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ABSTRACT

In 1989, a study was conducted of the mathematics assessment portion of the matriculation process at California's Saddleback College (SC). The two main purposes of the study were to examine student enrollment behavior in recommended mathematics courses as well as to compare the success rates of students who enrolled in the recommended courses with those who enrolled in self-placed, higher level courses. All those who participated in the mathematics assessment process between July 5, 1988 and January 11, 1989 were included in the population for the study. The assessment process consisted of four separate examinations: Algebra Readiness; Elementary Algebra; Intermediate Algebra; and Pre-Calculus. In all, 2,354 exam were completed. Of the tested students, 1,336 enrolled in a mathematics class within three terms. Major findings and recommendations of the study are as follows: (1) almost all (94%) of those who participated in the mathematics assessment process enrolled in courses in the district, and slightly less than two-thirds of those who enrolled, took a math class within three terms following completion of the assessment process; (2) nearly two-thirds of those who enrolled in a mathematics class chose the course recommended by the assessment/advisement process of the matriculation program; (3) students who followed the course placement recommendations successfully completed those courses at a much higher rate than students who placed themselves above their recommended level; (4) it was recommended that the procedure for registration in mathematics courses be modified to give priority to students who had met course prerequisites or who had received a recommendation for a particular course level through the mathematics assessment process; and (5) it was recommended that the cutoff scores for course recommendations based on the assessment tests be modified. Summaries and analyses of the results of each of the four assessment tests are appended. (JMC)

A REVIEW OF THE MATHEMATICS ASSESSMENT OF SADDLEBACK COLLEGE STUDENTS THROUGH THE MATRICULATION PROGRAM

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A Review of the Mathematics Assessment of Saddleback College Students through the Matriculation Program

by

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Summary of Observations and Recommendations

1. Almost all (ninety-four percent) of those who participate in the mathematics assessment process will enroll.

2. Slightly less than two-thirds of those who enroll will also enroll in a mathematics course within three terms following completion of the mathematics assessment process.

3. Nearly two-thirds of those who enroll in a mathematics class choose the course recommended through the assessment/advisement process provided by the Matriculation Program.

4. Those students who follow the course placement recommendations successfully complete those courses at a much higher rate than students who place themselves in these courses after being advised to take a less advanced course.

5. It is recommended that the procedure for registration in mathematics courses be modified, when technically possible, to give priority to students who have met the course prerequisite or have received a recommendation for a particular course level through the mathematics assessment process. This could be accomplished, for example, once telephone registration becomes a reality. A student not meeting the conditions noted above, as determined by a computer check, could be placed on a waiting list for a particular course during the registration period. At some later time, if the course had not filled with students possessing a higher probability for success, the computer could add those on the waiting list to the class roster.

6. It is likely that many students who participate in the mathematics assessment activity already know into which mathematics course they would like to enroll. It is recommended that during the period when students are advised about the test choices they have, that students who are interested in taking basic mathematics be instructed to take the Algebra Readiness test. Students interested in enrolling in beginning algebra should take either the Algebra Readiness or Elementary Algebra test. Those who would like to take intermediate algebra should complete either the Elementary Algebra or Incermediate Algebra test. Students interested in trigonometry, statistics, finite

mathematics, mathematics for liberal arts students, mathematics for elementary school teachers, or the brief course in calculus should be instructed to take the Intermediate Algebra test. Students who are interested in taking pre-calculus or calculus should be encouraged to take the Pre-Calculus test.

7. It is recommended that the cut off scores for course recommendations based on the MDTP assessment tests be as follows:

Algebra Readiness Test:

Score:	26 and above	Recommend:	Beginning Algebra Level
Score:	25 and below	Recommend:	Arithmetic

Elementary Algebra Test:

Score:	28 and above	Recommend:	Intermediate Algebra
Score:	17 through 27	Recommend:	Beginning Algebra Level
Score:	16 and below	Recommend:	Arithmetic

Intermediate Algebra Test:

Score:	27 and above	Recommend:	Trigonometry/Statistics Level
Score:	20 through 26	Recommend:	Intermediate Algebra
Score:	12 through 19	Recommend:	Beginning Algebra Level
Score:	11 and below	Recommend:	Arithmetic

Pre-Calculus Test:

Score:	23 and above	Recommend:	Calculus
Score:	18 through 22	Recommend:	Pre-Calculus
Score:	17 and below	Recommend:	Intermediate Algebra

A Review of the Mathematics Assessment of Saddleback College Students through the Matriculation Program

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Introduction

Saddleback College uses the diagnostic tests made available through the Mathematics Diagnostic Testing Program (MDTP) (a joint project of the University of California and California State University) for the mathematics assessment portion of the matriculation process. There are four separate tests: Algebra Readiness (fifty items), Elementary Algebra (fifty items), Intermediate Algebra (forty-five items), and Pre-Calculus (forty items). The mathematics department faculty at Saddleback College analyzed these tests and determined, each of the four separately, those scores necessary for the student to receive the recommendation to enroll in the various mathematics courses offered by the department. The minimum or cut off scores selected were as follows:

Algebra Readiness Test:

Score: 26 and above	Recommend:	Beginning Algebra Level
Score: 25 and below	Recommend:	Arithmetic

Elementary Algebra Test:

Score: 27 and above	Recommend:	Intermediate Algebra
Score: 16 through 26	Recommend:	Beginning Algebra Level
Score: 15 and below	Recommend:	Arithmetic

Intermediate Algebra Test:

Score: 30 and above	Recommend:	Trigonometry/Statistics Level
Score: 22 through 29	Recommend:	Intermediate Algebra
Score: 11 through 21	Recommend:	Beginning Algebra Level
Score: 10 and below	Recommend:	Arithmetic

Pre-Calculus Test:

Score: 25 and above	Recommend:	Calculus
Score: 20 through 24	Recommend:	Pre-Calculus
Score: 19 and below	Recommend:	Intermediate Algebra

Participants in the assessment testing portion of the matriculation process were required to attend one of the regularly scheduled testing periods. At this session they first completed the English assessment and then were given one of the mathematics tests. Individually, the participants selected the MDTP test they desired to complete. This choice was based primarily on their background and self-assessment as to the current level of their mathematics competency. They were informed that they should not guess at answers to problems for which they had no clue how to solve, because of the assessment nature of this activity. Those who finished the portion of the test with which they felt comfortable before the end of the testing period were permitted to turn in their materials and exit the testing center at that time. The matriculants arranged to meet with a counselor either individually or during one of the regularly scheduled orientation/advisement sessions to receive their scores and associated course placement recommendations. These recommendations were only advisory. The student was free to enroll in any mathematics course that was desired.

Purpose

It was the purpose of this study to compare student enrollment behavior in mathematics courses with the recommendations they received. Further it was the purpose of this study to compare the success rates of students who enrolled in the recommended courses with those who self-placed in higher level courses. These

comparisons formed a basis for the validation of the cut off scores on the various MDTP tests and for recommendations for improvement in the mathematics assessment process at Saddleback College.

Procedure

All those who participated in the mathematics assessment process between July 5, 1988 and January 11, 1989 were included in the population for this investigation. In all, 2354 exams were completed. Of this group sixty records were defective in such a way that tracking of the participant was not possible. Consequently, tracking was possible for 2294 (97.5 percent) of the participants. Of this group 2153 (93.9 percent) became students within the three terms (fall semester, spring semester, summer session) immediately following completion of the mathematics assessment process by actually enrolling in at least one course. Of these students, 1336 (62.1 percent) enrolled in a mathematics class within the three terms noted above. It was on the enrollment decisions and course success of these students that this study was focused.

Students were considered successful in a mathematics course if they completed it with a grade of C or better. Students who, for any reason, dropped, withdrew or received a grade other than A,B,or C were considered unsuccessful. Because it was not possible to know why a student dropped or withdrew, it was not possible to segregate those who were having academic difficulty from those who were not. It should be noted that students who stopped attending after the last day permissible to withdraw from classes could not be assigned a grade of W by the instructor and consequently may have received a grade of F. Thus the failing grade, F, may have reflected a

student's attendance record rather than the level of difficulty the student had meeting the requirements of the class.

Results

Of the 2354 participants who took one of the four mathematics assessment tests, the enrollment behavior for ninety-eight percent was tracked. Of this group, ninety-four percent became students. This suggested that applicants who were willing to take the time to engage in this assessment exercise were almost certain to actually enroll.

Of the 2153 students who enrolled following the mathematics assessment activity, 1336 (62.1 percent) enrolled in a mathematics class within three terms Consequently, nearly two-thirds of the participants benefited directly from this mathematics testing activity.

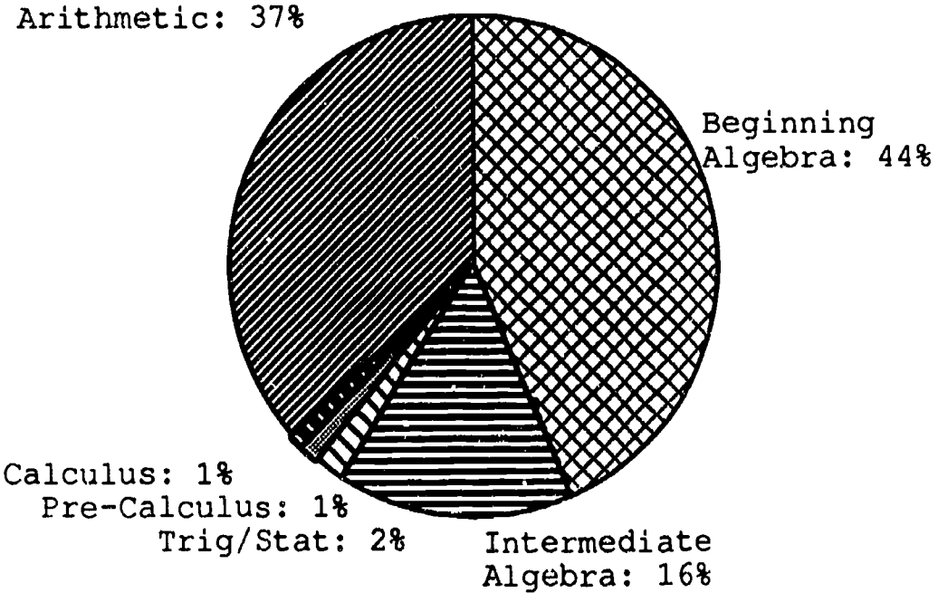
Comparison of Course Recommendations with Actual Enrollment Decisions

The course recommendations given to the participants covered the entire range possible: from arithmetic to first semester calculus. For the 1336 students who enrolled in mathematics the distribution of recommendations was as follows: arithmetic 489 (36.6 percent), beginning algebra 584 (43.7 percent), intermediate algebra 217 (16.2 percent), trigonometry/finite mathematics/mathematics for liberal arts students/business calculus/statistics 22 (1.7 percent), pre-calculus 12 (0.9 percent), calculus 12 (0.9 percent). This distribution was shown graphically in figure 1.

The courses in which the participants actually enrolled also ranged from arithmetic to first semester calculus. This constituted the complete range of possible recommendations and included the

course in geometry for which no recommendation was given through the advisement process. Of the 1336 students who enrolled in mathematics, the distribution of actual course enrollments was as follows: arithmetic 313 (23.4 percent), beginning algebra 527 (39.5 percent), geometry 8 (0.6 percent), intermediate algebra 294 (22.0 percent), trigonometry/finite mathematics/mathematics for liberal arts students/business calculus/statistics 120 (9.0 percent), pre-calculus 36 (2.7 percent), calculus 38 (2.8 percent). This distribution was shown graphically in figure 2.

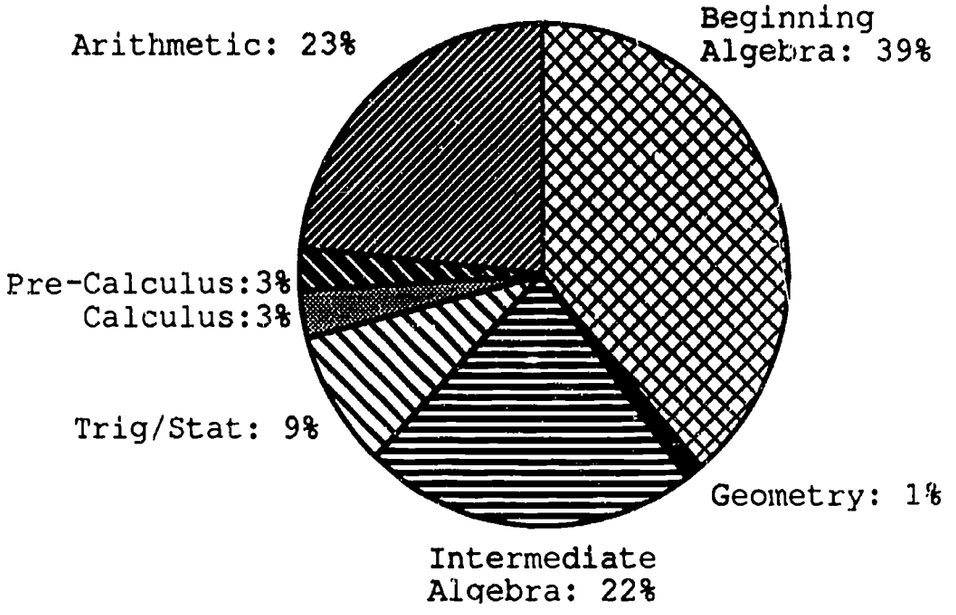
Figure 1
Distribution of Course
Recommendations
N = 1336



course in geometry for which no recommendation was given through the advisement process. Of the 1336 students who enrolled in mathematics, the distribution of actual course enrollments was as follows: arithmetic 313 (23.4 percent), beginning algebra 527 (39.5 percent), geometry 8 (0.6 percent), intermediate algebra 294 (22.0 percent), trigonometry/finite mathematics/mathematics for liberal arts students/business calculus/statistics 120 (9.0 percent),

pre-calculus 36 (2.7 percent), calculus 38 (2.8 percent). This distribution was shown graphically in figure 2.

Figure 2
Distribution of Actual
Course Enrollments
N = 1336

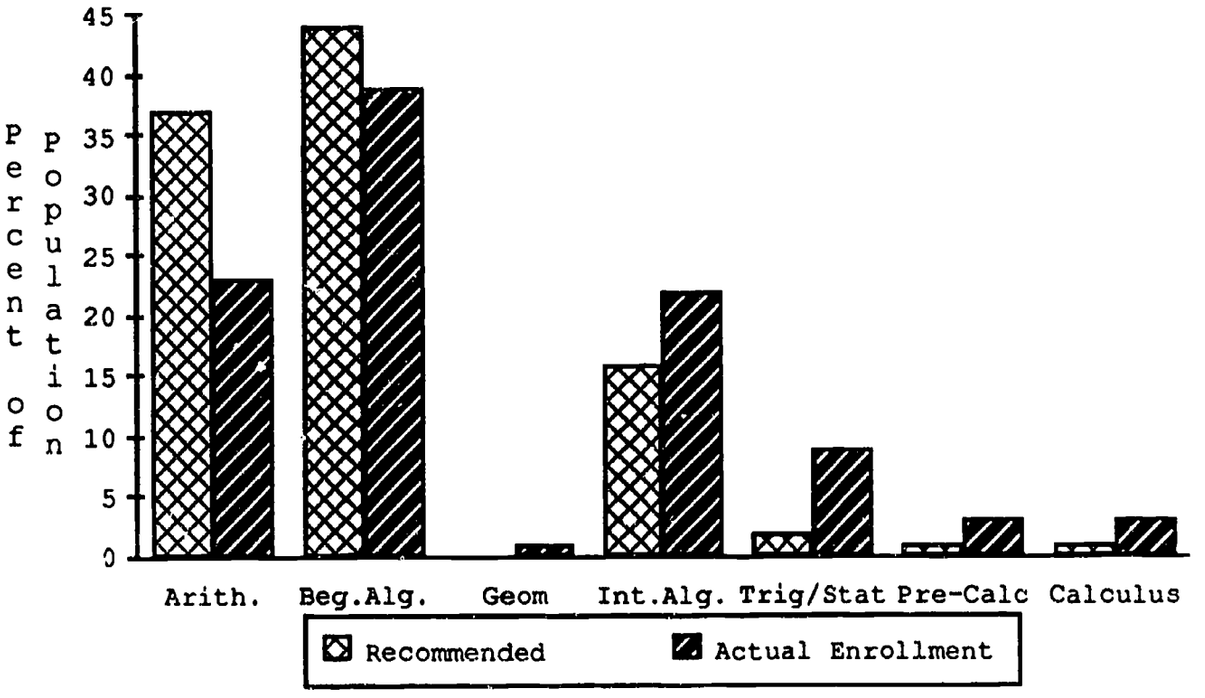


It was clear that, overall, the enrollments in arithmetic and beginning algebra were lower than expected based on the recommendations given to the students and the enrollments in intermediate algebra and more advanced courses were correspondingly higher than expected. To simplify the process of comparing specific course enrollments and recommendations, figure 3 was constructed.

While the difference between the levels of expected and actual enrollments was clearly depicted in figure 3, the level with which individual course recommendations matched course enrollments was not obvious. The course recommendation matched the course enrollment for 829 (62.1 percent) of the students. The course recommendation was lower than the level of the actual course in which the student actually enrolled for 474 (35.5 percent) of the students. Only

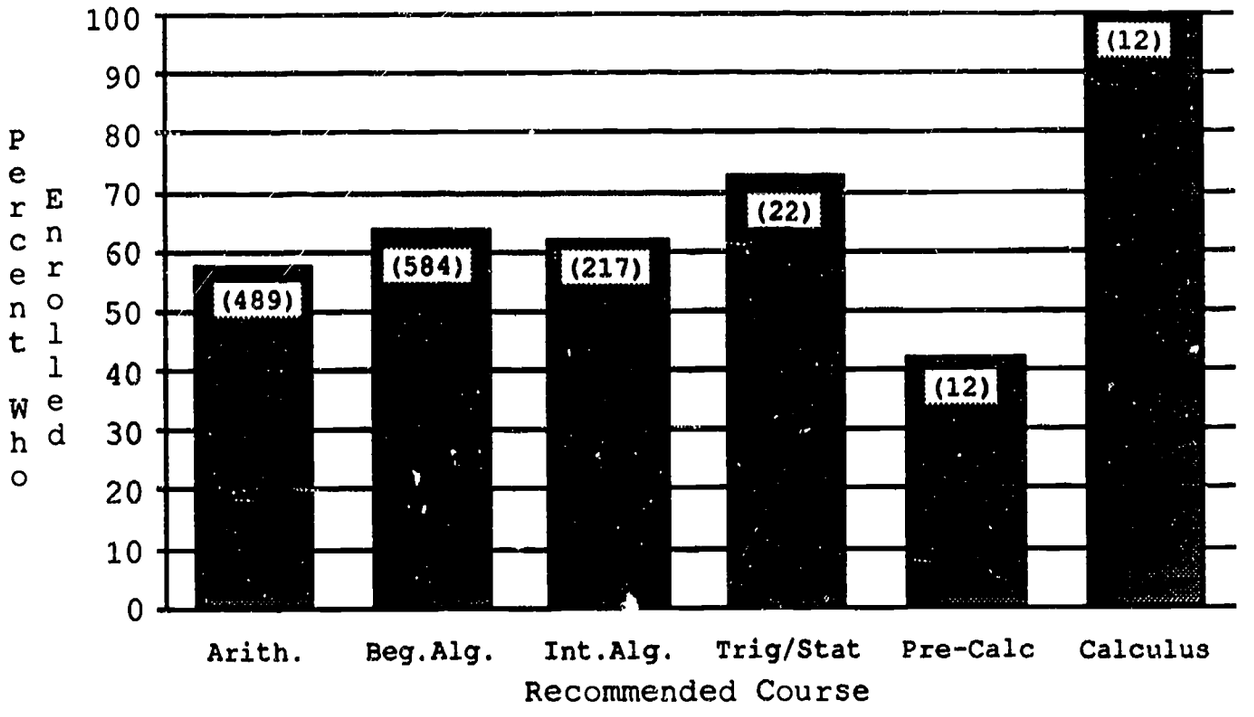
thirty-three (2.5 percent) students enrolled in a lower course than that recommended.

Figure 3
Comparison of Course Recommendations and Actual Enrollments
N = 1336



It was found that 58.3 percent of those 489 students who received the recommendation to enroll in arithmetic actually enrolled in that course. Of the 584 students who received a beginning algebra recommendation, 64.4 enrolled in beginning algebra. While 62.2 percent of those 217 students who received an intermediate algebra recommendation enrolled in that course, 72.2 percent of the twenty-two students who earned the recommendation to enroll in a course at the trigonometry/statistics level made that choice. Twelve students received the recommendation for the pre-calculus course and 41,7 percent followed that recommendation. All of the twelve students for whom calculus was the recommendation enrolled in that course. These results were represented in graphical form and placed in figure 4.

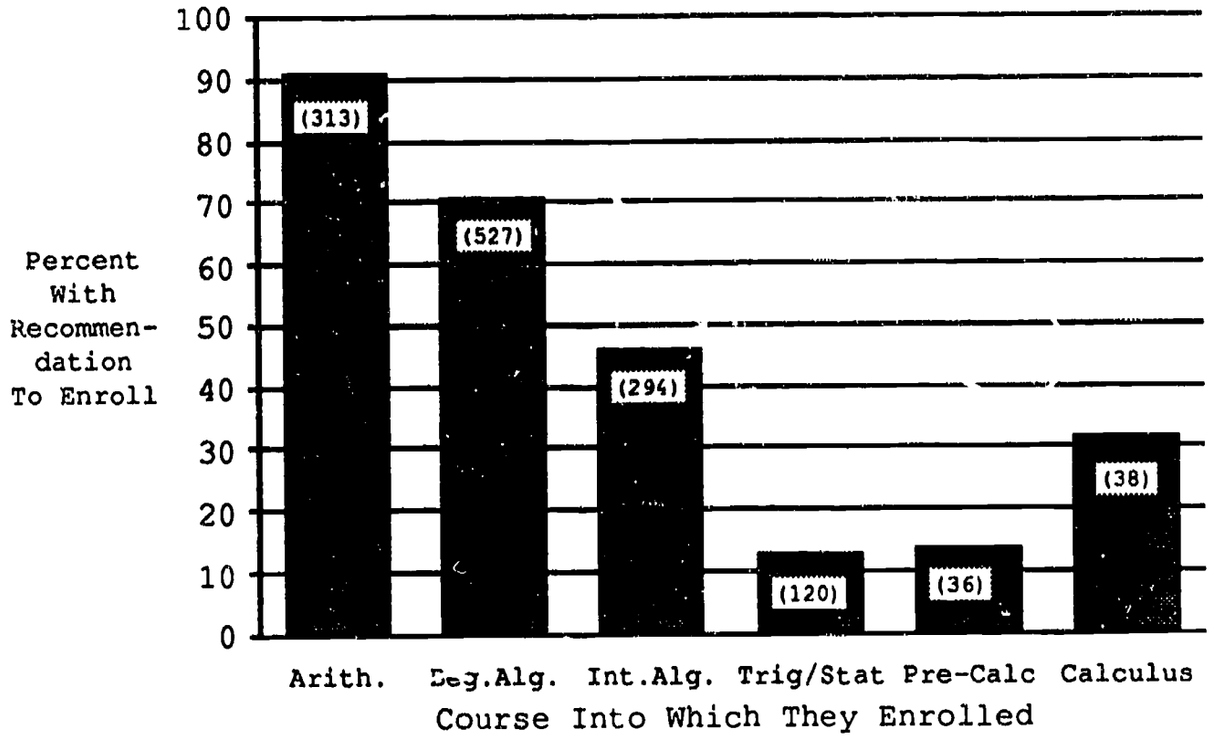
Figure 4
Rate of Enrollment in the Recommended Course
(N)



To gain another perspective on the match between the course recommendations and the course enrollments, the percentage of those enrolled in each of the course levels who received a recommendation into that level were computed. It was found that 91.1 percent of those 313 students who enrolled in arithmetic had received that course recommendation. Of the 527 students who enrolled in beginning algebra, 71.3 percent had been recommended to do so. While 45.9 percent of those 294 students who enrolled in intermediate algebra had that recommendation, 13.3 percent of the 120 students who enrolled in a course at the trigonometry/statistics level had received such a recommendation. Thirty-six students enrolled in the pre-calculus course although only 13.9 percent had received that recommendation. All of the twelve students for whom calculus was the recommendation enrolled in that course and amounted to 31.6 percent

of the group that actually enrolled. These results were represented in graphical form and placed in figure 5.

Figure 5
Percent of Those Who Received a Recommendation
For the Course Into Which They Enrolled
(N)

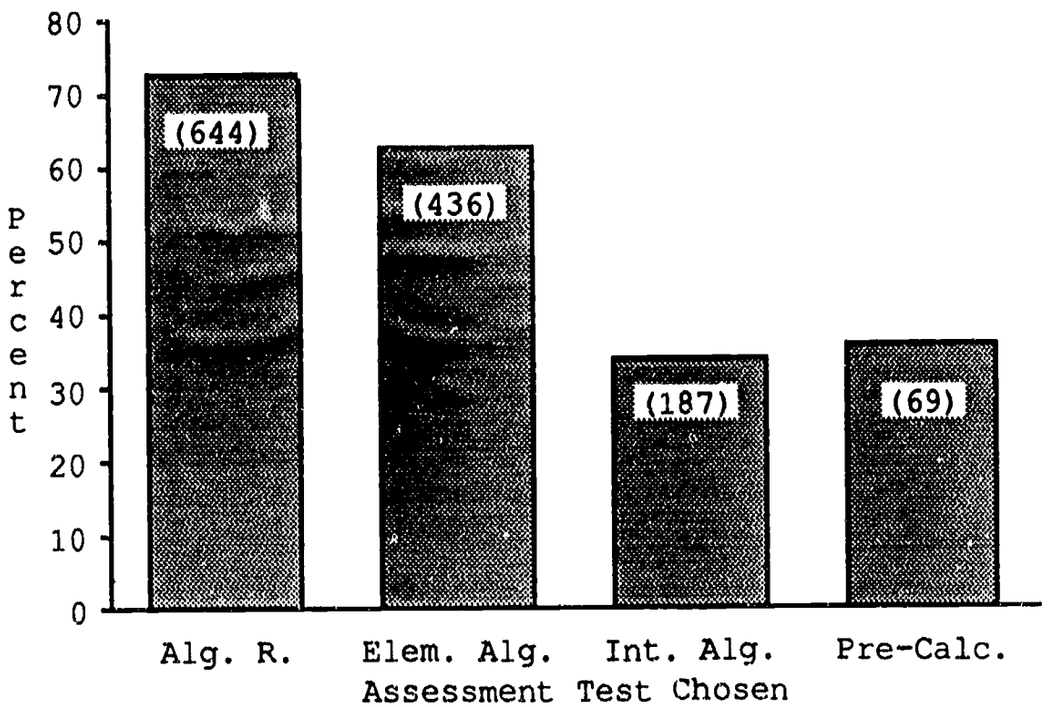


Based on this information, it was concluded that nearly two-thirds of the students followed the course advisement and slightly more than one-third chose to take a more advanced class than that recommended. Although it was not possible to state that students enrolled in a particular course because of the recommendation they had received from the assessment process, it was encouraging to see such a high level of matching. It appeared, however, that the degree of matching between the course recommendations and course enrollments decreased as the level of course increased

It was further observed that the degree of matching between the course recommendation and the actual course enrollment tended to decrease as the level of the assessment test chosen by the student

increased. The individual matches by specific test were as follows: Algebra Readiness -- seventy-three percent; Elementary Algebra -- sixty-three percent; Intermediate Algebra -- thirty-four percent; Pre-Calculus -- thirty-six percent.

Figure 6
Percent of Students Who Enrolled in the Recommended Course vs the Assessment Test Chosen
(N)



These results suggest that students at the more basic mathematics levels of arithmetic and beginning algebra were more comfortable with the recommendations provided by the tests than those at the higher levels. Of course to be recommended into a higher level course it was necessary for the student to take a fairly difficult test and to do rather well. Evidently students interested in taking courses at the more advanced levels tended to feel that either their performance on the assessment test was not indicative of their actual ability or that the opinion of the mathematics faculty

as to what competency was needed to suggest success in a particular course was not realistic.

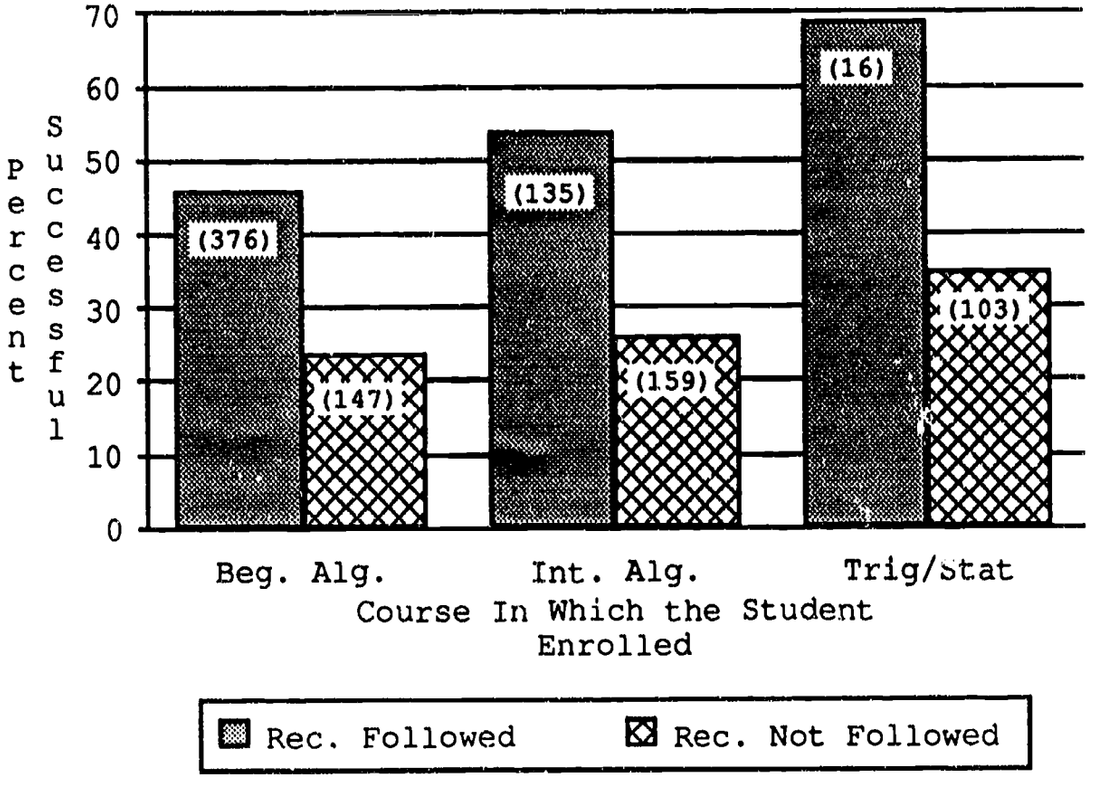
A total of 131 (9.8 percent) students enrolled in a course for which the test they chose provided no recommendation. This level tended to increase as the level of test increased. While nine percent of the students who took the Algebra Readiness test and nine percent of those who took the Elementary Algebra test enrolled in courses for which these instruments provided no recommendation, the level was twelve percent for those who chose the Intermediate Algebra test and twenty-two percent for those who chose the Pre-Calculus test.

Comparison of Course Recommendations with Course Success

Students who self-placed into a course at the levels of beginning algebra, intermediate algebra, or trigonometry/statistics had a significantly lower success rate than those who enrolled after having received a recommendation into that course level. Of the 376 students who were recommended into beginning algebra and subsequently took that course, forty-six percent were successful. This compared with a twenty-four percent success rate for the 147 students who self-placed into this course. Of the 135 students who were recommended into intermediate algebra and subsequently took that course, fifty-four percent were successful. This compared with a twenty-six percent success rate for the 159 students who self-placed into this course. Of the sixteen students who were recommended into the trigonometry/statistics level courses and subsequently took one of these courses, sixty-nine percent were successful. This compared with a thirty-five percent success rate for the 103 students who

self-placed into this course level. This information was place in figure 7.

Figure 7
Comparison of the Rate of Success of
Students Who Followed the Recommendation and
Those Who Did Not
(N)



Of the five students who received the recommendation to enroll in pre-calculus and subsequently took that course, forty percent were successful. This compared with a forty-two percent success rate for the thirty-one students who self-placed into this course. Of the twelve students who were recommended into calculus and subsequently took that course, fifty-eight percent were successful. This compared with a fifty-four percent success rate for the twenty-six students who self-placed into this course. In the pre-calculus and calculus courses, the success rates were essentially the same for those who followed the recommendation and those who did not. While there may have been many reasons for this, there was evidence that students at

this level on occasion did not demonstrate their full ability on the test. For example a student who scored a twelve out of fifty on the elementary algebra test and received a recommendation into arithmetic only to then enroll in calculus and successfully complete that course was, under no stretch of the imagination, demonstrating his/her knowledge of algebra while engaged in the assessment process. Again because the Pre-Calculus test was difficult and a great deal of thought was necessary to score sufficiently high to have received a recommendation for the calculus course, it was likely that the student simply did not want to be bothered.

It is likely that some students will continue to take this position in the future if no external motivation is provided to a student for doing well on the test. Consequently, it is expected that comparisons of self-placement success rates with the success rates of students who follow the recommendation will not change for the pre-calculus and calculus courses.

Cut off Scores for Course Placement Recommendations

As in any placement test situation, of significant concern was the appropriateness of the cut off scores used to make the course placement recommendations. A detailed analysis of the success of students versus their placement scores was conducted. Of interest here were the levels of correct predictions in comparison to the levels false prediction. A student who was given a recommendation to enroll in a particular course level and then was successful in that course was referred to as a true positive and, likewise, a student who was unsuccessful in a course after receiving a recommendation to take a lower level course was categorized as a true negative. If a student successfully completed a course at a higher level than that

recommended, that student was identified as a false negative. In other words, it was incorrect to have recommended against enrollment in that course for that student. If a student was unsuccessful in a course for which she/he had received a recommendation, that student was referred to as a false positive. In other words, it was incorrect to have recommended that course to that student. Ideally, the sum of the percents of true positives and true negatives would be one hundred and the total of the percents of false negatives and false positives would be zero.

This ideal was not achieved. Students who were fully capable of completing a class may have had to leave it for other than academic reasons. This would have created a false positive. A student may not have delivered an assessment test truly representative of her/his subject competence and then enrolled in a higher course than that recommended. If she/he then completed that course, for which the student was actually qualified, she/he would have created a false negative. Further, the test items or cut off levels may not have been perfect. This may have lead to recommendations that created either false negatives or false positives. Although it was not expected that the level of false positives and false negatives would be zero, there was the hope that most of the recommendations would be true (positives and negatives, collectively). Further, it was considered desirable to have the level of false positives comparable to the level of false negatives.

After calculating the levels of true and false recommendations for each cut off score on each test, it was found that the existing cut off scores were reasonable. The details of this analysis were included in the appendixes for each of the specific MDTP tests. On the basis of this analysis it was recommended that only a few minor adjustments be made in the cut off scores for future mathematics

placement recommendations. The recommended cut off scores were as follows:

Algebra Readiness Test:

Score: 26 and above	Recommend:	Beginning Algebra Level
Score: 25 and below	Recommend:	Arithmetic

Elementary Algebra Test:

Score: 28 and above	Recommend:	Intermediate Algebra
Score: 17 through 27	Recommend:	Beginning Algebra Level
Score: 16 and below	Recommend:	Arithmetic

Intermediate Algebra Test:

Score: 27 and above	Recommend:	Trigonometry/Statistics Level
Score: 20 through 26	Recommend:	Intermediate Algebra
Score: 12 through 19	Recommend:	Beginning Algebra Level
Score: 11 and below	Recommend:	Arithmetic

Pre-Calculus Test:

Score: 23 and above	Recommend:	Calculus
Score: 18 through 22	Recommend:	Pre-Calculus
Score: 17 and below	Recommend:	Intermediate Algebra

Single Semester Transfers

A total of sixty students transferred from one mathematics class to another during the first term in which they enrolled in mathematics following completion of the mathematics assessment process. In general, students who transferred to a less advanced class were successful, while those who transferred to a more advanced class were not. A total of twenty-three (thirty-eight percent) students transferred to a more advanced class. Of these transfers, the student successfully completed the second course in eight (thirty-five percent) instances. The number of students who transferred to a less advanced class was thirty-four (fifty-seven percent) and twenty-one (sixty-two percent) of these transfers were

successful. Three students transferred to a class at the same level as the first and one was successful.

Twenty-one students transferred to a lower course from intermediate algebra and thirteen (sixty-two percent) of these students were successful. Three students transferred from intermediate algebra to a more advanced class and none of these students were successful. The most common single transfer was from intermediate algebra to beginning algebra. A total of eighteen students (thirty percent) made this shift and eleven (sixty-one percent) of these were successful. The second most common transfer was from beginning algebra to intermediate algebra. A total of eight students (thirteen percent) made this change in their schedule. Two (twenty-five percent) of these students were successful.

Recommendations

1) As noted in the previous section, slight modifications to the cut off scores are recommended.

2) As discussed more fully in the appendices, it is recommended that students be informed of what assessment test they should choose if they have a good idea of the course into which they wish to enroll. For example, a student who thinks he/she will be enrolling in statistics should be told to take the Intermediate Algebra test.

3) It is recommended that consideration be given to providing a component of external motivation that will encourage students to do their best during the assessment session. There appears to be particular need for this at the higher course levels were students are much less likely to follow the recommendation coming from their performance on the assessment instrument and where they are likely to take an exam that does not provide a recommendation for the course in which they actually enroll. Within the Saddleback Community College

District discussions have begun concerning the institution of a telephone registration capability. This process and the associated computer support that would be associated with it would provide one means of implementing this recommendation. When a student called to enroll for a class, the computer could check to see if the student had met the prerequisite for the course or received a recommendation to enroll in that course from the mathematics assessment process. If so, the student would be enrolled. If not the student would be put on a waiting list and other students who met the criteria noted above, but who call in later, would be enrolled in the class. At some point in time, if the class had not closed, students would be moved from the waiting list on to the class list. This procedure would, hopefully, give those students with the greatest likelihood of completing a class a better chance of being able to enroll in it.

Appendix I

Algebra Readiness Test

Summary and Analysis

A total of 1287 Algebra Readiness tests were given between July 5, 1988 and January 11, 1989. For forty-one of these it was not possible to track the participant to determine if he/she had enrolled in a class in the District. Of the 1246 participants who could be tracked, 1163 (93.3 percent) enrolled in the District within three terms (fall semester, spring semester, summer session) following completion of the mathematics assessment process. Of these 1163 students, 644 (55.4 percent) enrolled in a mathematics class.

Based on the results from all the participants who took the Algebra Readiness test, the frequency distribution of scores on this assessment instrument was calculated and placed in figure I-1. The scores ranged from none correct to forty-eight correct on this fifty item instrument. The median score (i.e. the fiftieth percentile) was twenty-four and consequently most of those who took the Algebra Readiness test should have enrolled in an arithmetic class.

Based on the results from all the participants who chose the Algebra Readiness test and enrolled in a mathematics class during at least one of the three terms immediately following completion of the test, the frequency distribution of scores on this assessment instrument was calculated and placed in figure I-2. The scores ranged from none correct to forty-eight correct. The median scores was twenty-four. This distribution did not significantly differ from that for the population as a whole. The range of scores and median score achieved by those who actually enrolled in a mathematics course were the same as the population of participants who chose this test.

Figure I-1
Frequency Distribution of Scores for
All Participants Who Chose the
Algebra Readiness Test

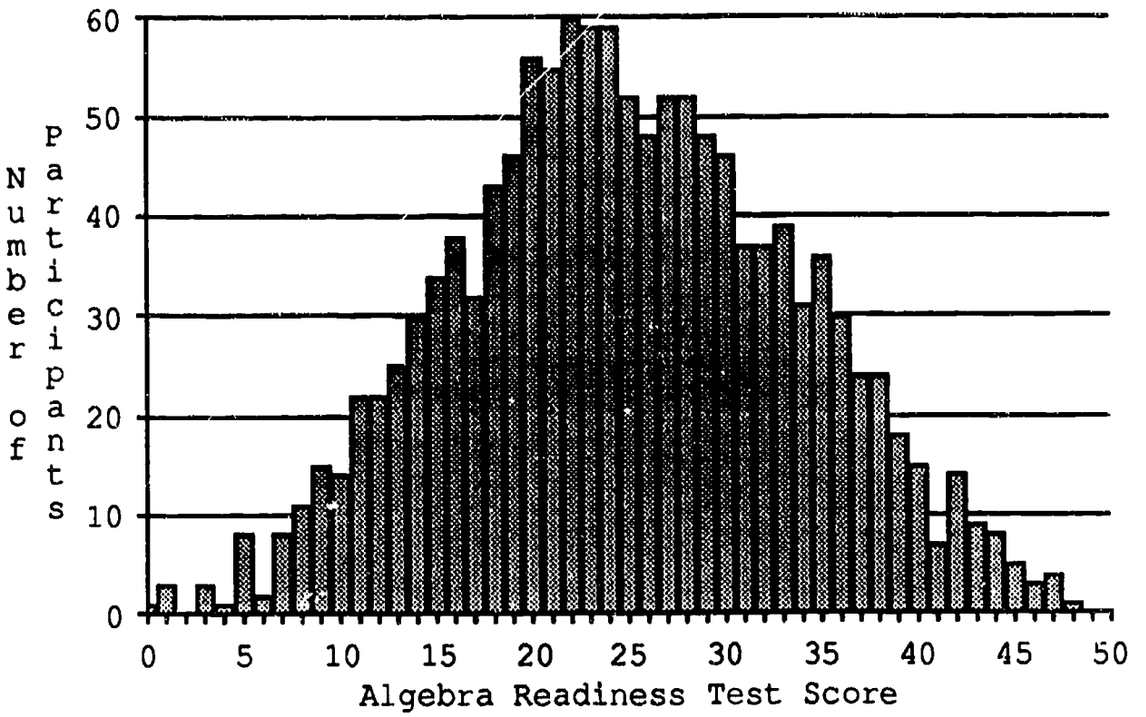
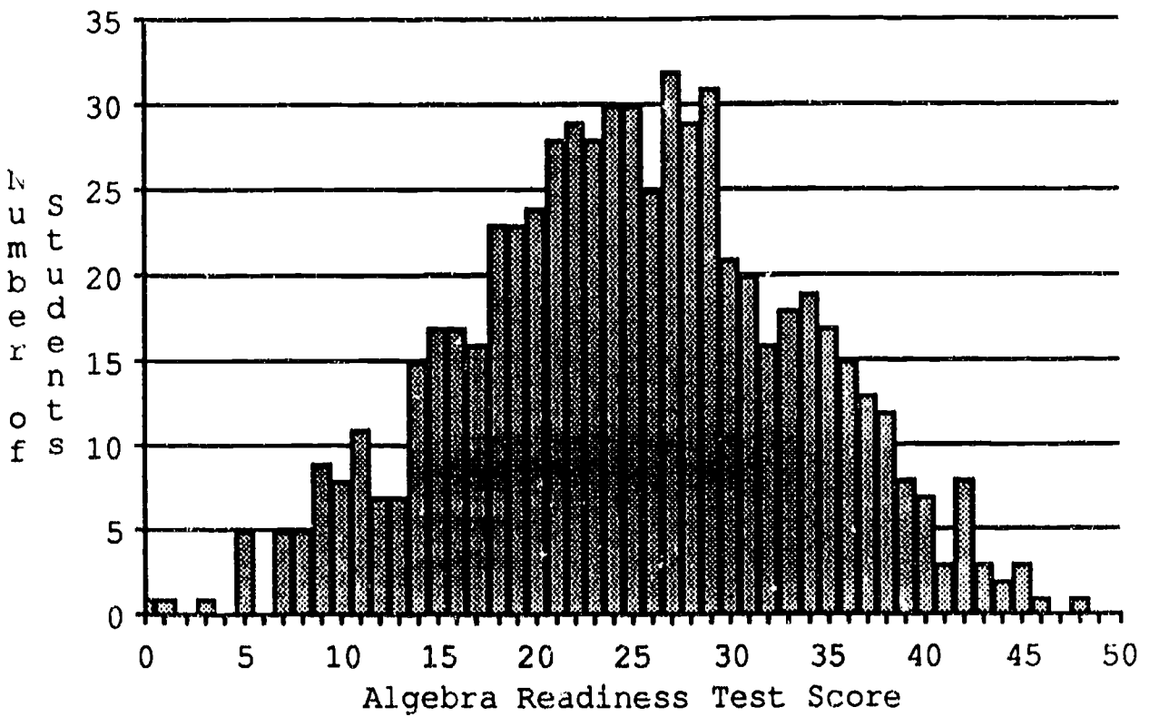


Figure I-2
Frequency Distribution of Scores for All Those
Who Chose the Algebra Readiness Test and
Enrolled in a Mathematics Course



The distribution of course recommendations and actual course enrollments were placed in figure I-3 and I-4 for those 644 individuals who chose the Algebra Readiness test and later enrolled in a mathematics course.

It was clear from a review of figures I-3 and I-4 that the actual course enrollments were somewhat different from the recommendations given to students based on their performance on the Algebra Readiness test. Of the 644 students who chose the Algebra Readiness test and later enrolled in a mathematics course, 480 (74.5 percent) enrolled in the recommended course. A total of 134 (20.8 percent) enrolled in a higher level course than that recommended.

In general students who placed themselves in a course at a higher level than that recommended were less successful. While forty percent of the 480 students who followed the recommendation were successful, this was the case for only seventeen percent of the 134 students who enrolled in a higher level course than that recommended.

Participants in the matriculation process who selected the Algebra Readiness test were about as likely to enroll in a mathematics class as not. While there are possibly many explanations for this, one may be that most students simply are at this very basic level in mathematics competency and are pursuing interests that do not require the development of a high degree of such competency. Thus these students do not face a long string of mathematics courses in their future and can comfortably delay their enrollment in a mathematics course.

Students who select the Algebra Readiness test are highly likely to follow the recommendation given. Of those who chose not to follow the course placement recommendation given them, most (ninety-two students) were placed into arithmetic and enrolled in beginning algebra. These students evidently did not feel that their

Figure I-3
Distribution of Course Recommendations
for Those Who Enrolled in a
Mathematics Class
N = 644

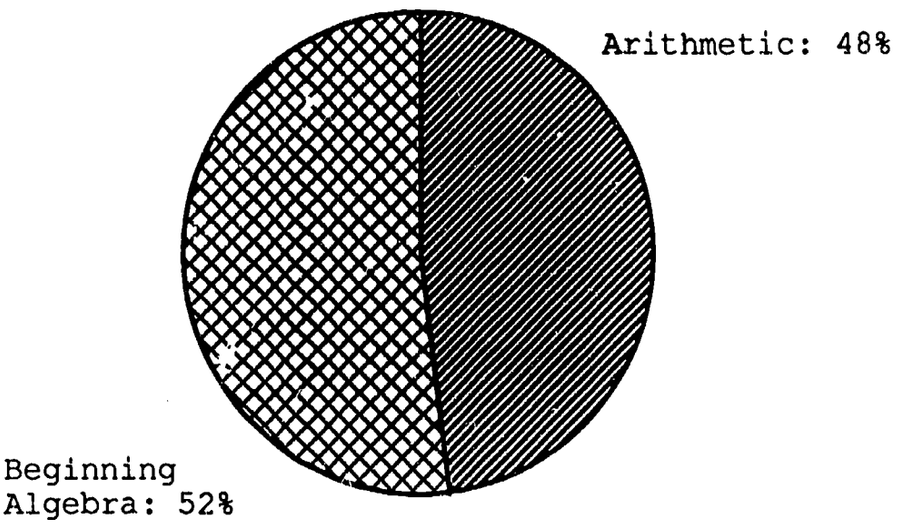
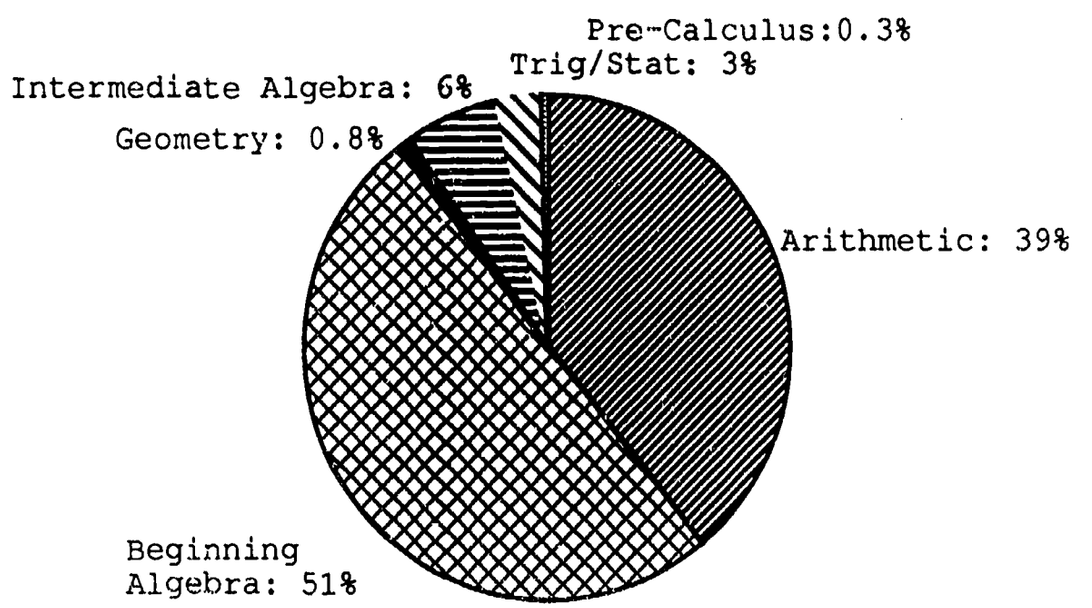


Figure I-4
Distribution of Actual Enrollments in
Mathematics Classes
N = 644



performance on the test was truly representative of their arithmetic competence or did not feel that the cut off scores used in the recommendation process were appropriate. The success rate of these

students was twenty-six percent while the success rate for those who followed the placement recommendation into beginning algebra was seventy percent. Since the success rate of those students who placed themselves in the beginning algebra course was nearly one-third that of those who followed the the placement recommendation into this algebra course, it appeared that this was not a wise decision for the students to have made.

Of further interest was that group of sixty-two students who enrolled in a course for which the Algebra Readiness test provided no recommendation. They enrolled in courses at the intermediate algebra, trigonometry/statistics, and pre-calculus levels. It was doubtful that the actual scores the students received on the Algebra Readiness test influenced their decisions to enroll in these courses because the range of scores ran from ten to forty-three. At the time they selected the assessment test it was possible that these students already knew into which course they were going to enroll. They perhaps selected a test far below the capability of those who would be successful in these courses in order to minimize the amount of effort they would need to expend to complete the matriculation process. The success rate of these students was a disaster. Only seven (11.2 percent) successfully completed the course in which they enrolled.

It is recommended that, during the period when students are advised about the test choices they have, students who are interested in taking pre-calculus or calculus be instructed to take the Pre-Calculus test. Students who are interested in taking trigonometry, statistics, finite mathematics, mathematics for liberal arts students, mathematics for elementary school teachers, and the brief course in calculus should be instructed to take the Intermediate

Algebra test. Students who are interested in taking intermediate algebra should be instructed to take the Elementary Algebra test.

Adjustment of the Cut Off Score:

At the time these assessment tests were taken, the minimum score for beginning algebra was twenty-six. The sum of the true positives and negatives was 51.9 percent. The false positive rate was 42.4 percent and the rate of false negatives was 5.8 percent. It was obvious that the false positive rate was uncomfortably high and that it would be very desirable to lower it even at the expense of increasing the false negative rate that was quite low. This adjustment was attempted, but it was found that relative little of significance could be accomplished. This was because the range of scores for unsuccessful students extended as high as forty-four correct out of the fifty possible. As an example, if the cut off score was raised to twenty-eight, the false positive rate would be lowered to 33.8 percent but the false negative rate would be doubled (11.9 percent). The sum of the true positives and true negatives would increase only slightly more than two percentage points. If the cut off score were made equivalent to the mastery level of thirty-five set by the authors of the test itself, the false positive rate would lie at a comfortable 12.2 percent but the false negative rate would be an unacceptable 24.7 percent. It was therefore recommended that the current minimum score of twenty-six be maintained for future testing.

The actual scores on the Algebra Readiness test received by students were placed in Table I-1 along with the courses in which they enrolled and an indication of their success in those courses. Students were considered successful (denoted S) if they received a

grade of A, B, or C. Otherwise they were considered not successful (denoted NS).

Table I-1
Algebra Readiness Test Scores vs Course Success

	Arith		Beg. Alg		Geom		Int. Alg.		Trig/Stat		Pre-Calc		Calc		Row
Score	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	Total
0	1														1
1	1														1
2															0
3	1														1
4															0
5	3	1		1											5
6															0
7	5														5
8	2	2	1												5
9	8	1													9
10	6	1					1								8
11	5	4	1						1						11
12	3	1	2	1											7
13	4	0	2	1											7
14	7	5	1	1			1								15
15	6	9	1				1								17
16	6	7	1	2			1								17
17	7	5	3	1											16
18	9	9	5												23
19	12	5	3	1	1				1						23
20	3	13	6	1			1								24
21	9	6	10	2			1								28
22	13	9	4	1	1			1							29
23	13	7	6				1		1						28
24	10	5	10	4			1								30
25	2	6	17	3					2						30
26	1	2	11	8	1		1		1						25
27	1		17	12			2								32
28	3	2	13	7			4								29
29	1		13	12			2		1	1	1				31
30	1	3	12	5											21
31	1		9	7			1		2						20
32			9	4			3								16
33	1	1	10	5			1								18
34	3	1	9	2			2		1		1				19
35			8	5			2	1	1						17
36			7	5			2		1						15
37			5	6			2								13
38			3	4			3	1	1						12
39			2	4					1	1					8
40			3	3	1										7
41				2			1								3
42		1	4	1		1				1					8
43			1	1			1								3
44			1	1											2
45				3											3
46			1												1
47															0
48			1												1
49															0
50															0
Total	148	106	212	116	4	1	35	3	14	3	2	0	0	0	644

Appendix II

Elementary Algebra Test

Summary and Analysis

A total of 703 Elementary Algebra tests were given between July 5, 1988 and January 11, 1989. For only nine of these was it not possible to track the participant to determine if she/he had enrolled in a class in the District. Of the 694 participants who could be tracked, 662 (95.4 percent) enrolled in the District within three terms (fall semester, spring semester, summer session) following completion of the mathematics assessment process. Of these 662 participants, 436 (65.9 percent) enrolled in a mathematics class.

Based on the results from all the participants who took the Elementary Algebra test, the frequency distribution of scores on this assessment instrument was calculated and placed in figure II-1. The scores ranged from one correct to forty-eight correct on this fifty item exam. The median score (i.e. the fiftieth percentile) was twenty-one and consequently most of those who took the Elementary Algebra test should have enrolled in a beginning algebra or arithmetic course.

Based on the results from all the participants who chose the Elementary Algebra test and enrolled in a mathematics class during at least one of the three terms immediately following completion of the test, the frequency distribution of scores on this assessment instrument was calculated and placed in figure II-2. The scores ranged from five correct to forty-five correct. The median score was twenty-one. This distribution did not significantly differ from that for the population as a whole shown in figure II-1. The range of scores for those who actually enrolled was slightly smaller. The medians for the two distributions were identical.

Figure II-1
Frequency Distribution of Scores for
All Participants Who Chose the
Elementary Algebra Test

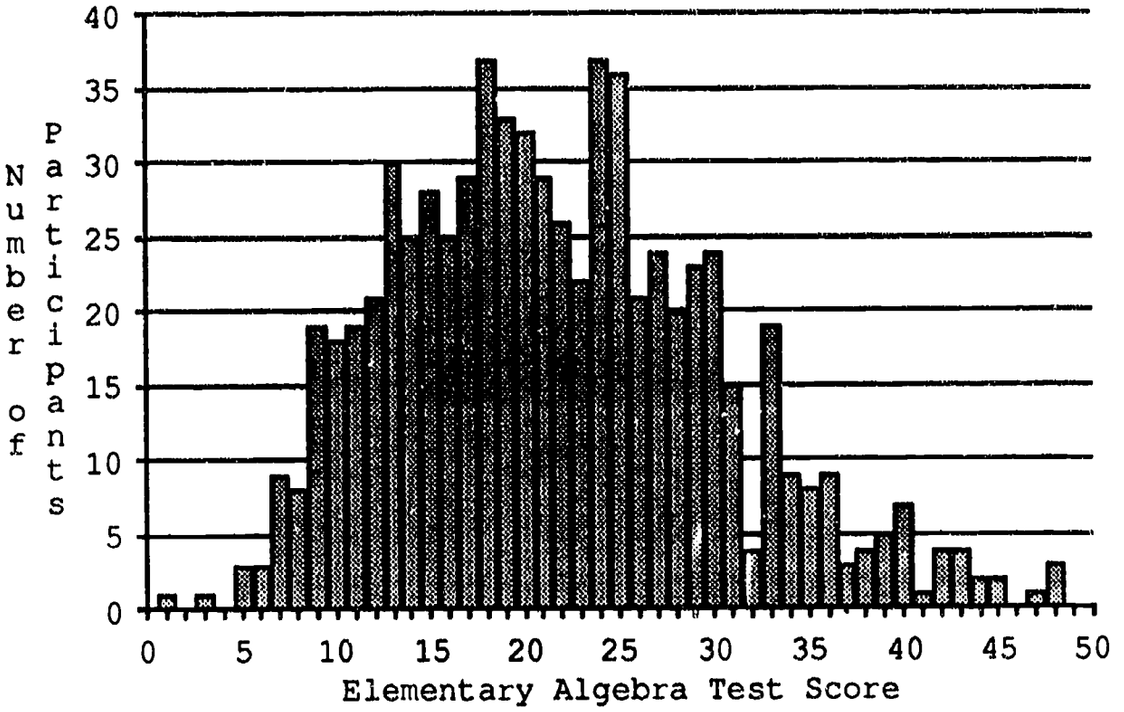
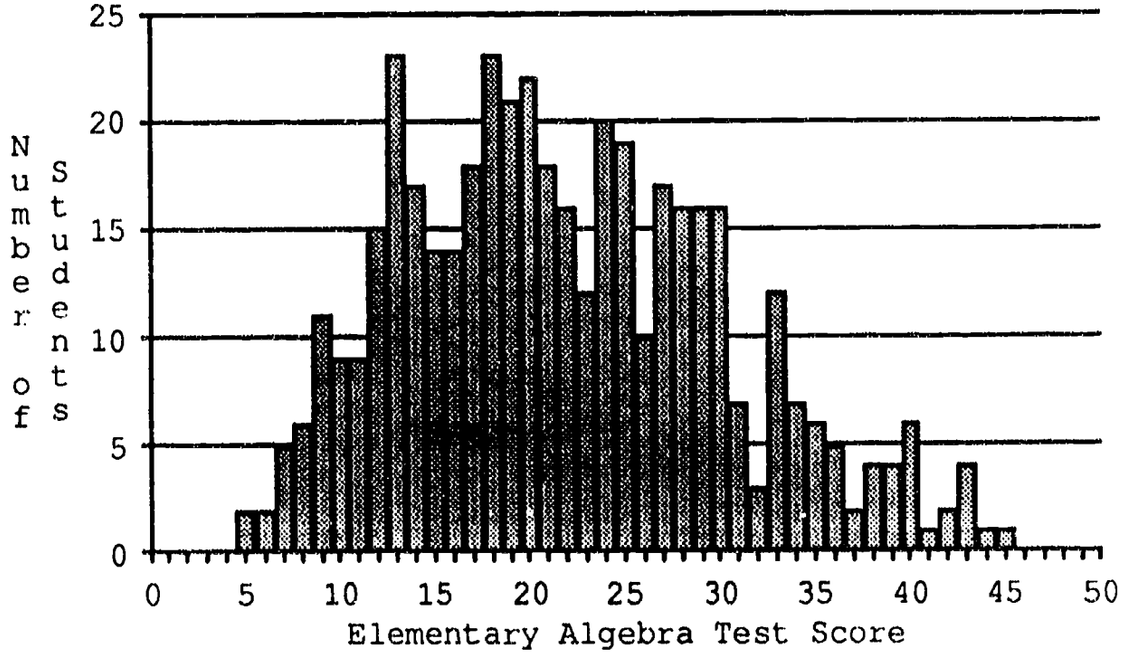


Figure II-2
Frequency Distribution of Scores for
All Those Who Chose the Elementary
Algebra Test and Enrolled
in a Mathematics Course



The distribution of course recommendations and actual course enrollments were placed in figures II-3 and II-4 for those 436 individuals who chose the Elementary Algebra test and later enrolled in a mathematics course.

Figure II-3
Distribution of Course Recommendations
for Those Who Enrolled in a
Mathematics Class
N = 436

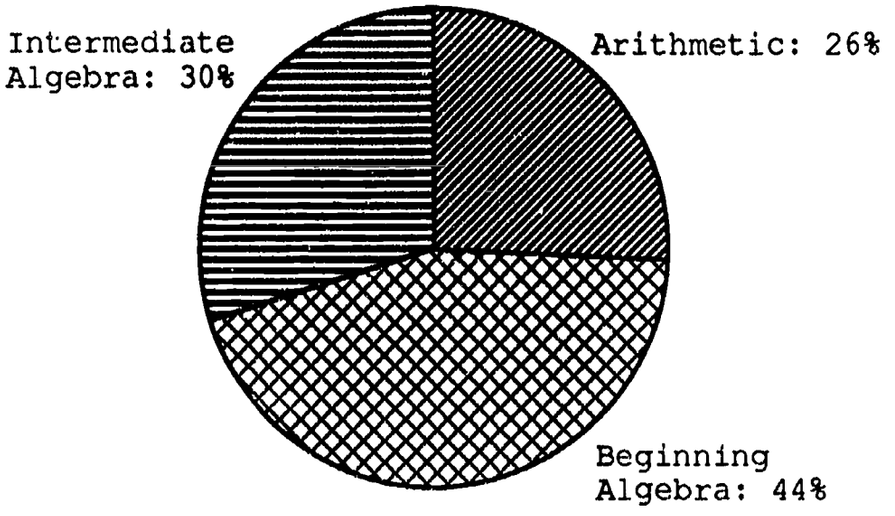
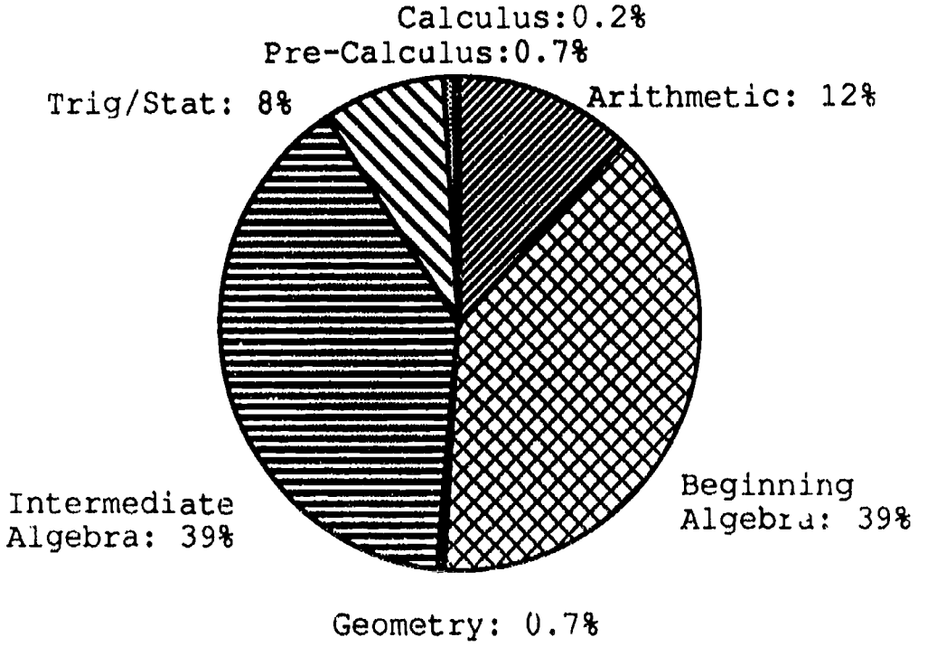


Figure II-4
Distribution of Actual Enrollments in
Mathematics Classes
N = 436



The actual course enrollments were somewhat different from the recommendations given to students based on their performance on the Elementary Algebra test. Of the 436 students who chose the Elementary Algebra test and later enrolled in a mathematics course 272 (62.4 percent) enrolled in the recommended course. A total of 154 (35.3 percent) enrolled in a higher level course than that recommended.

In general, students who placed themselves in a course at a higher level than that recommended were less successful. While fifty percent of the 272 students who followed the recommendation were successful, this was the case for only thirty-one percent of the 154 students who enrolled in a higher level course than that recommended.

The participants in the matriculation process who selected the Elementary Algebra test were highly likely to enroll in a mathematics course. The odds in favor of their enrolling were nearly two to one. With nearly these same odds they were likely to enroll in the recommended course. Of those who chose not to follow the course placement recommendation given them, most (105 students) were placed into arithmetic and enrolled in beginning algebra or were placed in beginning algebra and enrolled in intermediate algebra. These students evidently did not feel that their performance on the test was truly representative of their mathematics competence or did not feel that the cut off scores used in the recommendation process were appropriate. The success rate of these students was thirty-one percent while the success rate for those who followed the placement recommendation into these courses was fifty-three percent. Since the success rate of those students who placed themselves in the course immediately above the recommended course was nearly one-half that of those who followed the the placement recommendation into these two

algebra courses, it appeared that this was a risky decision for the students to have made.

Of further interest was that group of forty students who enrolled in a course for which the elementary algebra test provided no recommendation. An implied recommendation could be made for the three students who enrolled in geometry. Since geometry had a beginning algebra prerequisite, a student placing into intermediate algebra based on an appropriate score on the Elementary Algebra test would have been expected to be successful in a geometry course. As it turns out neither of the three geometry students scored well enough to be placed into intermediate algebra. The remaining thirty-seven students enrolled in courses at the trigonometry/statistics, pre-calculus, or calculus levels. It was doubtful that the actual scores the students received on the Elementary Algebra test influenced their decision to enroll in these courses because the range of scores was enormous. These students received scores from seven correct to forty-three correct. At the time they selected the test it was possible that these students already knew into which course they were going to enroll. They perhaps selected a test far below the capability of those who would be successful in these courses to minimize the amount of effort they would need to expend to complete the matriculation process. One student received a score of twelve correct and then proceeded to earn a B in calculus. It was impossible for this score to have accurately represented his/her knowledge of beginning algebra. Of the fifty questions, he/she answered only twenty-nine. How long it took him/her to mark the answers to these questions was unknown. It seems clear that he/she already knew into which course he/she was going to enroll and completed the test (and chose one far below his/her capability) to simply satisfy a requirement for registration.

It is recommended that, during the period when students are advised about the test choices they have, students who are interested in taking pre-calculus or calculus be instructed to take the Pre-Calculus test. Students who are interested in taking, trigonometry, statistics, finite mathematics, mathematics for liberal arts students, mathematics for elementary school teachers, and the brief course in calculus should be instructed to take the Intermediate Algebra test rather than the Elementary Algebra test.

Adjustment of the Cut Off Scores:

It is recommended that the cut off scores each be raised by one. For a beginning algebra level cut off at seventeen, the sum of the true positives and true negatives would be raised to sixty-two percent from the fifty-nine percent level while the false positives would fall by five percentage points to twenty-seven percent and the false negative would increase only two points to eleven percent. For the intermediate algebra cut off at the recommended level of twenty-eight, the sum of the true positives and true negatives would rise from fifty-eight to sixty-four percent, while the false positive level would fall by six percentage points to twenty-five percent and false negatives would rise just two points to twelve percent.

The actual scores on the Elementary Algebra test received by students was placed in Table II-1 along with the courses in which they enrolled and an indication of their success in those courses. Students were considered successful (denoted S) if they received a grade of A, B, or C. Otherwise they were considered not successful (denoted NS).

Table II-1
Elementary Algebra Test Scores vs. Course Success

	Arith		Beg. Alg		Geom		Int. Alg.		Trig/Stat		Pre-Calc		Calc		Row
Score	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	Total
0															0
1															0
2															0
3															0
4															0
5	1	1													2
6				1		1									2
7	1	1	2						1						5
8	2	1	2	1											6
9	3	3	3				1		1						11
10	5	1	2							1					9
11	2		4	2					1						9
12	4	3	5	1			1							1	15
13	6	6	3	6			2								23
14	4	3	3	2			3		1	1					17
15	1		9	2			2								14
16	1		8	4			1								14
17	1	1	4	6			6								18
18			11	8		1	3								23
19			6	8			5	1	1						21
20			6	9			3	1	2		1				22
21			5	5			5	2	1						18
22			1	5	1		3	3		3					16
23			3	3			3	3							12
24	2		6	7			4	1							20
25				10			4	3	1		1				19
26			3	1			2	4							10
27				2			11	3	1						17
28			1	1			8	6							16
29							8	6		2					16
30							10	4	1	1					16
31							2	5							7
32							1		2						3
33							3	8			1				12
34							2	1	2	2					7
35								5	1						6
36		1					2	1	1						5
37							1	1							2
38								4							4
39							1	2	1						4
40							2	3	1						6
41									1						1
42							1			1					2
43								2	1	1					4
44							1								1
45								1							1
46															0
47															0
48															0
49															0
50															0
Total	33	21	87	84	1	2	101	70	21	12	3	0	0	1	436

Appendix III

Intermediate Algebra Test

Summary and Analysis

A total of 272 Intermediate Algebra tests were given between July 5, 1988 and January 11, 1989. For only nine of these was it not possible to track the participant to determine if she/he had enrolled in a class in the District. Of the 263 participants who could be tracked, 249 (94.7 percent) enrolled in the district within three terms (fall semester, spring semester, summer session) following completion of the mathematics assessment process. Of these 249 students, 187 (75.1 percent) enrolled in a mathematics class.

Based on the results from all the participants who took the Intermediate Algebra test, the frequency distribution of scores on this assessment instrument was calculated and placed in figure III-1. The scores ranged from three correct to forty-one correct on this forty-five question exam. The median score (i.e. the fiftieth percentile) was seventeen and consequently most of those who took the Intermediate Algebra test should have enrolled in a beginning algebra level course or an arithmetic course.

Based on the results from all the participants who chose the Intermediate Algebra test and enrolled in a mathematics class during at least one of the three terms immediately following completion of the test, the frequency distribution of scores on this assessment instrument was calculated and placed in figure III-2. The scores ranged from four correct to forty correct. This distribution did not significantly differ from that for the population as a whole. The median score achieved by those actually enrolled in a mathematics course was eighteen and thus one point higher than that for the

Figure III-1
Frequency Distribution of Scores for
All Participants Who Chose the
Intermediate Algebra Test

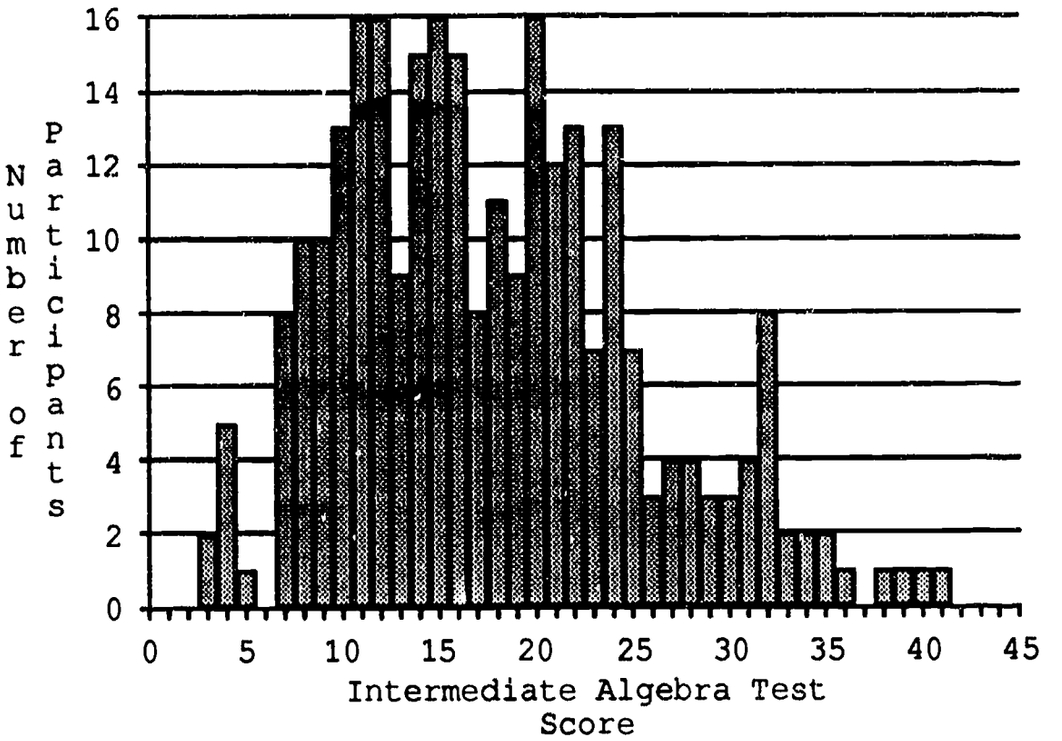
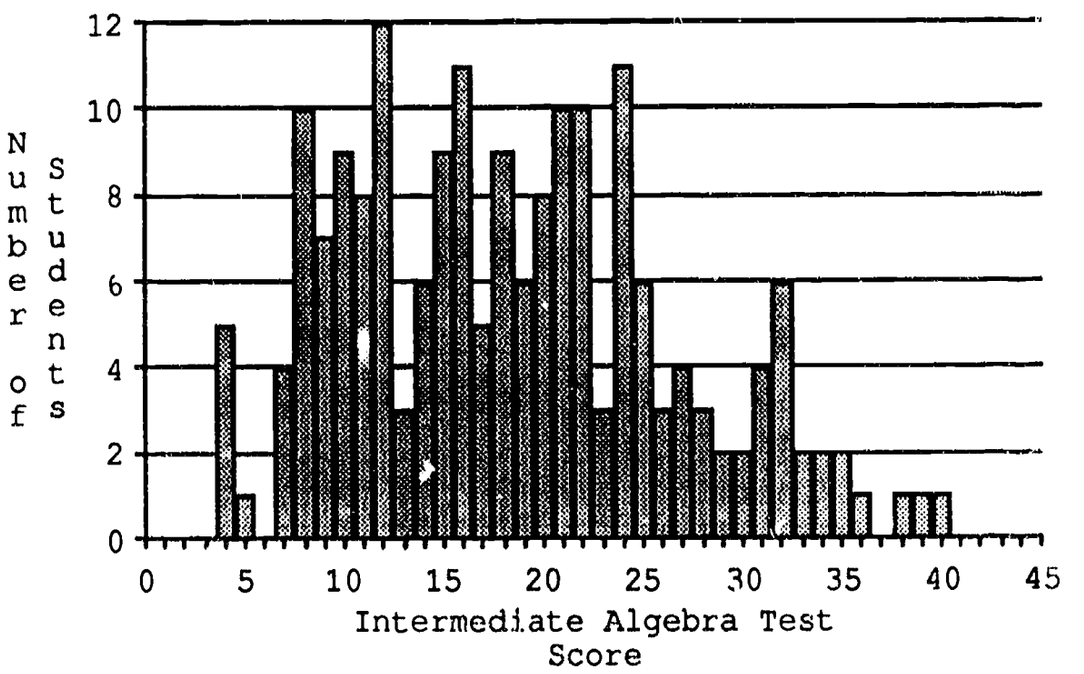


Figure III-2
Frequency Distribution of Scores for
All Those Who Chose the Intermediate
Algebra Test and Enrolled in a
Mathematics Course



population of participants who chose this test. The range of scores was essentially the same.

The distribution of course recommendations and actual course enrollments was placed in figures III-3 and III-4 for those 187 individuals who chose the Intermediate Algebra test and later enrolled in a mathematics course.

The actual course enrollments were significantly different from the recommendations given to students based on their performance on the Intermediate Algebra test. Of the 187 students who chose the Intermediate Algebra test and later enrolled in a mathematics course sixty-four (34.2 percent) enrolled in the recommended course. A total of 123 (65.8 percent) enrolled in a higher level course than that recommended.

In general students who placed themselves in a course at a higher level than that recommended were less successful. While sixty-one percent of the sixty-four students who followed the recommendation successfully completed the course, this was the case for just forty-one percent of those 123 students who did not enroll in the recommended course.

Participants in the matriculation process who selected the Intermediate Algebra test were almost certain to enroll in a mathematics class and likely to enroll in a class at a higher level than that suggested by their performance on the test. While there may have been many explanations for this it was possible that many of these students were following programs that required a fairly high degree of mathematical competency. Therefore the students were already aware of what courses they needed to take and were anxious to make progress with respect to completion of those requirements. If they scored low on the test, they may have been unwilling to take a course too far back from the ones that counted toward their degree

Figure III-3
Distribution of Course Recommendations
for Those Who Enrolled in a
Mathematics Class
N = 187

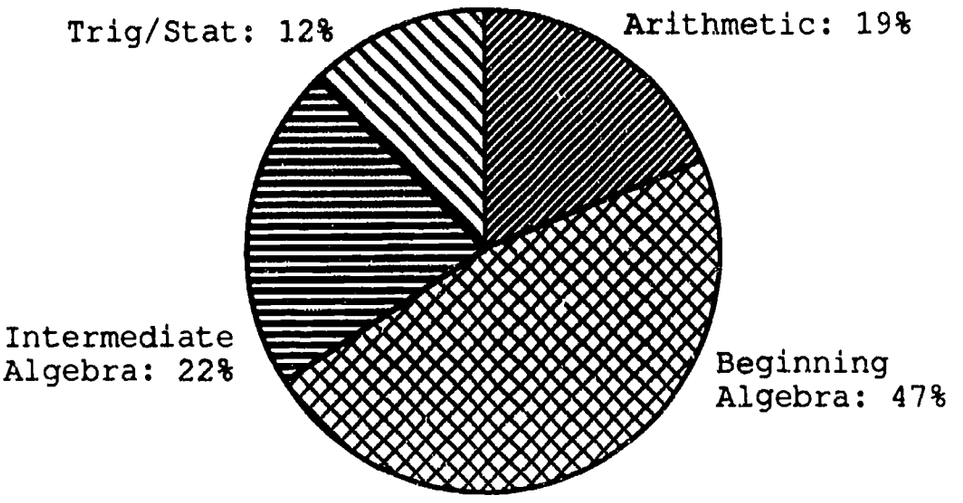
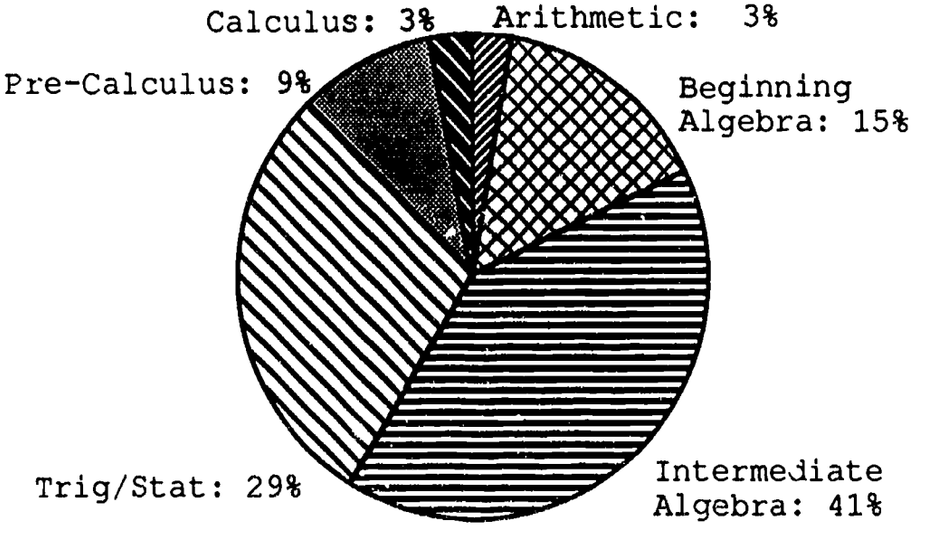


Figure III-4
Distribution of Actual Enrollments in
Mathematics Classes
N = 187



and thus enrolled in a higher level course. Also, if they already knew what courses they needed to take, they may elected not to sufficiently apply themselves during the testing period to achieve the score necessary for a recommendation into one of those courses.

They may have then proved to be successful in this higher level course, not because of a fault in the test or the cut off scores, but because they did chose to apply themselves to the actual course in order to achieve the desired grade. This explanation likely applied to one of the students who scored only four correct on this forty-five question test and then went on to successfully completed intermediate algebra. Since she/he only answered eight of the questions it was doubtful the assessment process was taken very seriously.

Because it was likely that students taking the Intermediate Algebra test had already decided into which course they will enroll (they freely enrolled in courses other than those recommended during the period of this investigation), it was disturbing that twelve percent of the students enrolled in a course for which this test provided no recommendation. This test provided no recommendation for a student to enroll in a pre-calculus or calculus course. It is recommended that during the period when students are advised about the test choices they have, that students who are interested in taking pre-calculus or calculus be instructed to take the Pre-Calculus test rather than the Intermediate Algebra test.

Adjustment of the Cut Off Scores:

It is recommended that the cut off scores for this exam be adjusted slightly. By raising the beginning algebra minimum level one point to twelve, the sum of the true positives and true negatives would be increased from fifty-four percent to sixty-four percent. The level of false positives would be lowered a total of fourteen percentage points to twenty-five percent while the false negative rate would raise four percentage points to eleven percent.

If the intermediate algebra cut off score were lowered two points to twenty, the sum of the true positives and true negatives would be raised from sixty-two percent to sixty-seven percent. The false negative rate would be lowered from twenty-seven percent to eighteen percent. Although this level was higher than desirable, the scores of successful students in the intermediate algebra course range from four to twenty-eight. To lower the false negative rate to ten percent would require a very high level (thirty-one percent) for the false positive rate. It was doubtful that the students who scored four correct on the exam and then successfully completed intermediate algebra allowed the exam to accurately reflect their level of mathematics competency. As was mentioned above, one of these individuals only answered eight of the forty-five questions on the test. It was likely that the student already knew into which course she/he was going to enroll and only engaged in the exam to complete a requirement for registration. One must be careful not to use this student's score to adjust placement levels for recommendations to other students actually seeking guidance.

If the trigonometry/statistics level minimum were lowered to twenty-seven, the sum of the true positives and true negatives would increase from sixty percent to sixty-three percent and the false negatives lowered from thirty-one percent to twenty-five percent. Again scores of successful students ranged from twelve (a student in the liberal arts mathematics course) to forty (a student in the trigonometry course). To lower the false negative rate to ten percent would cause the false positive rate to exceed twenty-five percent and the cut off score would be placed at a lower than appropriate level for this set of courses. While some of the problem here may again be students not allowing the exam score to accurately reflect their mathematical skills, there may be another aspect at

work. The difficulty levels of the courses in this group vary widely although they all have the same prerequisite course (intermediate algebra). The brief course in calculus is generally considered more difficult than the liberal arts mathematics course. It may not be reasonable to have the same cut off score for these two courses. It may be that certain of these courses have a greater requirement for competency of the material in the prerequisite course than others.

The actual scores on the Intermediate Algebra test received by students were placed in Table III-1 along with the courses in which they enrolled and an indication of their success in those courses. Students were considered successful (denoted S) if they received a grade of A, B, or C. Otherwise they were considered not successful (denoted NS).

Table III-1
Intermediate Algebra Test Scores vs Course Success

	Arith		Beg. Alg.		Geom		Int. Alg.		Trig/Stat		Pre-Calc		Calc		Row
Score	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	Total
0															0
1															0
2															0
3															0
4			1				2	2							5
5		1													1
6															0
7		1	1				2								4
8		1	1	1			3		2		2				10
9	1	1	1				3		1						7
10			1	1			4	3							9
11			4	1			1		2						8
12			1	1			3	3	2	1	1				12
13			1								2				3
14			1	2				1	1	1					6
15			1	1			3	2	2						9
16			1	2			3		2	3					11
17							2	1		2					5
18			1	2			3	1			2				9
19							2	1	2	1					6
20			1				2	3		1		1			8
21				1			1	4	1	1		1	1		10
22							5	2	1	2					10
23								1	1				1		3
24								5	2	1	1	2			11
25							1	3	1	1					6
26							1		1				1		3
27								2		1		1			4
28							1	1		1					3
29									1	1					2
30										1		1			2
31									1	3					4
32									3	2		1			6
33									1	1					2
34										2					2
35														2	2
36												1			1
37															0
38														1	1
39										1					1
40										1					1
41															0
42															0
43															0
44															0
45															0
Total	1	4	16	12	0	0	42	35	27	28	8	8	3	3	187

Appendix IV

Pre-Calculus Test

Summary and Analysis

A total of ninety-two Pre-Calculus tests were given between July 5, 1988 and January 11, 1989. For only one of these was it not possible to track the participant to determine if he/she had enrolled in a class in the District. Of the ninety-one participants who could be tracked, seventy-nine (86.8 percent) enrolled in the District within three terms (fall semester, spring semester, summer session) following completion of the mathematics assessment process. Of these seventy-nine participants, sixty-nine (87.3 percent) enrolled in a mathematics class.

Based on the results from all the participants who took the Pre-Calculus test, the frequency distribution of scores on this assessment instrument was calculated and placed in figure IV-1. The scores ranged from one correct to thirty-seven correct on this forty item test. The median score (i.e. the fiftieth percentile) was sixteen and consequently most of those who took the pre-calculus test should have enrolled in an intermediate algebra or lower level class.

Based on the results from all the participants who chose the Pre-Calculus test and enrolled in a mathematics class during at least one of the three terms immediately following completion of the test, the frequency distribution of scores on this assessment instrument was calculated and placed in figure IV-2. The scores ranged from one correct to thirty-seven correct. This distribution was not significantly different from that for the population as a whole. The range of scores and median score achieved by those actually enrolled in a mathematics course was the same as the population of participants who chose this test.

Figure IV-1
Frequency Distribution of Scores for
All Participants Who Chose the
Pre-Calculus Test

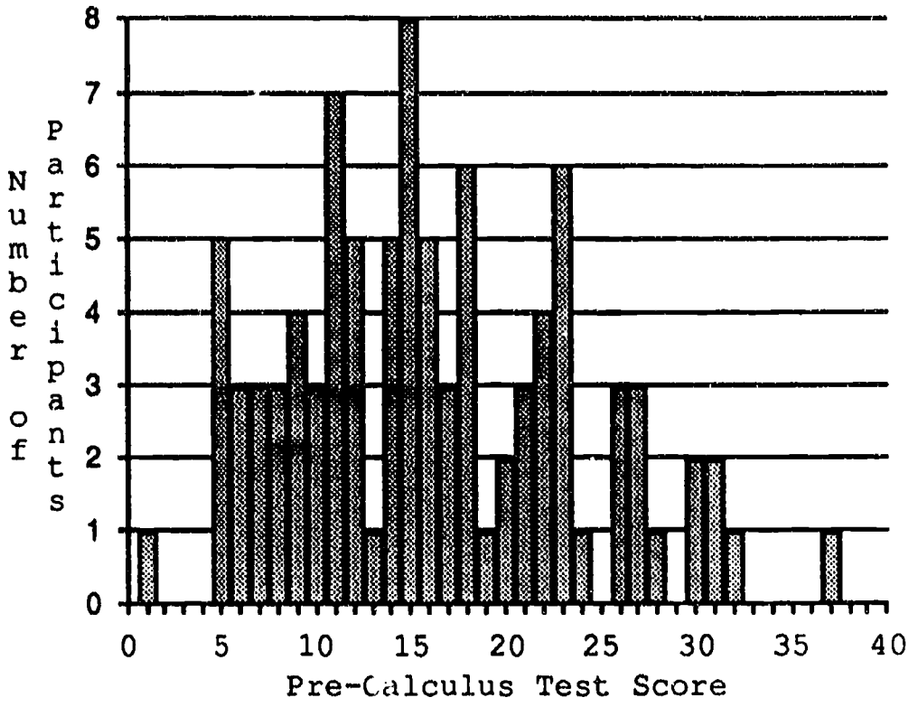
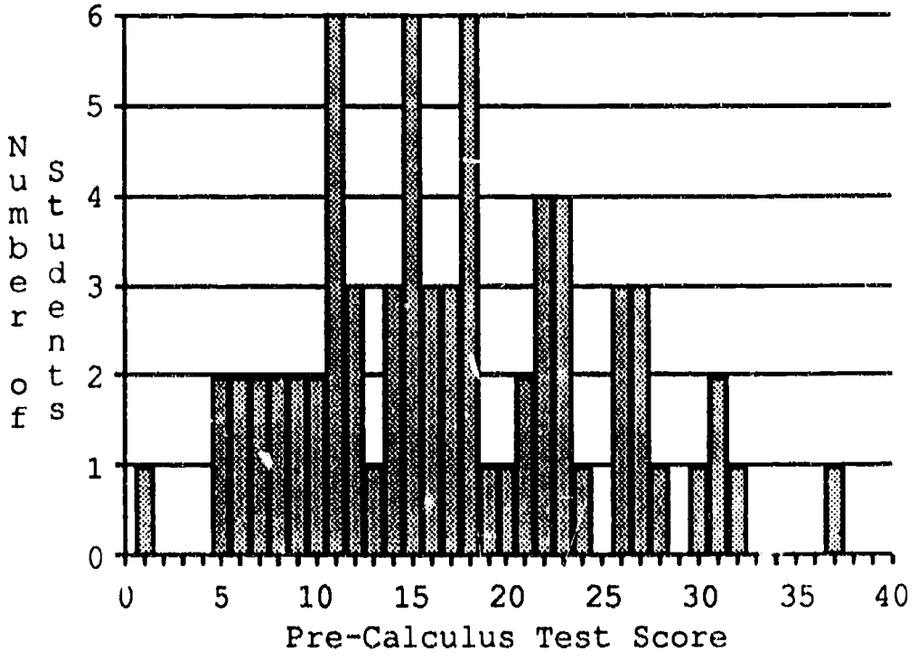


Figure IV-2
Frequency Distribution of Scores for
All Those Who Chose the Pre-Calculus
Test and Enrolled in a Mathematics
Course



The distribution of course recommendations and actual course enrollments was placed in figures IV-3 and IV-4 for those sixty-nine individuals who chose the Pre-Calculus test and later enrolled in a mathematics course.

The actual course enrollments were significantly different from the recommendations given to students based on their performance on the Pre-Calculus test. Of the sixty-nine students who chose the Pre-Calculus test and later enrolled in a mathematics course only twenty-five (36.2 percent) enrolled in the recommended course. A total of forty-three (62.3 percent) enrolled in a higher level course than that recommended. Only eight of the forty-five students who were given a recommendation to enroll in intermediate algebra followed that recommendation and these were not the lowest scoring students. Of those eleven students who scored nine or lower, only two enrolled in intermediate algebra. This was one less than the number who enrolled in calculus. Of the three lowest scoring students, one enrolled in trigonometry, one enrolled in finite mathematics, and one enrolled in pre-calculus. None of these three students successfully completed the course into which he/she enrolled.

In general, students who placed themselves in a course at a higher level than that recommended were less successful. While sixty-four percent of the twenty-five students who followed the recommendation were successful, this was the case for only forty-four percent of the forty-three students who enrolled in a higher level course that that recommended.

It was clear that participants in the matriculation process who selected the Pre-Calculus test were almost certain to enroll in a mathematics class and likely to enroll in a class at a higher level than that suggested by their performance on the test. While there may have been many explanations for this it is possible that many of

Figure IV-3
Distribution of Course Recommendations
for Those Who Enrolled in a
Mathematics Class
N = 69

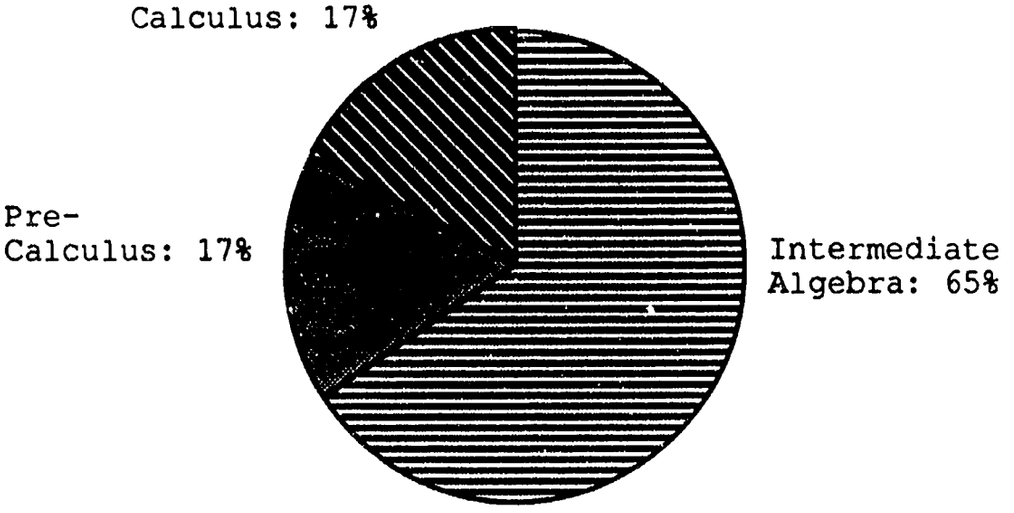
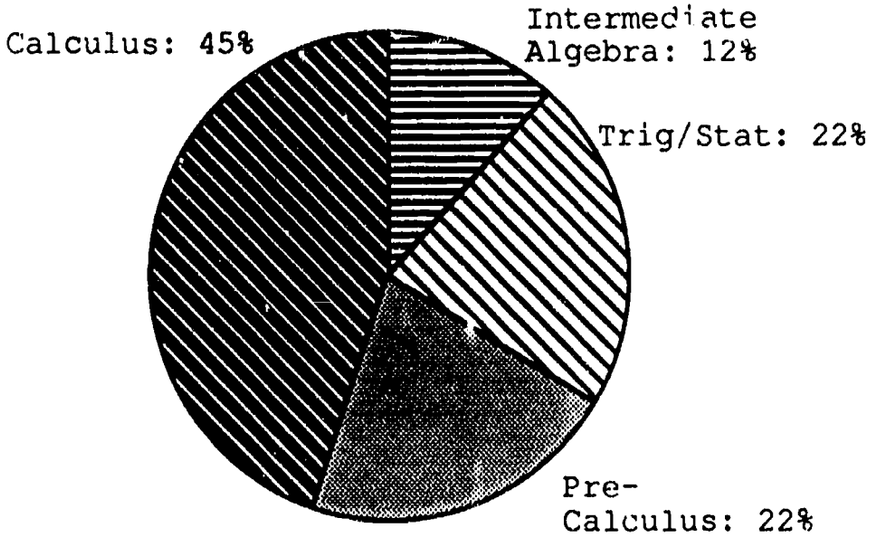


Figure IV-4
Distribution of Actual Enrollments in
Mathematics Classes
N = 69



these students were following programs that required a fairly high degree of mathematical competency. Therefore the students were already aware of what courses they needed to take and were anxious to make progress with respect to completion of those requirements. If they scored low on the test, they may have been unwilling to take a

course too far back from the ones that counted toward their degree. Also, if they already knew what courses they needed to take, they may have elected to not sufficiently apply themselves during the testing period to achieve the score necessary for a recommendation into one of these courses. They may have then proved to be successful in this higher level course, not because of a fault in the test or the cut off scores, but because they did chose to apply themselves to the actual course to achieve the desired grade.

Because it was likely that students taking this test had already decided into which course they were to enroll, it was disturbing that almost a quarter of the students enrolled in a course for which this test provided no recommendation, specifically the trigonometry/statistics level. It is recommended that during the period when students are advised about the test choices they have, that students who are interested in taking trigonometry, statistics, finite mathematics, mathematics for liberal arts students, mathematics for elementary school teachers, or the brief course in calculus be instructed to take the Intermediate Algebra test rather than the Pre-Calculus test.

Adjustment of the Cut Off Scores:

It is recommended that the cut off scores for the Pre-Calculus exam be adjusted slightly. By lowering the pre-calculus minimum level score two points to eighteen the sum of the true positives and true negatives would increase from forty-six percent to fifty-four percent while the false negative rate would decrease from thirty-three percent to twenty percent. If the calculus cut off score were similarly lowered two points to twenty-three the sum of the true positives and true negatives would be increased from fifty-two percent to sixty-four percent while the false negative rate would be

lowered from thirty-two percent to nineteen percent. The false positive rate would be unchanged at sixteen percent.

The actual scores on the Pre-Calculus test received by students was placed in Table IV-1 along with the courses in which they enrolled and an indication of their success in those courses. Students were considered successful (denoted S) if they received a grade of A, B, or C. Otherwise they were considered not successful (denoted NS).

Table IV-1
Pre-Calculus Test Scores vs Course Success

	Arith		Beg. Alg.		Geom		Int. Alg.		Trig/Stat		Pre-Calc		Calc		Row
Score	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	Total
0															0
1									1						1
2															0
3															0
4															0
5									1		1				2
6								1		1					2
7													2		2
8										1			1		2
9							1		1						2
10								1				1			2
11									1		2	1	1	1	6
12								1	1					1	3
13												1			1
14								1						2	3
15								3	1				1	1	6
16									2				1		3
17									2		1				3
18										2	1	1	2		6
19												1			1
20														1	1
21											2				2
22										1		2	1		4
23														4	4
24											1				1
25															0
26													1	2	3
27													2	1	3
28													1		1
29															0
30														1	1
31														2	2
32													1		1
33															0
34															0
35															0
36															0
37														1	1
38															0
39															0
40															0
Total	0	0	0	0	0	0	1	7	10	5	8	7	14	17	69