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ABSTRACT

Between the spring of 1970 and the summer of 1974, 1,747 students enrolled in Math X, a multilevel PSI (Personalized System of Instruction) type of open-ended mathematics instruction system at Antelope Valley College. Results of a study designed to evaluate the course by comparing it with the more conventional mathematics lecture course indicated that: (1) students who had enrolled in Math X completed fewer units; (2) fewer students received success grades in Math X than in conventional lecture classes; (3) Math X students had a higher grade point average; (4) students who earned low or nonsuccess grades in Math X went on to do better in conventional classes, whereas students who earned high grades in Math X tended not to do as well in conventional math classes; (5) Math X instruction cost approximately three percent less than conventional instruction; (6) only 38% of lecture-only students continued to study math, while over 52% of those exposed to Math X did so. Results of a questionnaire sent to 300 Math X students (30% response) indicated that students believed Math X to be about as difficult as other math courses, that most respondents would repeat Math X for more advanced study if such were offered, and that most would be interested in classes in other subjects taught using the same format. (DG)

A COST-EFFECTIVE ANALYSIS AND FOLLOW UP STUDY ON A MULTI-LEVEL MATHEMATICS INSTRUCTION SYSTEM AT ANTELOPE VALLEY COLLEGE

Prepared by

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June, 1975

ABSTRACT

A COST-EFFECTIVE ANALYSIS AND FOLLOW UP STUDY ON A MULTI-LEVEL MATHEMATICS INSTRUCTION SYSTEM AT ANTELOPE VALLEY COLLEGE

A cost-effective analysis and follow up study was conducted on a random sample of students after exposure to a multi-level PSI system of math instruction. The study includes comparison of cognitive accomplishment and cost of instruction under the innovative system to similar parameters as evidenced in a random sample control group which received conventional lecture-type instruction in mathematics.

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* Available only to authorized persons

DEFINITIONS OF SYMBOLS AND ACRONYMS

PSI	Personalized System of Instruction
PSI/AT	Personalized System of Instruction -- Audio-Tutorial Mode
CIS	Coordinated Instructional System

A COST-EFFECTIVE ANALYSIS AND FOLLOW UP STUDY ON A MULTI-LEVEL MATHEMATICS INSTRUCTION SYSTEM AT ANTELOPE VALLEY COLLEGE

A multi-level PSI type of open-ended mathematics instruction system was introduced at Antelope Valley College during the Fall of 1970. The class was named Math X. Between the Fall of 1970 and the Summer of 1974, 28 sections involving as few as 32 and as many as 146 students had been completed. More recently, over 200 students were enrolled in a single extended day section.

Until 1974, statistics on these sections were included in the standard grade and attrition study with little concern. Some reflection on the nature of Math X caused concern that the inclusion of grade and attrition figures from PSI systems with statistics from conventional lecture type classes was a mixing of apples and oranges. The following unusual features of the Math X system make comparisons with conventional systems of instruction difficult:

1. Students are allowed to enroll without screening or consideration of prerequisites.
2. Placement in any level within Math X is decided after inventory testing and upon the advice of a teacher or proctor.
3. After a student is counseled into the appropriate

level, the instructor or proctor advises him regarding the objectives of that level for success. The student may not have to study all elements if he exhibits mastery of certain elements.

4. Math X students are allowed to progress at their own rate through a sequence of PSI materials (usually a programmed text or audio-tutorial materials) and may complete a level at any time during a semester or may require over one semester to be successful. Instructor pacing is practiced in an attempt to help establish sound study habits and to insure as many successes each semester as possible.

5. No penalty grades are ever awarded, and students may enter or drop the class or level at any time. They may also transfer into a lecture section (if qualified) at any time.

6. All tests are repeatable; ie., a student may restudy after a test and retake an alternate form of the test as many times as he wishes in an attempt to obtain the grade he desires.

7. Up to 19 units can be earned in remedial math topics (levels from arithmetic through trigonometry) and College Algebra during one semester. (This has not happened yet -- the maximum number completed is 12.)

Consideration of the unusual features listed above provides convincing evidence that the Math X learning scheme cannot be compared with standard methods of instruction using conventional grade and attrition percentage methods. This study was designed to fill the need for accountability in the Math X program. An attempt will be made to develop a cost-effective analysis model for comparing lecture type instruction with Math X (PSI) methods.

A second element of this study will be the assessment of the comparative satisfaction of students who have been exposed to Math X study (follow up).

The stated objectives of the study are:

1. To compare student success figures from classes taught using Math X procedures with figures from conventional math classes.
2. To assess and compare the relative abilities of students from Math X classes with students from conventional math classes by correlating grades made in classes taken after taking Math X with grades made in Math X.
3. To determine the cost of Math X instruction as compared with conventional math instruction on a per-student basis.
4. To set up an accountability model enabling comparisons between conventionally taught lecture

type math classes with the Math X instructional system (a cost-effectiveness model).

5. To assess student satisfaction with the Math X program after the student has had a chance to be away from the program.

In general, the study will provide feedback for use in refining and perfecting what seems to be one of the latest methods of mathematics instruction strategies.

PSI Instruction (Institutional Research from the Literature)

Over 46 studies are recorded by Dr. Robert A. Reiser of Arizona State University in his literature-search study titled "Self-Pacing and Instructor Pacing in PSI Courses." While the thrust of his study is toward pacing procedures, optimization of sucoess is his major concern (as it is the concern of this study). All authors mentioned in Dr. Reiser's study agree that pacing is necessary and believe in using positive motivational methods rather than punitive tactics, which may include the threat of non-success grades. Most PSI methods considered involve student proctors under one professional. The ratio of instructor-proctor to students is generally about 1:20. While cost-effectiveness is mentioned, a model is not proposed in Dr. Reiser's study.

A study done by Mary A. Golladay and three associates

under the auspices of the U.S. Office of Education, published in May of 1975[2], indicates that models of traditionally structured educational experiences are inappropriate for use in assessing individualized instructional programs. Their study, titled "Problems in Empirical Research on Individualized Mathematics Programs," includes a system of "descriptors" and a complex flow diagram for analysis purposes but sheds no light on building a cost-effective model for our study.

A study published by Merrill Publishers regarding the use of the Merrill system of A.T. instruction at Fullerton Community College (Project 70)[3] describes cost savings in PSI math instruction at Fullerton. The study reports data from the 1971-1972 period and claims a saving of $10,800 per year on a program involving three sections of 35 students each in a "Fundamentals of Algebra" class (single level). Modified self pacing is reported and a fair degree of success is claimed in the Merrill analysis.

A three-part study titled "Relative Direct Institutional Costs of Biology Two and English A Laboratory at Golden West College" by Dr. Richard W. Brightman attempts a comparison of costs of instruction per hour in PSI/AT classes versus conventional instruction. The Golden West College PSI systems (many are CIS) are reportedly very cost-effective. The model developed in the analysis was

modified slightly and used in a report written at Antelope Valley College titled "Comparing Instructional Costs of Selected Programs at a Junior College."[5] Portions of the research models from these papers will be combined with a student success factor called Units Completed Per Student (UCS) to provide a cost-effective model of analysis for Math X.

Research Hypothesis

1. It is hypothesized that a cost reduction per student of approximately 20% can be realized using Math X methods of PSI with a staffing formula involving instructors and student aides (proctors). The relative cost per ADA will be based on "the current costs of education " as calculated on a median conventional math class. (A median conventional math class is defined as a lecture type math class staffed by an instructor receiving a salary at the median in the salary range.)
2. A cursory examination of data from Math X programs indicates a higher proportion of unsuccessful students than in conventional math classes. It is hypothesized that a cost-effective analysis will disclose that success versus nonsuccess may not be a useful criterion on which to base the desirability or rating of the Math X instructional scheme.

3. PSI instructional schemes are tailored to meet the needs of the individual student. Some educators question the validity of any scheme that does not place hurdles in the path of success for the purpose of screening the population in order to filter out those learners who are not able to adapt to classical college procedures. It is hypothesized that the "quantity" is approximately the same as would be learned in lecture and that Math X students succeed as well in the next math class despite the special handling present in Math X.

Methodology of the Study

Statistical sampling procedures will be used in this study. Two main samples will be used. The first sample will be made up of approximately 300 students randomly selected from the Math X population. The second group will be selected from students involved in all types of math study and will be used as a control group typical of the general math student. A subset of the last group made up of those students who did not encounter Math X in any of their studies will be examined statistically.

Finally, a questionnaire will be mailed to the Math X students asking for their opinion of the program.

The Research Model

1. Units completed per student will be compared using the control group versus the Math X sample.
2. Cost of instruction of a math student in a lecture setting will be calculated. The cost of instruction of a Math X student using the factor "Units Completed Per Student Ratio" will be compared to the cost of lecture type instruction on a cost-effective basis.
3. To complete the cost-effective accountability model, comparison of grades awarded in the two math instructional schemes will be made and a calculation of the correlation between grades made in Math X versus grades made in classes after Math X will be attempted.

The Math X Sample

A sample of approximately 300 students from a population of 1747 students who had enrolled in Math X between the spring of 1970 and the summer session of 1974 was drawn by random number methods using an IBM System 3 Model 10 computer. Alpha numbers of students in the population were placed in the memory of the computer and the draw of the sample was done by generating six-digit random numbers. Alpha numbers corresponding to the random numbers from the computer were selected as the Math X sample. The sample

was then checked for validity by comparing certain characteristics of sub-groups in the population with similar characteristics of the sample (by percentage). After some minor adjustments in the sample, stratification validity was found to exist and the sample was judged to be fairly representative of the Math X population.

The Control Group

Students in the control group were picked on a stratified random sample basis using a random number table to select section, teacher, and line number on a roll sheet. Stratification was accomplished by selecting the number of students enrolled from 1970 to 1974 (the same period used with the Math X group) in each level of math, ie., Math 50, Math A, Math B, etc., as the proportion these groups represented to the total number of students in the math division in the semesters of concern.

The sub-group of students not involved in Math X was separated using the computer to match alpha numbers of the control group with the Math X population.

One hundred forty were selected from the roll sheets of instructors by the random methods mentioned above. The grades of each of these sample members were recorded on data record cards and a transcript search provided historical math records which were also recorded. Confidentiality was preserved during these procedures by using alpha

numbers instead of student names.

Control Group Characteristics

Fifty-nine students in the original sample of 140 had been involved in Math X at one time or another. Thirty-four of the original sample were purged because of incomplete records or because they were still in attendance (our sample was supposed to be made up of students enrolled between 1970 and the summer session of 1974). Eighty-one of the 106-member final sample had not been involved in Math X studies and the remaining 26 had taken Math X as a part of their math program. (As an aside, a rough calculation indicated that about 42% of the students selected in the original sample had been exposed to Math X during their study of mathematics.)

Data indicates that students in the control group received 24 W grades, 4 D grades, and no R grades. Combining W's and D's (these are considered non-success grades) and comparing this total with all success grades earned yields a 29.6% non-success rate. This agrees closely with the percentage of W's and D's reported in non-Math X classes on the attrition and grade study prepared annually by the Office of Instruction. It was also determined that the average number of units earned per student in lecture classes is 4.05 (the arithmetic mean) with a standard deviation of 2 units. Ninety-one passing grades in 303

units were recorded by 76 of the 81 non-Math X students. Slightly over 12% of the control sample did not receive a success grade (C or better) in any math class. This group will be compared to the Math X sample in the research model which follows.

Results: The Math X Sample Versus the Control Group by Objectives

OBJECTIVE 1 -- Comparison of Student Success Between Control Group and Math X Group

On a per-person basis, fewer units are completed in Math X than in the conventional lecture setting. In lecture classes, 4.05 units per student were completed, while only 2.55 units per student were completed in Math X.

Among the special group of 95 Math X students who took conventional math classes after taking Math X, 4.75 units per student were accumulated. A "t" test of significance disclosed that 4.75 versus 4.05 was not significantly different and therefore students who went on after Math X were not significantly different from the population (at least in terms of units completed). The total Math X sample of 287 with units per person of 2.55 tested significantly different from the population at the .001 alpha level.

A comparison of GPA earned by the control group to the GPA of the Math X sample shows that a significant difference

exists; this difference tests well in excess of the .01 alpha level. The Math X GPA was found to be 2.92 with s = .83, while the control group showed a 2.67 GPA with an s = .87. Higher grades are being awarded to successful students in Math X. It is concluded that fewer units per student are being completed by Math X students, and that grades awarded to these students are higher. It should be noted that similar standardized final examinations are given in most similar Math X and non-Math X classes at A.V. College, so that GPA figures do have a common base.

OBJECTIVE 2 -- Correlation of Grades Received in Math X With Grades Earned by the Same Students in Conventionally Taught Math Classes After Exposure to Math X

A point biserial correlation was attempted (see Appendix D). An $r_{pb} = -.52$ was calculated. If this statistic were used to predict degree of success, only a 34% improvement over chance alone would be realized with such a value. However, while not highly significant, the result does indicate a trend. Apparently, students who received low or non-success grades in Math X went on to do better in conventional classes. Conversely, those students who received high grades in Math X had a tendency not to do as well in conventional classes. A careful check of the members of the 95 in the sample of those Math X students who went on to conventional classes reveals that very few

made grade point averages varying more than one point in the class following Math X (see Appendix A).

OBJECTIVE 3 -- An Approximate Cost Per Student-Hour Calculated on Conventional Math Classes And Math X Classes

An approximate cost per student-hour in regular math instruction calculates to be $1.56. Costs computed on a similar basis for Math X are about $.95. An apparent difference of about 40% exists. However, it must be understood that fewer students make success grades in Math X and, therefore, a factor must be used to adjust costs for comparison purposes.

OBJECTIVE 4 -- An Accountability Model Enabling Comparisons Of the Effectiveness of Conventional Versus PSI Math X-Type Classes in Mathematics Instruction

A Units Completed per Student Factor (UCSF) was developed by dividing mean units completed per Math X student by mean units completed per conventional student. UCSF = .63. In order to correct the cost per hour calculated in OBJECTIVE 3, one must divide $.95 by the UCSF, which yields a corrected value of $1.51 per hour for Math X instruction. The effective difference seems to be only about 3% instead of the apparent 40% lower cost percentage calculated above. (Math X cost figures were calculated using the present

staffing formula which calls for one instructor for the first 45 students and two aides for each additional 45 students, except after 135, when usually two instructors are assigned.)

A first consideration might lead one to conclude that the Math X scheme of instruction is not as cost-effective as it should be. However, income from ADA is not based upon units completed -- only on those students who are in attendance during the fourth week of instruction. Therefore, income from the ADA formula is in excess of what this cost-effective model indicates. It should also be noted that some students are not "paid for" under the ADA arrangement because they enter well after the fourth week (Census Week).

Aside from costs per hour of instruction, other factors about Math X should be considered. The UCSF does not take into account the services provided in Math X that are not provided in conventional math classes. Testing and guidance functions are provided within the class structure. The "stretched semester" concept and "drop-in" capabilities meet the needs of special students who otherwise might not succeed, or even get an exposure to math instruction. Also, lecture-only students do not continue in their math studies to the degree which those students exposed to Math X apparently do. Only about 38% of

lecture-only students go on to study math, while over 52% of those exposed to Math X go on to enroll again in math classes. This may indicate the existence of a covert motivational factor inherent in the Math X system.

Considering the added services provided students in Math X, maybe the UCSF method of comparison is a bit harsh. OBJECTIVE 5 explores student attitudes toward the system. If Math X pleases the students to the extent that its enrollment figures indicate, probably it is more cost-effective than this accountability model indicates.

OBJECTIVE 5 -- An Assessment of Student Attitudes Toward Math X Instructional Methods

About 300 questionnaires were mailed to the students of the Math X sample. Forty-nine questionnaires were returned undelivered. (Noting the tabulated dates in Appendix C, students in the earlier sections did not return the questionnaire -- probably because they had moved out of the area and were not contacted.) Over 30% of the delivered questionnaires were returned before the cut-off date of the survey (this is the approximate percentage estimated in the design phase of this model).

The returned survey forms indicate that students feel Math X studies are about as difficult as non-Math X. Sixty-nine percent of the sample indicate that they would repeat Math X for more advanced study, if offered, and

that they would also be interested in classes other than math classes taught using the same format (PSI). These answers indicate positive feelings toward the learning method. In answer to the question, "Do you feel you would have learned more math in a classical lecture type class?", 32 said yes while 35 said no. A Likert scale ranging from 0 (much less) through 5 (about the same) to 10 (much more) was provided as a validity measure. The mean response on this scale was 5.35, with a standard deviation of 2.95.

The most outstanding feature of Math X was the ability to move as fast through a course as desirable. Open-ended enrollment ranked second in popularity (by GPA rating comparison -- see Appendix C).

Students rated the programmed textbooks lowest among the features, with the role of the teacher (non-lecturing, student-helper mode) next lowest. Many comments were included regarding the features. From these comments, it is the feeling of the researcher that students are concerned about the slow pace through the programmed texts because of such "little bits" in each frame, and students concerned with the different role of the teacher clearly indicated that they prefer lectures.

The tenor of the responses was generally one of positive feeling for the system. Those who liked Math X liked it very much. Those who did not wish to take it again seemed

to desire strong pacing discipline procedures with lecture type presentations. These students are the ones who undoubtedly are not willing to be responsible for their own success (or failure).

Examination of Hypotheses

HYPOTHESIS 1

Costs per ADA have risen from $762.45 in 1970-71 to $847.32 in 1973-74. Calculations using the last figure yield an average cost per ADA-hour of $1.61 in the Antelope Valley College District. If equipment costs and amortization charges are subtracted (math is a low-equipment subject), cost of instruction is about $1.56 per student hour.

HYPOTHESIS 1 claimed a minimum of a 20% saving could be realized using Math X methods. A "worst case" consideration using the UCSF comparative method produces a savings of only 3% -- therefore, this hypothesis is rejected.

HYPOTHESIS 2

HYPOTHESIS 2 states that success versus non-success may not be a useful criterion on which to base the desirability of the Math X type of instruction. Up to this point, "success" in a class has meant receiving a passing grade. In Math X, many students enroll to study a portion or a topic in math, leaving the class as soon as they have mastered that topic. Additionally, passing a class may

require more than one semester, in which case a student receives a non-success grade (W) during the first phase of his studies. In either case, the non-success grade does not really mean non-success. A convention discovered in the literature and practiced by most PSI proponents allows one and one-half semesters for success in a course of study before a non-success grade is awarded. While this modification in definition would have contributed positively to our results, it is difficult to estimate the precise effect.

On the basis of the responses received on the student questionnaire and the continuing upward trend in enrollment, HYPOTHESIS 2 will be accepted and a diligent effort will be made to establish a new base for assessment of Math X success.

HYPOTHESIS 3

An objective comparison of the amount of math learned in Math X versus the amount learned in lecture math classes is difficult to make. HYPOTHESIS 3 stated that about as much or maybe more mathematics was learned in the Math X system. Apparently students are not hurt by the scheme, and many do go on to do well in conventional math classes. A standard Pearson r was calculated using the grades from the sample group which went on to more advanced math study. An r = .02 resulted. The point biserial correlation

discussed in OBJECTIVE 2 with the value $r_{pb} = -.52$ compared how well students did in Math X with whether they did the same or better (considered positive) or worse (negative). (The "worse" condition included the condition unsuccessful.) This value of correlation does not yield any conclusive evidence (refer to OBJECTIVE 2 for discussion).

In view of the low correlations calculated, this hypothesis needs further investigation, but will be tentatively accepted because of the strong indications that many student needs not met in conventional math classes are being met in the Math X classroom. Without the counselor screening, it is speculated that the initial abilities of many of the Math X enrollees may be somewhat lower than abilities in conventional math classes, indicating a difference in the type of student served in Math X.

Summary of Conclusions

1. Fewer students receive success grades in Math X than in conventional lecture classes. A "units completed per student factor" has been developed, enabling cost-effective comparisons. The value computed for the UCSF is .62. When this factor is used to compare conventional and Math X instruction, a 5¢ reduction in cost per hour of training a "successful" math student results. A

40% reduction in costs is indicated if one considers all students handled.

2. Grades earned in Math X are found to be significantly higher: a GPA of 2.92 in Math X compared with 2.67 in the control group has been calculated (t test shows significance beyond the .01 alpha level for this difference). Math X best serves those students who are willing to accept that learning is their responsibility. Of even more importance is the fact that 52% of the students exposed to Math X continued to study math, while the conventional math group showed a persistence percentage of only 38%.

3. A point biserial correlation of -.52 indicates a tendency to do better in a lecture class after taking Math X, or, conversely, to do more poorly in lecture after doing fairly well in Math X. A scatter plot revealed that most successful students in Math X went on to be successful in conventional math classes, but the plot was such that no pattern of linear regression was present in the ordered pairs of grades -- hence a Pearson r of only .02 was found to exist.

4. Considering the added services and the individual attention furnished students in the Math X setting

(the type of individual attention impossible in conventional lecture classes), the PSI scheme of instruction is judged even more cost-effective than the 3% decrease in cost of instruction per student hour indicates. Popularity of the class is also indicative of the feelings of students toward the learning method.

5. A careful study of the characteristics of "successful" versus "unsuccessful" Math X students would probably reveal differences in learning styles related to maturity. Further study of the characteristics of students and their success patterns is necessary. A matching of cognitive styles of students to teachers and pedagogical schemes could prove useful in reducing non-success ratios in all classes. Studies of this type are called Cognitive Mapping Studies, and perhaps should be undertaken as a next step in the analysis of instructional schemes. In any event, it is known that certain students succeed in certain settings better than in others. Considering this aspect, Math X is providing another way to study mathematics.

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DESCRIPTIVE STATISTICS

Table 1 Math X Statistics

Number of students enrolled at census week between F'70 through SS'74 in Math X classes	1610
Total enrollment (includes "Drop-ins")	1747
Number of students counting repeaters once	1489
Number of "Drop-ins" (Those students entering after the fourth week, census week)	137
Number of "Drop-ins" counting repeaters once	114
Number of Math X students that repeated the class. (15% of the population, 17.5% of the individuals)	262
Percentage of students that repeat more than twice (three and more enrollments)	4.7%
Percentage of non-success grades recorded	58.9%
Percentage of success grades recorded by level (class)*	
Math 50, Arithmetic	12.8%
Math A, Elementary Algebra	9.3%
Math B, Geometry	1.6%
Math C, Intermediate Algebra	6.6%
Math D, Trigonometry	6.3%
Math 6, College Algebra	3.3%
Percentage of students that enrolled two times and received success grades both times	4.9%
Percentage of students that required two semesters to succeed in Math X	6.3%
Percentage of students that enrolled more than once and received a "W" grade (non-success) for all tries	4.1%
Percentage of students completing at least two math classes in a single semester of study in Math X	3.3%

Math X Enrollments By Semester

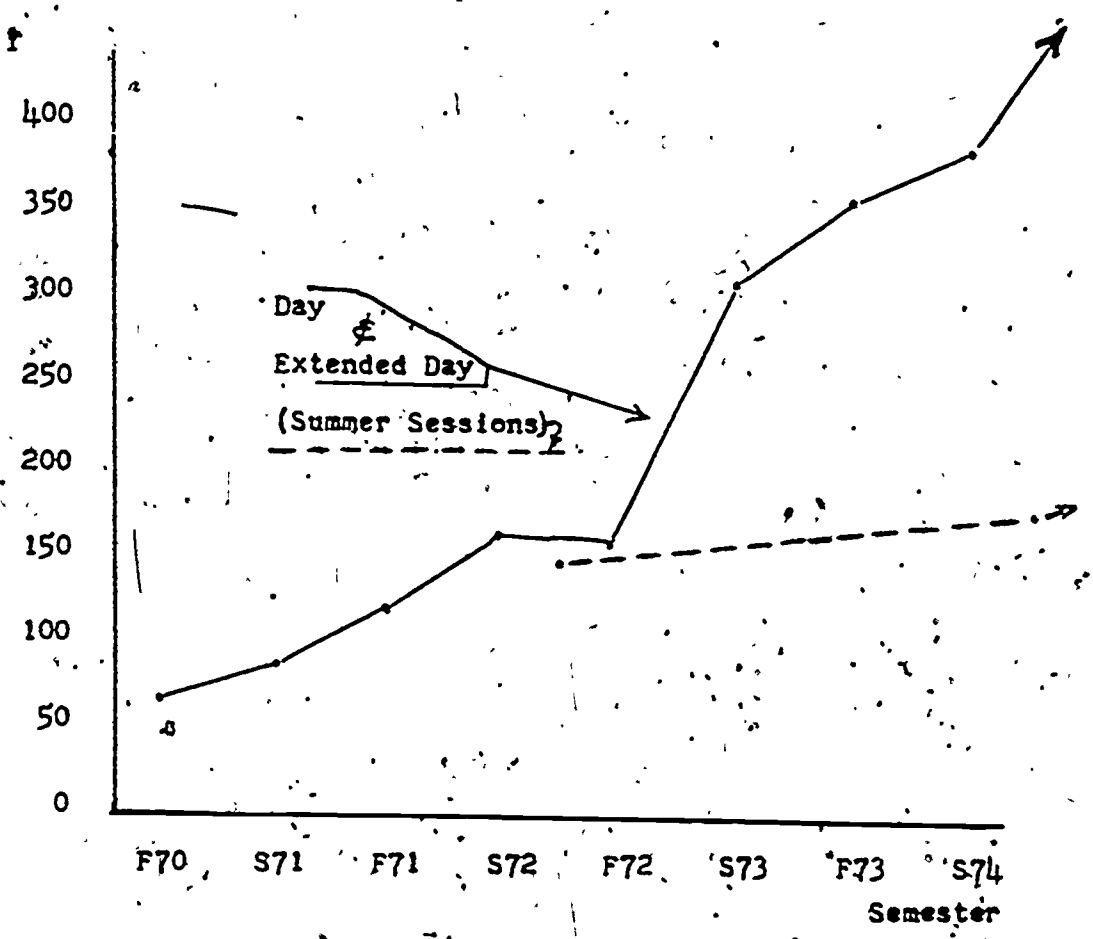

Table 1 Math X Enrollments

Control Group Statistics

General Information:

U = Population of math students enrolled between Fall 1970 and the Summer Session of 1974.

A = Students in the control group that took math in Math X and in conventional lecture-type sessions

B = Students that took math in conventional lecture-type sessions only

$N_A = 25$

$N_B = 81$

$N_{A+B} = 106$

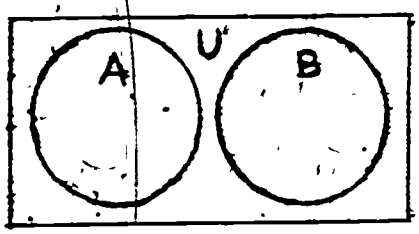

Table 2	Group A		B		AUB	
Characteristic	No.	%	No.	%	No.	%
Students that made Ws in all classes attempted	4	15%	6	7%	10	9%
Students that completed a lecture class and did not go on to another math class	6	23%	46	56%	52	49%
Students that completed a math class, enrolled in a second math class but were unsuccessful in the second class	2	8%	15	18%	17	16%
Students that received lower grades in classes after completing a pre-requisite math class			16	19%		
Non-success grades earned (46 Ws, 5 Ds, 1 F out of 179 attempts)					52	29.6%
Average number of units earned per student			4.05			

MATH X SAMPLE STATISTICS

287 Number of students in the sample. A return of about 30% of the student questionnaires was anticipated. In order to get a substantial number of returns, 304 samples were drawn. Seventeen students were purged because of present enrollment or because their transcript and grades were not available.

95 students in the sample took both Math X and conventional lecture.

192 students took Math X only.

148 of the 192 Math X only students completed a math class and did not go on to take another class.

54 of the 192 Math X only students completed a math class and went on to take another math class.

95 students took Math X and conventional math.

52% of the 287 students in the sample enrolled in math at least twice.

2.55 units per person are completed with a passing grade in Math X.

2.92 is the mean GPA per student. (NOTE: This is a mean of means -- use care in interpreting it.) s = .83.

APPENDIX SECTION

* Available only to authorized persons

APPENDIX A

Information on Appendix A

GPA Columns indicate calculated grade point averages made in Math X classes and non-Math X classes.

GF Column Code:

1 means greater success in non-Math X class after having tried Math X (and may have been successful in Math X)

0 means no success, ie., took math in Math X and inconventional math methods and did not receive a success grade in either mode.

\- means lower achievement level in non-Math X class after having been involved in Math X (and was successful in Math X)

LISTING OF THOSE STUDENTS THAT TOOK MATH AFTER MATH X ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	GP	DROP IN
115835		SS 72	6=A	4					
115835					F 72	7A=W		-	
118250		S 71	X=W						
118250					S 71	6=W			
118250					SS 71	0=W			
118250					F 72	6=C	2	1	
135628		F 71	X=W						
135628					F 74	7A=W		0	
156484		SS 72	X=W						
156484					S 74	15=W		0	
157970		S 74	C=B						
157970		F 73	A=B	3					
157970					F 74	B=A	4	1	
166241		S 74	D=C						
166241		SS 73	C=A						
166241		S 73	A=C	2.67					
166241					S 73	50=A			
166241					F 73	E40A=C	3	1	
166241					S 74	E40B=W			
174104		F 73	X=W						
174104		SS 73	A=A	4			2	-	
174104					F 73	C=C			
205713		S 74	X=W					0	
205713					F 74	7A=W			
206815		F 73	X=W						
206815					S 74	50=W		0	
222629		F 71	X=W						
222629		F 72	X=W						
222629		F 73	X=W						
222629					F 73	15=C	2	1	
230366		S 74	D=B,6=B	3			4	1	4

LISTING OF THOSE STUDENTS THAT TOOK MATH AFTER MATH X ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	GP	DROP IN
230366					F 74	15=A			
238081		S 72	X=W						
238081					SS 72	A=B	2	-	4
238964		SS 73	X=W						
238964		S 72	50=B	03			2	-	
238964					SS 73	A=C			
245423		F 73	X=W						
245423					F 74	D=W			
245423					S 74	7A=W		0	
245675		S 72	W=C	2					
245675					F 74	7B=A			
245675					S 74	7A=B		1	
245675					S 73	408=A, D=C			
245675					F 72	40A=B	3.05		
247890		S 74	C=A						
247890					S 74	15=C			
249103		SS 74	D=A	4			4	1	
249103					F 74	6=A			
249605		S 73	X=W						
249605					F 73	A=A, 15 = W	4	1	
256576		SS 74	6=C	2			2	1	
256576					F 74	7A=C			
262031		S 72	X=W						
262031		S 71	D=B						
262031		F 70	A=A, C=A						
262031				3.66	S 70	15=W		-	
262031					S 73	15=W			
271705		S 74	X=W						
271705					F 74	50=W		0	
281312		F 71	D=C	2			2	1	

LISTING OF THOSE STUDENTS THAT TOOK MATH AFTER MATH X ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	GP	DROP IN
281312					F 71 6=C				
281312					S 72 7A=C				
281312					S 73 15=W				
282694		SS 72	C=A,D=A	4			3.4	1	
282694					F 72 6=B,15=A				
287751		S 74	X=W					0	4
287751					S 74 50=W				
306544		S 73	6=A						
306544		S 72	0=B	3.57			4	1	
306544					S 7[illegible] 6=A				
306544					F 70 7A=W				
316572		S 74	50=A	4			2	-	
316572					F [illegible] 4=C				
325713		SS 74	50=A	4			3	-	
325713					F 74 A=B				
333493		S 73	A=A	4				-	
333493					F 73 850=W,15=W				
340906		F 71	X=W						
340906		S 72	X=W						
340906					F 71 A=W				
340906					F 74 850=W			0	
348110		SS 72	X=W						
348110					F 73 50=W				
348110					SS 72 A=W				
348110					S 72 A=W			0	
348625		S 72	X=W						4
348625					S 72 15=B		3	1	
353604		S 74	X=W						
353604					S 74 0=W				
353604					F 74 0=C		2	1	
376853		SS 74	50=A						

LISTING OF THOSE STUDENTS THAT TOOK MATH AFTER MATH X ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	GP	DROP IN
376853				4	F 74	A=B	3	-	
379502		S 71	X=W						
379502					F 73	A=W		0	
383965		F 74	X=W						
383965					F 73	E40A=W			
383965					S 74	50=A			
383965					F 74	B50=C	3.33	1	
388151		S 73	X=W						
388151					S 74	50=A	4	1	
399182		F 73	X=W						
399182					F 73	50=A	4	1	
404776		F 73	X=W						
404776					S 74	A=B	3	1	
409951		74	X=W						
409951					F 73	A=B	3	1	
424000		S 73	X=W						
424000					F 73	A=W			
424000					S 74	15=W		0	
429883		SS 74	C=C						
429883		S 74	B=C						
429883		F 73	A=C	2.					
429883					F 74	D=B	3	1	
435221		F 72	6=A						
435221		SS 72	C=B				3.6	1	
435221		S 72	A=A	3.4					
435221					S 73	7A=A 15=B			
441517		S 72	D=A,6=A						
441517		F 71	C=A	4			4	1	
441517					F 72	7A=A			
441517					S 74	78=A			
450223		S 73	X=W						

LISTING OF THOSE STUDENTS THAT TOOK MATH AFTER MATH X ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	QP	DROP IN
456225					SS 7050=C		2	1	
456225					F 70 C=W				
460242		F 73	X=W						
460242					F 73 50=W				
460242					S 74 6=C		2	1	
467949		S 74	X=W						
467949		F 73	X=W						
467949		SS 73	B=C						
467949		S 73	A=B	2.5					
467949					F 73 D=W				
467949					F 74 B50=W				
470999		S 74	X=W						
470999					F 74 50=C		2	1	
475265		S 73 57	X=W						
475265		S 72	X=W						
475265					S 72 A=W			0	
485113		SS 73	A=B	4					
485113					F 74 G=B		3	-	
495979		S 72	X=W						
495979					F 72 6=C		2	1	
507979		S 74	X=W						
507979					F 74 A=C		2	1	
515386		SS 74	X=W						
515386		S 74	A=A,C=C						
515386				3	SS 74 850=B		2.3	-	
515386					F 74, D=C, B=C, B=C				
527341		F 73	D=C	2			2	1	
527341					S 7 6=C, F 74 7A=W				
527518		72	X=W						
527518					S 73 D=C		2	1	
549335		SS 72	X=W						

LISTING OF THOSE STUDENTS THAT TOOK MATH AFTER MATH X ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	OR DROP IN
549335		S 72	X=W		F 74 A=W		0	
549335								
551145		F 72	50=A,A=A					
551145				4	S 73 B=W		-	
564409		F 72	X=W					
564409					S 73 C=W		0	
566240		F 73	X=W					
566240					S 74 50=W		0	
572229		S 74	C=C	2				
572229					F 74 D=W		-	
574007		S 72	X=W					
574007					F 72 B50=W		0	
577979		F 71	50=C	2				
577979					S 72 A=W		-	
577979					F 72 A=W		-	
588850		S 74	50=A	4				
588850					SS 74 A=B	3	--	
590610		SS 74	X=W					
590610					F 74 C=B	3	1	
594759		SS 72	X=W					
594759					S 73 C=C,D=W	2	1	
594814		S 74	X=W					
594814		F 73	50=C	2				
594814					S 74 B50=W		-	
600148		S 72	50=A	4				
600148					F 72 A=D		-	
608797		S 74	C=A	4			2	-

LISTING OF THOSE STUDENTS THAT TOOK MATH AFTER MATH X ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	OF DROP IN
608797					F 74	6=C		
611370		F 73	X=W					
611370					F 74	50=A	4	1
623000		S 73	X=W					
623000					S 73	15=W		0
624834		S 74	50=B	3				
624834					F 74	B50=W		
636793		F 71	X=W					4
636793					F 71	50=W		
636793					S 72	15=C	2	1
647312		F 70	X=W					4
647312					F 70	A=W,C=B	3	1
648926		SS 74	D=A,6=A	4				
648926					S 71	D=B, 6=D		
648926					F 74	7A=C	2.8	-
651607		S 74	X=W					4
651607					F 71	7A=C		
651607					S 72	78=C, 15=B		
651607					S 74	A=W		
651607					SS 74	A=B	2.4	1
662500		SS 74	X=W					
662500					F 74	A=W		0
662896		F 73	C=C	2				
662896					F 73	15=W C=W		-
670075		S 72	X=W					
670075		F 71	C=C	2.				-
670075					S 72	15=W, D=W		
670075					F 74	C=W, D=W, 1		
716222		S 74	X=W					

LISTING OF MUSE STUDENTS THAT TOOK MATH AFTER MATH A ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	CR	UNSP IN
718222					S 74 50=A			0	
749454		SS 74	X=W						
749454					SS 74 A=W			0	
802784		S 74	50=A	4					
802784					F 74 A=C		2	1	
811271		S 74	X=W						
811271					F 74 A=B				
811271					S 73 A=W		3	1	
811669		F 74	X=W						
811669		SS 73	X=W						
811669					SS 74 50=W			0	
816667		F 72	C=C	2					
816667					F 73 C=C		2	1	
845385		F 73	50=A	4					
845385					S 74 15=C		2	-	
848188		F 71	X=W	-					
848188					F 71 A=W			0	
875250		F 70	X=W						
875250					F 70 15=A			0	
879078		F 70	C=B	3					
879078					S 74 B=B				
879078					SS 71 D=W				
879078					F 71 D=W				
879078					S 72 B=B, D=C		2.6	-	
879078					F 72 7A=W				
880375		F 71	X=W						4
880375					F 71 B=A				
880375					S 72 15=C				
880375					F 72 7A=C		2.6	1	
881568		F 74	X=W						

LISTING OF THOSE STUDENTS THAT TOOK MATH AFTER MATH X ENROLLMENT

ALPHA NO.	NAME	MATH X INFO. SEMESTER	GRADE	G.P.A.	OTHER MATH CLASSES SEMESTER	GRADE	G.P.A.	GP	DROP IN
881568					SS 73 50=A				
881568					F 73 A=A		4	1	
886896		S 73	X=W						
886896		F 73	X=W						
886896					S 74 A=C		2	1	
889890		F 71	X=W						
889890					F 73 A=W			0	
899893		S 74	X=W						
899893					S 74 15=W			0	
904312		F 73	X=W						
904312		F 74	X=W						
904312					S 74 50=W			0	
908721		SS 74	X=W						
908721		S 74	X=W						
908721		SS 73	X=W						
908721		F 73	B=D	1					
908721					F 74 D=W			-	
911531		S 72	X=W						
911531		F 71	X=W						
911531					F 71 15=W				
911531					F 72 7A=W				
911531					S 73 D=W			0	

APPENDIX B

THOSE STUDENTS WHO DID NOT TAKE MATH CASSES AFTER MATH X

108245	D=B	S	72	528
110372	D=C	F	72	490
110372	C=C	SS	72	063
110904	X=W	S	74	526
117054	X=W	F	70	519
117906	X=W	S	73	600
117906	X=W	F	72	491
121900	50=B	F	73	540
121900	A=C	S	74	547
123628	X=W	F	72	490
125468	X=W	S	73	600
125468	X=W	S	74	547
128078	X=W	S	72	550
131376	X=W	F	73	517
133430	X=W	S	74	525
139337	X=W	F	72	490
162101	A=B	F	70	519
169020	X=W	SS	72	063
183562	X=W	SS	72	063
185046	X=W	SS	72	063
185351	X=I	F	70	519
185595	X=W	SS	72	063
186283	X=W	S	71	511
186812	6=C	S	72	550
197371	X=W	S	73	600
212390	X=W	F	73	518
212836	X=W	S	74	547
213000	X=W	S	71	511
220514	X=W	S	74	525
220514	50=C	F	73	518
222319	50=C	S	74	525
222441	X=W	S	74	547
222441	X=W	F	73	540
222597	X=W	SS	74	074
225090	50=C	S	74	547
225304	X=W	S	74	547
230488	X=W	S	73	577
237846	X=W	F	73	540
242381		F	74	D=A,
247125	50=B	S	73	577
247125	B=C	S	74	525
251460	X=W	F	73	540
260986	A=C	SS	74	073
263844	B=A	F	73	517
266340	X=W	SS	74	074
271597	A=B	S	72	527
271759	X=W	F	73	540
271815	X=W	S	73	577
278087	X=W	F	73	540
278327	X=W	F	72	

THOSE STUDENTS WHO DID NOT TAKE MATH CLASSES AFTER MATH X

278327 50=C SS 72 063
280861 X=W S 73 600
282515 50=A S 73 599
288321 A=C S 74 525
292198 X=W S 74 526
294387 X=W S 74 526
294387 X=W F 74
303164 A=B SS 72 063
316656 X=W S 74 526
318781 X=W F 74
323100 C=C SS 72 063
334964 X=W F 73 517
336637 A=C F 73 518
336658 50=A S 73 599
344839 X=W SS 74 074
347798 X=W S 73 576
348286 50=A S 74 547
356300 X=W S 74 547
356716 X=W S 74 547
360348 X=W F 73 517
366380 X=W F 73 540
366449 X=W F 73 517
383862 50=B,A=C S 74 547
385772 50=B,A=C S 72 550
388261 50=A S 74 547
389440 50=C S 73 599
391583 A=C SS 72 063
395255 X=W S 74 547
395255 C=B F 73 517
395723 X=W F 73 540
397656 X=W S 72 527
397656 6=C SS 72 063
402614 X=W F 73 540
403618 X=W S 74 547
407255 X=W F 73 540
408149 X=W F 74
408149 X=W SS 74 074
408149 X=W S 74 526
410171 X=W SS 74 074
419111 X=W F 73 518
423704 X=W S 74 526
424466 C=B SS 72 063
426106 50=C F 71 538
426517 X=W S 74 525
430864 50=C F 71 538
435105 X=W SS 74 074
439326 74 7A=8
449187 X=W F 73 540
450302 X=W F 73 540
451905 X=W S 73 577

THOSE STUDENTS WHO DID NOT TAKE MATH CLASSES AFTER MATH X

460350	X=W	SS	73	080	551063	X=W	S 74 547
460350	A=A	S	73	577	551629	X=W	F 74
468811		S	73	A=A	551629	C=A	SS 74
468823	X=W	SS	74	074	552369	X=W	F 73 518
472989	50=B	S	73	599	552369	X=W	S 74 525
475418		S	74	A=W,SS 74 A=W	552369	50=C	SS 73 080
493162	A=C	S	74	547	552677	50=B	S 73 600
494523	50=A	S	72	550	556005	50=A	SS 74 074
498562	A=B	S	74	525	559082	X=W	S 73 600
507442	X=W	F	73	517	561095	X=I	F 70 519
507971	A=B	SS	74	074	561095	X=W	S 71 511
509320	X=W	S	73	577	571932	X=W	S 73 577
512062	X=W	F	70	540	575843	A=I	F 70 540
523744	X=W	S	74		581484	X=W	S 74 547
523744	X=W	F	73	517	587443	50=B	SS 73 080
527475	6=C	S	73	577	587481	D=C	SS 74 073
527475	D=C	F	72	490	587518	X=W	S 72 550
530928	50=B,A=C	S	74	547	587518	D=C	S 73 599
532785	50=A	S	74	547	589070	A=C	S 73 576
535945	X=W	F	74		594690	6=B	F 72 490
535945	X=W	S	73	576	596183	D=B	SS 73 080
535945	X=W	S	74	547	596479	X=W	F 71
535945	C=C	F	73	518	596479	D=D	S 71 532
544155	X=W	F	73	518	596607	X=W	S 73 600
551062	B=C	SS	72	063	596607	D=A	SS 72 063

THOSE STUDENTS WHO DID NOT TAKE MATH CLASSES AFTER MATH X

	597508	X=W	F	74	
	599155	X=W	F	73	540
	599156	X=W	F	74	
4	599734	50=A	S	74	526
	606906	X=W	S	71	532
	606906	A=C	F	70	540
	607239	X=W	S	73	576
	613108	50=A	SS	74	073
4	613632	X=W	F	72	490
	614796	X=W	SS	73	
	614796	X=W	F	72	490
	617250	X=W	F	72	490
	617250	X=W	SS	73	080
	617250	X=W	S	73	577
4	630160	X=W	S	74	526
	634542	6=B	S	74	526
	640455	6=A	SS	73	080
	649234	X=W	F	73	518
	674562	A=C	S	72	528
	680214	50=A	S	71	532
	680487	X=W	F	73	518
	684833	X=W	F	73	518
	692240	X=W	F	73	518
	695419	A=C	F	70	540
	696691	X=W	S	74	525
	696691	D=C,6	SS	74	074
	696691	C=B	F	73	517
	702465	X=W	S	74	547
	703800	50=B	F	72	490
	712697	X=W	S	74	526
	712697	X=W	F	73	518
	719360	X=W	S	73	576
	719360	X=W	F	73	540
	721857	C=C	SS	72	063
	722162	X=W	F	73	518
	730149	50=B	S	74	547
	730886	X=W	S	74	547
	732386	50=B	SS	74	074
	735765	X=W	F	64	
	735765	A=C	S	73	599
	741529	X=W	F	73	517
	743066	X=W	F	73	540
	744075	X=W	S	74	525
	746658	X=W	F	74	
	746658	B=A	S	74	547
	746658	A=A	F	73	540
	769286	50=C	S	73	576
	772491	X=W	F	73	540
	773949	X=W	F	74	
	773949	X=W	SS	74	073

THOSE STUDENTS WHO DID NOT TAKE MATH CLASSES AFTER MATH X

778038	X=W	S	73 599	854792	X=W	S	73 576
780780	X=W	S	71 511	868593	C=C	S	72 527
781115	X=W	F	73 540	869377	X=W	S	73 599
788472	X=W	S	74 525	869758	C=C	F	73 518
788472	X=W	F	73 517	880359	X=W	S	74 525
788472	D=B	SS	74 074	881651	A=B	S	73 577
795161	A=B	F	73 540	882603	X=W	F	74
796444	50=B	SS	74 074	882603	X=W	SS	72 063
801527	A=A,C=A	SS	74 074	884368	X=W	S	71 532
802571	X=W	S	74 525	884388	X=W	S	71 532
802571	X=W	F	73 518	889650		F	73 50=D
817071	X=W	F	73 540	889780	X=W	F	73 540
830521	X=W	S	73 576	889780	X=W	S	74 547
830521	50=B	F	73 518	899914	50=A	S	74 547
830521	A=C	S	74 525	900466	X=W	F	73 540
832171	X=W	S	72 527	904870	50=B	S	73 576
835388	X=W	S	74 547	904870	A=C	SS	73 080
835388	X=W	F	73 540	908752		F	72 6=C,S 73 15=C
839200	X=W	S	73 599	910096	X=W	SS	74 073
842927	X=W	F	73 540	910096	X=W	F	74
843451	X=W	SS	73 080	918220	X=W	S	72 550
844523	C=C	S	72 526				
848354	X=W	S	74 547				
848838	X=W	S	73 600				
854290	X=W	S	74 547				

APPENDIX C SUMMARY OF REPLIES

ANTELOPE VALLEY COLLEGE
INSTITUTIONAL RESEARCH

297 Questionaires mailed
49 Not delivered
74 Returned (30%)

YOU ARE AMONG A SPECIAL SAMPLE OF STUDENTS CHOSEN BECAUSE YOU ONCE ENROLLED IN A MATH X CLASS AT ANTELOPE VALLEY COLLEGE.

THE MATH DIVISION IS DESIROUS OF KNOWING YOUR OPINION OF THE MATH X PROGRAM. THEY WOULD APPRECIATE YOUR TAKING THE TIME TO ANSWER THE QUESTIONS BELOW. YOUR ANSWERS WILL HELP MAKE THE MATH X LEARNING SCHEME BETTER FOR ALL STUDENTS.

DIRECTIONS: ENCIRCLE, OR OTHERWISE MARK THE ANSWERS ON EACH QUESTION BELOW. ANY COMMENTS MAY BE WRITTEN ON THE REVERSE SIDE OF THIS QUESTIONNAIRE.

1. NUMBER OF UNITS COMPLETED IN MATH X:

A. NONE	B. 3 UNITS	C. 4 UNITS	D. 6 UNITS	E. OVER 8	F. OVER 16		
11	35	2	13	8	3	N = 74	ø = 2

2. IF YOU RECALL THE SEMESTERS DURING WHICH YOU TOOK MATH X, ENCIRCLE THEM:

S70	F70	SS70	S71	F71	SS71	S72	F72	SS72	S73	F73	SS73	S74	F74	SS74	
0	0	0	2	3	2	6	5	6	6	15	4	25	10	11	N = 99, ø = 4

NOTE: S = SPRING, F = FALL, SS = SUMMER SESSION, 70, 71, 72, 73, 74 INDICATE THE YEAR

3. IN COMPARISON WITH OTHER CLASSES YOU HAVE TAKEN, PLEASE RANK MATH X ON THE TWO SCALES BELOW:

	0	1	2	3	4	5	6	7	8	9	10			
WITH RESPECT TO OTHER MATH CLASSES	5	3	6	7	10	11	4	6	7	0	2	$\bar{X} = 4.47$	s = 2.54	ø = 13
WITH RESPECT TO ALL CLASSES	2	2	4	11	8	21	8	4	3	2	2	$\bar{X} = 4.81$	s = 2.06	ø 6

EASIER — ABOUT THE SAME — MUCH MORE DIFFICULT

(PLACE A CHECK IN THE BOX THAT DESCRIBES YOUR FEELINGS BEST)

I AM UNABLE TO COMPARE MATH CLASSES [12]

I AM UNABLE TO COMPARE MATH CLASSES TO OTHER CLASSES [8]

Note: Seldom did both boxes get checked by the same sample

COMMENTS: ______________________________

4. WOULD YOU CONSIDER TAKING CLASSES OTHER THAN MATH CLASSES IF OFFERED IN A FORMAT SIMILAR TO THE MATH X FORMAT? YES 58 NO 13 ø = 3

5. WILL YOU REPEAT MATH X FOR MORE ADVANCED MATH STUDY IF THE OPPORTUNITY OR NEED ARISES? YES 51 NO 21 ø 2

6. WERE YOU ABLE TO GET HELP FROM THE INSTRUCTORS OR PROCTORS WHEN YOU NEEDED IT IN MATH X. (MARK THE SCALE)

0	1	2	3	4	5	6	7	8	9	10			
1	0	3	1	3	11	2	1	11	5	36	$\bar{X} = 7.91$	s = 2.62	N = 74

NEVER — MOST OF THE TIME — ALWAYS

7. HOW "READABLE" DID YOU FIND THE TEXTBOOKS USED IN MATH X ?

0	1	2	3	4	5	6	7	8	9	10			
0	0	1	4	4	14	7	10	17	3	12	$\bar{X} = 6.87$	s = 2.13	ø = 2

IMPOSSIBLE TO LEARN FROM THE TEXTS — FAIR — MUCH BETTER THAN MOST MATH TEXTS

APPENDIX C, (CONT.) SUMMARY OF REPLIES

ANTELOPE VALLEY COLLEGE
INSTITUTIONAL RESEARCH

8. IN RETROSPECT, DO YOU FEEL YOU WOULD HAVE LEARNED MORE MATH IN A CLASSICAL LECTURE-TYPE CLASS?

YES 32 NO 35 (PLEASE MARK THE SCALE BELOW)

BASED ON PAST EXPERIENCE IN MATH CLASSES, HOW "MUCH MATH" DO YOU FEEL YOU LEARNED IN MATH X ?

0	1	2	3	4	5	6	7	8	9	10
4	3	6	9	5	14	9	4	5	3	11

$\bar{X} = 5.35$
$s = 2.95$
$\phi = 1$

MUCH LESS THAN I USUALLY LEARN IN A LECTURE — ABOUT THE SAME — MUCH MORE THAN I USUALLY LEARN IN LECTURE

9. CONSIDER THE FEATURES OF MATH X LISTED BELOW. PLEASE RATE THESE FEATURES BY PLACING THE APPROPRIATE "GRADE" IN THE BOX PROVIDED.

A = VERY GOOD, B = GOOD, C = JUST O. K., D = SHOULD BE MODIFIED, F = TERRIBLE

"GPA" in box

a.	3.4	SELF PACING (CAN STUDY AT YOUR OWN RATE)	Factor of "Range of Opinion" = s $s = .91$	
b.	3.2	CAN STUDY ONLY THOSE TOPICS WHERE WEAKNESS IS EXHIBITED	$s = .95$	$\phi = 2$
c.	2.8	TEXTBOOKS ARE PROGRAMMED (IN VERY SMALL LEARNING STEPS)	$s = 1.1$	$\phi = 1$
d.	3.5	REPEATABILITY OF TESTS FOR IMPROVEMENT OF GRADES	$s = .83$	$\phi = 2$
e.	2.9	THE DIFFERENT ROLE OF THE TEACHERS NON-LECTURING STUDENT-HELPER MODE	s 1.2	$\phi = 2$
f.	3.7	THE ABILITY TO MOVE AS FAST THROUGH A COURSE AS DESIRABLE (OBTAINING UP TO 19 UNITS IN A SINGLE SEMESTER)	$s = .59$	$\phi = 2$
g.	3.6	OPEN ENDED ENROLLMENT (CAN DROP OR ADD AT ANY TIME DURING REGULAR SEMESTERS)	$s = .76$	$\phi = 3$
h.	3.2	NON-PUNITIVE GRADING (NO D'S OR F'S EVER)	$s = 1.04$	$\phi = 2$

10. SELECT TWO FEATURES ABOVE THAT YOU FEEL NEED THE GREATEST AMOUNT OF IMPROVEMENT. RANK THEM BELOW.

ITEM NEEDING GREATEST AMOUNT OF IMPROVEMENT _____ OTHER ITEM _____

COMMENTS: 6 marked A; 8 marked B; 22 marked C; 3 marked D; 11 marked E; 1 marked F; 2 marked G; and 3 marked H in "Item needing greatest improvement"
23 did not mark any

5 marked A; 8 marked B; 5 marked C; 4 marked D; 7 marked E; 1 marked F, and 4 marked H in "Other item. 39 did not mark any.

APPENDIX D

Point Biserial Correlation Calculation

f_p Those students who received higher GPA in lecture classes (conventional math instruction) after having successfully completed Math X

f_n Those students who received lower GPA in lecture in math classes other than Math X after having taken Math X (and were successful in Math X)

Y	f_p	f_n	f	fY	fY^2	f_pY
4	4	13	17	68	272	16
3	6	3	9	27	81	18
2	5	5	10	20	40	10
1	0	1	1	1	1	0
0	23	2	25	0	0	0
Σ	38	24	62	116	394	44

$$r_{pb} = \frac{(62)(44) - (38)(116)}{\sqrt{(38)(24)(62)(394) - 115^2}} = \frac{-1680}{3196} = -.52$$

The negative point biserial value allows one to infer that students having a low GPA in Math X went on to do better in conventional math classes, while students with high grades in Math X did not do as well in conventional math classes. Average students seem to do about the same in either setting.

APPENDIX E

Calculations of Costs per Student Hour

General Information

Year	Costs of Education	ADA	Cost/ADA
1970-71	$ 2,046,405.00	2684	$ 762.45
1971-72	2,238,378.00	2672	810.42
1972-73	2,353,307.00	2662	884.04
1973-74	2,378,422.00	2807	847.32

Cost of Education = Current costs calculated by combining categories 100 through 800, excluding 500

One ADA = 525 Hours of Instruction

District-Wide Cost per Hour of Instruction

Year	Cost
1970-71	$1.45
1971-72	1.54
1972-73	1.68
1973-74	1.61

Cost per Hour in Math Instruction (Based on a Lecture Class of 45 Students)

Year	Cost
1973-74	$1.56

(Cost of conventional instruction from report Comparing Instructional Costs of Selected Programs at a Junior College; see listing (5) in Bibliography, page 22.)

Calculations for Math X Instruction

Sum of all categories from Cost of Instruction, excluding 213, divided by ADA = $383.47

ADA generated in Math X =

$$\frac{135 \times 3 \times 35}{525} = 27 \text{ per year}$$

$$383.47 + \frac{\frac{15,000}{5} + 420}{27} = 383.47 + 111.11 + 1.56$$

$$= \$496.14$$

And, $\frac{496.14}{525}$ = $.95 per Student Hour of Instruction in Math X