and yet have never formally studied statistics. They cite the fact that few graduate programs in mathematics even require course work in statistics. Others complain that teaching remedial courses such as arithmetic can be very difficult and wish that they had been exposed to meaningful methods courses in the teaching of remedial mathematics.

Below is a list of mathematics courses which are sometimes taught in two-year colleges. Please categorize each as follows:

A. I feel entirely secure about my qualifications to teach this course.
B. I can handle this course, but would do it better if I had an opportunity to study some appropriate background material (either mathematical, scientific, or pedagogical).
C. I don't feel qualified to teach this subject.
D. None of the above (explain briefly in space below).
E. Missing

The courses:

82 15 4 0 0	Elementary probability	57,35,4,2,2	Use of hand-held calculators	53	54
74 22 4 0 0	Statistics	33,26,39,0,2	Computer programming	55	56
83 15 2 0 0	Finite math	56,28,9,2,6	Technical mathematics	57	58
50 39 15 0 2	Linear programming	93,6,0,0,2	Math for liberal arts	59	60
37 44 15 0 3	Mathematics for finance	91,7,2,0,0	Calculus	61	62
44 44 9 0 2	Business mathematics	67,24,9,0,0	Differential equations	63	64
80 13 6 0 2	Linear algebra	41,4,0,0,2	Elementary algebra	65	66
85 7 4 2 2	Arithmetic	96,4,0,0,0	Intermediate algebra	67	68

4. Have you ever participated in NSF institutes? Yes ☐ (56) No ☐ (41) Missing (2) 69

(median) Number of summers? 2 Number of academic years? 1 70 71

5. If you have attended NSF institutes, please appraise the impact:

Yes ☐ No ☐ The NSF institutes were a factor in my move from teaching high school to teaching in the two-year colleges.. 72

Yes ☐ No ☐ The institutes were a factor in my decision to get a Master's degree. 73

Yes ☐ No ☐ The institutes had a significant influence on my mathematical development. 74

Yes ☐ No ☐ The institute program has proved to be of only modest importance to me in my subsequent career. 75

Other comments: 76 77 78 79 80

6. Your name (optional) _____

7. Institution at which you teach _____

8. Teaching full-time ☐ or part-time ☐ 1 2

9. ____ Age <35 (37) 36-45 (46) >45 (13) 10. ____ Sex Male (80) Female (15) Missing (6) 3

(median) 11. Years of teaching experience: 7 at two-year college level 4 5

5 at high school level 6 7

4 Other (specify) 8 9

12. 1 Years of professional non-teaching experience (specify type of work). 10 11

13. Most advanced degree earned: (Fill in each relevant column) 12

(absolute frequency)

Highest degree	In Math	In Applied Math	In Stat	In Computer Science	In Math Ed	In Operations Research	In Other (specify)
Ph.D.	25	4	1		24	3	
Ed.D.							
Dr. Arts							
Master's plus at least one year of course-work	5		2	1	2		1
M.A. or M.S.							
Special Master's e.g., MAT, MST	8	2					1
B.A. or B.S.	4	1					3
Other				1			

13 14 15 16 17 18 76 77 78 79 80