ED 376 916   JC 950 025

TITLE   Experience Tables, Predictive Validity Studies, and
                 Validation of Placement Tables for the MDTP Placement
                 Tests.
INSTITUTION   College of the Canyons, Valencia, CA. Office of
                 Institutional Development.
PUB DATE   94
NOTE   56p.
PUB TYPE   Reports - Research/Technical (143) -- Statistical
                 Data (110)

EDRS PRICE   MF01/PC03 Plus Postage.
DESCRIPTORS   Community Colleges; *Cutting Scores; *Mathematics
                 Tests; *Predictive Validity; *Predictor Variables;
                 Scores; *Student Placement; Tables (Data); *Test
                 Validity; Two Year Colleges
IDENTIFIERS   *Mathematics Diagnostic Testing Project CA

ABSTRACT
          California's College of the Canyons has used the four
Mathematics Diagnostic Testing Project (MDTP) tests to assess
students' abilities in basic and college math since spring 1989.
These four reports dated June 1993, July 1993, May 1994, and June
1994 examine the predictive validity of the MDTP tests and the cut
scores used to place students. The first report compares outcomes for
students in fall 1991 and fall 1992 who followed placement advice to
those who did not, finding that for MDTP tests 1, 2, and 4, a higher
percentage of students who followed placement advice were likely to
receive satisfactory grades than those not following advice. The
second and third reports examine the predictive validity of the MDTP
tests in studies conducted July 1993 and May 1994, with evidence from
the 1994 analysis indicating that the MDTP tests exceeded the minimal
standards for the predictive validity of placement instruments. This
report also recommends that MDTP versions 1, 2, and 4 be used to
direct students into mathematics classes. The fourth report examines
the best possible cut scores for the placement tests by using scatter
plots to separate successful versus unsuccessful course outcomes,
finding the current scores reasonable, and recommending that
sub-scores not be used in placement but that their results be given
to students and faculty as feedback. (KP)

Experience Tables, Predictive Validity Studies, and Validation of Placement Tables for the MDTP Placement Tests.

Office of Institutional Development
College of the Canyons
Santa Clarita Community College District

COLLEGE OF THE CANYONS
Santa Clarita Community College District

EXPERIENCE TABLES
FOR THE
MDTP PLACEMENT TESTS

June 1993

Office of Institutional Development

EXPERIENCE TABLES FOR THE
MATHEMATICS DIAG STIC TESTING PROJECT
PLAC ENT TESTS

Design 19

A practical evaluation of the usefulness of the mathematics placement tests is shown by comparing the outcomes of students who followed the placement advice to students who did not. This is a non-technical way to represent predictive validity data for use in counseling sessions with students.

SUBJECTS

The research was limited to first-time college students who had taken one of the four math placement tests and enrolled in a target math course during that semester, with no intervening coursework. The data for these computations represent Fall 1991 and Fall 1992 enrollments.

While it is recommended that a sample be composed of a minimum of 200 students, the samples for each of the four classes considered were much smaller, ranging from 27 to 78 students. Larger samples are preferable and will yield more trustworthy results.

PROCEDURE

End-of-course grades were used as the criterion measure. Grades were classified as either successful/satisfactory (C or higher) or unsuccessful/unsatisfactory (D, F or W).

Assessment scores were classified in two different ways. First, we classified students by whether they had achieved a score on the placement exam which made them fully prepared for the math course. In the case of the MDTP1 - Algebra Readiness Test, the math faculty established a minimum score of 35 as the score needed by a student to be fully prepared for Math 060 - Elementary Algebra. These students were classified as "Advice Followers." Students who scored below 35, but chose to enroll in the course anyway, were classified as "Non-Advice Followers."

-1-

Percentage of Satisfactory Grades
Fall 1991 and Fall 1992 Data

Course/Placement Test

□ Advice Followers ■ Non-Advice Followers
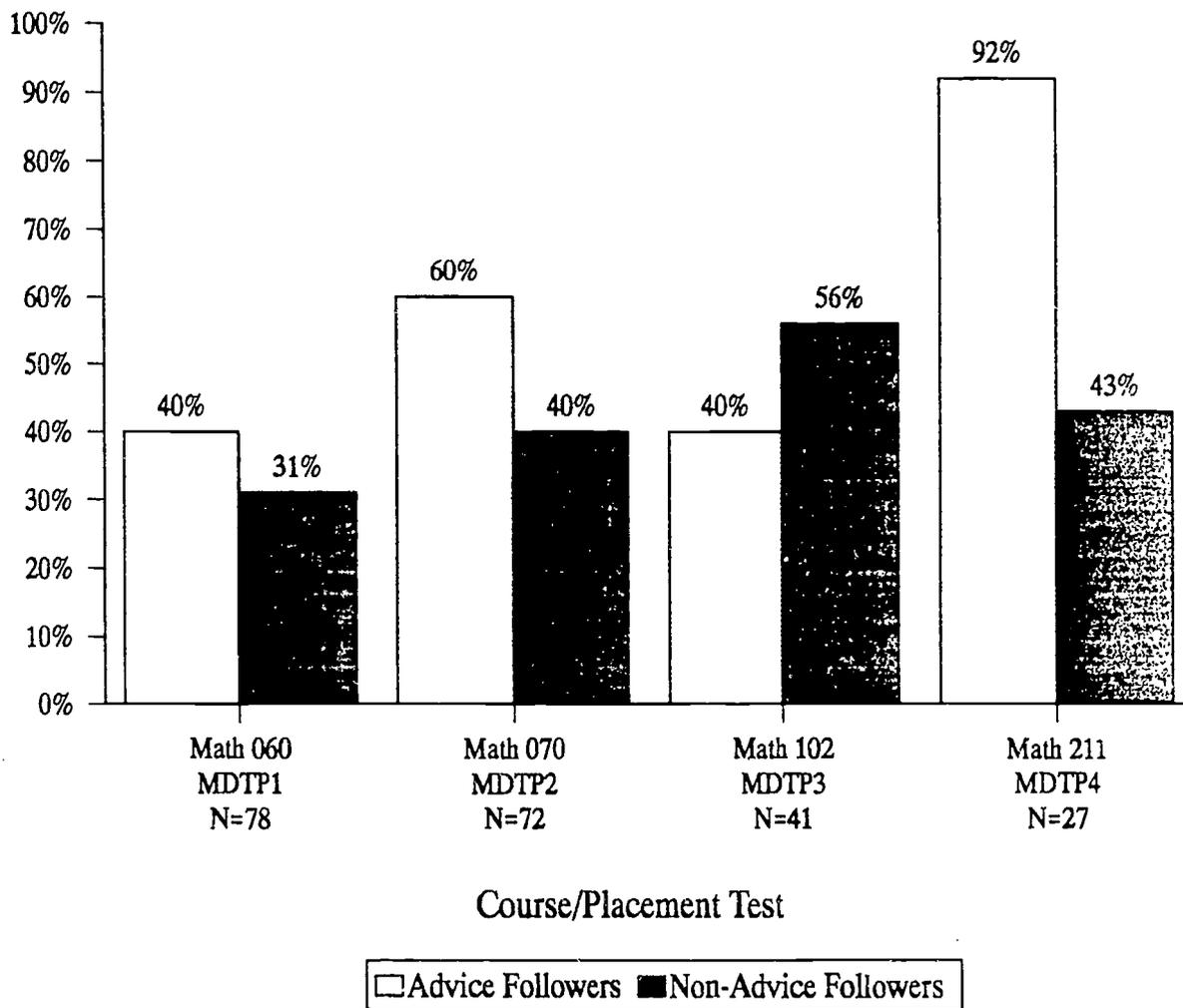
Advice Followers:	MDTP1 score of 35 or higher
	MDTP2 score of 35 or higher
	MDTP3 score of 33 or higher
	MDTP4 score of 28 or higher
Satisfactory Grades:	A, B or C

EXPERIENCE TABLES

Assessment scores were then set up in intervals, and the percentage of students receiving successful course grades (C or higher) shown for each interval. Because the tables summarize previous experience about student success, they are called experience tables.

We used the cut scores established by the mathematics faculty as the intervals for each of the math placement exams.

Experience Table 1
MDTP1 - Algebra Readiness Test

Assessment Score	Percentage Successful in Math 060 - Elementary Algebra
0 - 25	18%
26 - 29 (Needs much review)	22%
30 - 34 (Needs some review)	47%
35 - 50 (Fully prepared)	40%
Total Group N=78	35%

Experience Table 2
MDTP2 - Elementary Algebra Diagnostic Test

Assessment Score	Percentage Successful in Math 070 - Intermediate Algebra
0 - 25	38%
26 - 29 (Needs much review)	47%
30 - 34 (Needs some review)	35%
35 - 50 (Fully prepared)	60%
Total Group N=72	47%

-3-

Experience Table 3
MDTP3 - Intermediate Algebra Diagnostic Test

Assessment Score	Percentage Successful in Math 102 - Trigonometry
0 - 23	63%
24 - 27 (Needs much review)	44%
28 - 32 (Needs some review)	67%
33 - 45 (Fully prepared)	40%
Total Group N=41	54%

Experience Table 4
MDTP4 - Pre-Calculus Diagnostic Test

Assessment Score	Percentage Successful in Math 211 - Calculus I
0 - 23	0%
24 - 26 (Needs much review)	50%
27 - 27 (Needs some review)	60%
28 - 40 (Fully prepared)	92%
Total Group N=27	67%

DISCUSSION

BAR GRAPH
For all but the MDTP3, the bar graph illustrates that a
higher percentage of students who followed the advice of the
placement test were likely to receive satisfactory grades on
the target course. For example, 60% of the MDTP2 Advice

Followers received satisfactory course grades in Math 070 -
Intermediate Algebra, whereas only 40% of the Non-Advice
Followers received grades of C or higher.

Contrary to this, a higher percentage of the MDTP3
Non-Advice Followers received satisfactory grades in Math
102 than did Advice Followers (56% versus 40%). It is
difficult to know why there is a reversal of the expected
outcomes. It may simply be that too little data is
available, and the low cell counts are yielding percentages
influenced by chance. Caution needs to be used in
interpreting these data because of the small number of
students in the sample (41).

EXPERIENCE TABLES
When we looked at the success rate of students by assessment
score intervals, generally, students who scored higher on a
placement test were more likely to receive satisfactory
course grades. Experience Table 2 shows that while only 38%
of the students who scored from 0 to 25 received grades of C
or higher, this compared to 60% of the students who were
considered fully prepared (35 - 50).

This was not true for all placement tests, however.
Experience Table 3 shows that a higher percentage of
students who scored in the 28 to 32 interval on the MDTP3 -
Intermediate Algebra Diagnostic Test, were more likely to
receive a satisfactory course grade than were the students
who were thought to be fully prepared (67% versus 40%).
Caution must be used in interpreting these data because of
the small number of students in the sample (41).

RECOMMENDATION

These data are based on small samples and therefore may
prove to be untrustworthy. This caution is emphasized for
Experience Tables 3 and 4 with samples of only 41 and 27
students, respectively.

Math 070 - Intermediate Algebra, serves as a prerequisite
for Math 102 - Trigonometry and Math 103 - College Algebra.
Many students move into those courses because of their
successful completion of the prerequisite, not because of
their score on the placement test. This will be true of any
higher level math course. For this reason, it may take time
to assemble a database with 200 or more students for the
MDTP3 and MDTP4.

Since the college has only recently started collecting
social security numbers for its students, it has proven
difficult to retrieve and match assessment data with course
data prior to Fall 1991. We recommend that the math
research data bases be expanded by adding placement and
course data for Spring 1992, Spring 1993 and Fall 1993, to
further increase the size of the samples. This would
provide the college with comprehensive research data bases
for each of the four math placement tests from Fall 1991
forward. The expanded databases would assist the college in
making more trustworthy judgments about the ability of the
math placement tests to predict student success in the
target courses.

DES19.FW4

College of the Canyons
Santa Clarita Community College District

MDTP
PREDICTIVE VALIDITY STUDIES

July 1993

Office of Institutional Development

10

PREDICTIVE VALIDITY STUDIES
OF THE FOUR
MATHEMATICS DIAGNOSTIC TESTING PROJECT ASSESSMENT TESTS

July 1993

This report summarizes the predictive validity studies carried out during July of 1993. The four tests of the Mathematics Diagnostic Testing Project (MDTP) were examined to determine their ability to predict student success in both basic skills and college level mathematics courses offered at College of the Canyons.

Matriculation regulations require that community colleges which adopt a standardized test for making placement recommendations must qualify its use locally. The test must be a valid predictor of future course success given the unique features of the college curriculum, its instructors, and student population. Establishing a clear relationship between the test score and subsequent student performance in a particular course for which placement recommendations were made is predictive validity. A correlation of no less than +.35 is needed to conclude that the test instrument has sufficient predictive validity for advisement purposes.

One measure of course success was used, the final course grade. In all cases, Ws were recoded as failure and kept in the computation. The resulting correlations are shown in the tables below. The college has used the four tests of the MDTP series since Spring 1989 and the data for these computations represent information from first-time students from four semesters (Fall 1991, Spring 1992, Fall 1992 and Spring 1993). Since placement test scores were in use, the correlation values were adjusted by using a correction for restriction of range.

MDTP1 - Algebra Readiness Test

TEST	COURSE	MEAN	r- SCORE TO GRADE	NUMBER OF STUDENTS
MDTP1	Math 025	18.0	.47	117
MDTP1	Math 057	26.5	.47	47
MDTP1	Math 060	32.0	.42	98

11

MDTP2 - Elementary Algebra Test

TEST	COURSE	MEAN	r- SCORE TO GRADE	NUMBER OF STUDENTS
MDTP2	Math 025	10.0	.64	13
MDTP2	Math 060	19.9	.44	150
MDTP2	Math 063	No data available		
MDTP2	Math 070	30.6	.22	7&

MDTP3 - Intermediate Algebra Test

TEST	COURSE	MEAN	r- SCORE TO GRADE	NUMBER OF STUDENTS
MDTP3	Math 060	12.5	-.02	68
MDTP3	Math 063	No data available		
MDTP3	Math 070	18.5	.33	120
MDTP3	Math 102	26.9	.11	50
MDTP3	Math 103	27.3	.20	29
MDTP3	Math 140	24.3	-.51	16
MDTP3	Math 240	31.0	-.95	3

MDTP4 - Pre-Calculus Test

TEST	COURSE	MEAN	r-SCORE TO GRADE	NUMBER OF STUDENTS
MDTP4	Math 060	10.0	1.00	3
MDTP4	Math 063	No data available		
MDTP4	Math 070	14.8	.05	5
MDTP4	Math 102	21.0	.37	19
MDTP4	Math 103	20.9	.82	9
MDTP4	Math 140	25.0	.97	5
MDTP4	Math 211	27.9	.79	29
MDTP4	Math 240	19.0	.00	2

DISCUSSION

MDTP1 - Algebra Readiness Test
These findings offer initial support that the MDTP Algebra Readiness Test has predictive validity for Math 025, Math 057 and Math 060.

MDTP2 - Elementary Algebra Test
These findings offer initial support that the MDTP Elementary Algebra Test has predictive validity for Math 060.

The small number of students who enrolled in Math 025 after taking this placement test makes it impossible to judge the validity of the test for this course placement. The MDTP Elementary Algebra Test has not yet shown to have predictive validity for Math 070 ($r=.22$).

MDTP3 - Intermediate Algebra Test
The MDTP Intermediate Algebra Test has not yet shown to have predictive validity for any of the following mathematics courses: Math 060, Math 070, Math 102, Math 103, Math 140 or Math 240.

MDTP4 - Pre-Calculus Test
        These findings offer initial support that the MDTP
Pre-Calculus Test has predictive validity for Math 211.

        The small number of students in the samples makes it
impossible to determine with any accuracy the predictive
validity of the Pre-Calculus Test for the following
mathematics courses: Math 060, Math 070, Math 102, Math
103, Math 140 and Math 240.

        The reader is reminded that these correlations apply
only to the ability of the MDTP tests to predict the final
grade performance of first-time college students. Further
predictive validity computations will be performed as
additional data become available. Where predictive validity
has not been shown, it may be necessary to carry out content
validity studies with the mathematics faculty.

CONCLUSIONS

MDTP1 - Algebra Readiness Test
        The MDTP Algebra Readiness Test appears to be an
appropriate test for Math 025, Math 057 and Math 060.

MDTP2 - Elementary Algebra Test
        The MDTP Elementary Algebra Test appears to be an
appropriate test for Math 060.

MDTP3 - Intermediate Algebra Test
        The MDTP Intermediate Algebra Test may not be an
appropriate test for any of the mathematics courses studied,
although further data collection and analysis may qualify
it.

MDTP4 - Pre-Calculus Test
        The MDTP Pre-Calculus Test appears to be an appropriate
test for Math 211.

        The college should continue to evaluate the MDTP tests
and/or multiple measures which may provide the most accurate
advice possible when directing students into mathematics
classes.

PRED44.FW4

College of the Canyons
Santa Clarita Community College District

PREDICTIVE VALIDITY STUDIES
OF THE MDTP TESTS

MAY 1994

Office of Institutional Development

PREDICTIVE VALIDITY STUDIES
OF THE
MATHEMATICS DIAGNOSTIC TESTING PROJECT ASSESSMENT TESTS

May 1994

This report summarizes the predictive validity studies carried out during May of 1994. The four tests of the Mathematics Diagnostic Testing Project (MDTP) were examined to determine their ability to predict student success in both basic skills and college level mathematics courses offered at College of the Canyons.

The college has used the four tests of the MDTP series since Spring 1989 and the data for these computations represent information from first-time students from five semesters (Fall 1991, Spring 1992, Fall 1992, Spring 1993 and Fall 1993).

Matriculation regulations require that community colleges which adopt a standardized test for making placement recommendations must qualify its use locally. The test must be a valid predictor of future course success given the unique features of the college curriculum, its instructors, and student population. Establishing a clear relationship between the test score and subsequent student

performance in a particular course for which placement
recommendations were made is predictive validity. A
correlation of no less than +.35 is needed to conclude that
the test instrument has sufficient predictive validity for
advisement purposes.

Descriptive Statistics. The data collected for this study
are summarized in Table 1. These data constitute an
important step toward the development of local norms for the
MDTP test battery at College of the Canyons. The mean score
and skewness provide a clue about the relative degree of
difficulty of the tests. Positively skewed score
distributions (+), or those where the cases are clustered
more to the left of the mean, indicate that sampled students
tend to find the test difficult. Thus, the MDTP3 test was
clearly more difficult for students in Math 102 than was the
MDTP4 test for students in Math 211. In relative terms the
least difficult test was the MDTP1 Algebra Readiness Test,
for students in Math 057.

Table 1.
Descriptive Statistics for MDTP Placement Tests,
By Course Level

TEST	COURSE	N	MEAN	MEDIAN	STANDARD DEVIATION	SKEWNESS
MDTP1	Math 025*	165	18.44	19.00	5.82	-0.30
	Math 057	60	26.62	27.00	4.96	-0.67
	Math 060*	135	32.68	33.00	6.82	-0.43
MDTP2	Math 060	226	20.69	20.00	6.10	0.38
	Math 070*	115	31.10	32.00	7.28	-0.53
MDTP3	Math 060	82	12.44	12.00	3.62	0.25
	Math 070	172	18.74	19.00	5.00	-0.39
	Math 102*	70	27.09	27.00	4.96	0.38
	Math 103*	38	27.76	29.00	6.77	-0.50
	Math 140*	30	23.90	23.00	5.02	-0.11
	Math 240*	5	31.40	32.00	2.41	-0.29
MDTP4	Math 102	23	20.61	21.00	5.78	-0.52
	Math 103	16	19.88	18.50	6.99	0.43
	Math 140	11	20.55	18.00	5.80	0.26
	Math 211*	40	28.25	28.00	4.74	-0.09
	Math 240	4	20.25	20.00	1.50	0.14

* Primary target course(s) for placement test

<u>Predictive Validity</u>. The primary index of the strength of the relationship between test scores (predictor) and course grades (criterion) is the predictive validity coefficient, or the correlation between predictor and criterion.

Two correlation coefficients indicating predictive validity were computed for each course -- one between the test scores and course grades with all withdrawals (Ws) converted to Fail (F), and the second between the test scores and course grades with withdrawals deleted from the analysis.   The resulting correlations are shown in the table on the following page.   Since placement test scores were in use, the correlation values were adjusted by using a correction for restriction of range.

Table 2
Relationship Between MDTP Test Scores and Grades,
By Course

MDTP1 - Algebra Readiness Test

TEST	COURSE	r- SCORE TO GRADE	
		W=FAILURE	Ws EXCLUDED
MDTP1	Math 025*	.44 (124)	.43 (91)
	Math 057	.47 (41)	.58 (29)
	Math 060*	.42 (134)	.42 (86)

MDTP2 - Elementary Algebra Test

MDTP2	Math 060	.35 (226)	.33 (179)
	Math 070*	.24 (114)	.13 (73)

MDTP3 - Intermediate Algebra Test

MDTP3	Math 060	.18 (81)	.35 (62)
	Math 070	.40 (171)	.35 (127)
	Math 102*	.15 (70)	-.04 (49)
	Math 103*	.26 (38)	.18 (31)
	Math 140*	-.27 (29)	-.04 (24)
	Math 240*	-.79 (5)	-.79 (5)

MDTP4 - Pre-Calculus Test

MDTP4	Math 102	.51 (23)	.50 (22)
	Math 103	.54 (16)	.48 (15)
	Math 140	.83 (11)	.82 (8)
	Math 211*	.75 (40)	.68 (30)
	Math 240	-.99 (4)	-.99 (4)

* Primary target course(s) for placement test

MATRICULATION

DISCUSSION

As can be seen, there are only minor differences
between the validity coefficients computed for each course
with the two approaches. With the exception of Math 240 -
Math Analysis for Business and Social Science, that had only
five students in the MDTP3 and four students in the MDTP4
correlations, the median predictive validity value across
all levels is .41, ranging from a low of -.27 for MDTP3 -
Math 140 (with Ws included) to a high of .83 for MDTP4 -
Math 140 (with Ws included). Minimal standards are for
predictive validity coefficients for placement instruments
to be at least .35 (California Community Colleges, 1991).
Evidence from the current analysis indicates that the MDTP
tests meet and even exceed this standard at College of the
Canyons. This is a critical step in the local validation of
assessment instruments in that without at least a moderate
overall relationship between test scores and course grades,
a test would be no better at generating placement
recommendations than would a random method of doing so.
Indeed, given the attenuation of the validity coefficient
due to less than perfect reliability of both predictor and
criterion, and the restriction of range due to the use of
the test scores for placement, the obtained predictive
validity coefficients are particularly impressive.

21

MATRICULATION

The reader is reminded that these correlations apply only to the ability of the MDTP tests to predict the final grade performance of first-time college students.

CONCLUSIONS

The college should continue to evaluate the validity of the MDTP tests and determine multiple measures which may provide the most accurate advice possible when directing students into mathematics classes.

References:

Steven Isonio, <u>Implementation and Initial Validation of the MDTP Tests at Golden West College</u>. Huntington Beach: Golden West College, February 1992.

Jerry Rudmann, <u>A Study of Math 251 and Math 253 Assessment and Advisement for Matriculants</u>. Irvine: Irvine Valley College, May 1991.

PRED44.FW4

College of the Canyons
Santa Clarita Community College District

VALIDATING PLACEMENT RULES
FOR THE MDTP TESTS

June 1994

Office of Institutional Development

24

VALIDATING PLACEMENT RULES
FOR THE MDTP TESTS

June 1994

The report entitled <u>Predictive Validity Studies of the Mathematics Diagnostic Testing Project Assessment Tests</u> (May 1994) showed the adequate overall relationship between test scores and course grades, supporting the use of MDTP test scores as predictors of student performance at College of the Canyons.

The next issue is a very practical one -- how best to use the tests for making placement recommendations. This involves identifying cut scores. At what point in the continuum of test scores do we recommend placement of students in a given course? For example, are students who receive scores of 35 to 50 on the Algebra Readiness Test fully prepared to undertake Math 060 - Elementary Algebra? Should the score range be broader or narrower? No method of identifying cut scores is flawless. With typical validities of .35, only about 12 percent of the variance in student performance is associated with the test scores. A great many factors not tapped by the tests contribute to course grades. The goal of the process is to improve prediction of

24

success.

METHOD

The primary method used for establishing cut scores involves comparing success rates for contrasting groups over a range of scores. More specifically, the contrasting groups are defined as "successful students" or those who earned grades of A, B, C and CR, whereas persons with grades of D, F, NC or W (withdrawal) are categorized in the "unsuccessful" group. Given this distinction, it is then possible to determine the proportion of students with specific scores, and hence for score ranges, that were successful. Cut scores are then evaluated in terms of their ability to "predict" success (i.e. maximize the difference between success rates for persons scoring above a value and those scoring below it).

Subjects. The research participants were 1,421 students who were tested and enrolled in one of several target mathematics courses during that subsequent semester; 568 took the Algebra Readiness Test, 356 took the Elementary Algebra Test, 391 took the Intermediate Algebra Test and 106 took the Pre calculus Test. The four MDTP databases each contain five semesters of data (Fall 1991, Spring 1992, Fall 1992, Spring 1993 and Fall 1993). The students were first-time college students. Participating students were placed in mathematics courses using existing placement

-2-

procedures, including the use of placement test scores.
End-of-course grades were used as the student performance
criterion.

RESULTS

Placement Rules. The scatter diagrams presented in Figures
1 through 7 show the relationship between test scores and
success in each target class. These provide an initial
basis for establishing trial cut scores to minimize
placement errors. On the scatter plots, a number represents
one or more coincident data points while letters designate
two-digit numbers, i.e. A=10, B=11, C=12 etc. Withdrawals
were treated as unsuccessful course outcomes in this
analysis of dichotomized grades.

Figure 1.
Math 060 Success by MDTP1 - Algebra Readiness Test

College of the Canyons

SCATTER DIAGRAM
Data: Math 01 F91 - F93
Course: MATH 060
Test: MATH 01: ALGEBRA READINESS
Subgroup: TOTAL
N=134, R = 0.25

06/15/94 **APRS**
10:55:37   Page 1

Trial Cut Score = 30

-4-

Figure 2.
Math 060 Success by MDTP2 - Elementary Algebra Test

College of the Canyons   06/15/94 **APRS**
                                                          11:01:03 Page 1
SCATTER DIAGRAM
Data: Math 02 F91 - F93
Course: MATH 060
Test: MATH 02: ELEMENTARY ALGEBRA C
Subgroup: TOTAL
N=226, R = 0.29

```
A
B
C     11    2113669 3C7E7895244433  12  1
C
R

O
U
T
C
O
M
E

D
f     1    12544A88E5693334522221  23  22
N
C
E

  0        10        20        30        40        50
```

Trial Cut Score = 18

Figure 3.
Math 070 Success by MDTP2 - Elementary Algebra Test

College of the Canyons

06/15/94 **APRS**
11:02:16 Page 2

SCATTER DIAGRAM
Data: Math 02 F91 - F93
Course: MATH 070
Test: MATH 02: ELEMENTARY ALGEBRA C
Subgroup: TOTAL
N=115, R = 0.13


```
      A
      B
      C    1    1  11        2 2 4 4 2 2 3 3 2|2 3 1 5 3 3 2 1 1 2    1
O     C
U     R
T
C
O
M
E     D
      F    1          2 1 1 1 3 1   4 4 1 1 4 4 6 5 6|1 2 5 3 3 1   1   1          1
      N
      C
      W

      0        10         20         30         40         50
```

Trial Cut Score = 34

Figure 4.
Math 070 Success by MDTP3 - Intermediate Algebra Test

```
College of the Canyons                           06/15/94  **APRS**
                                                 11:04:30  Page 1
SCATTER DIAGRAM
Data: Math 03 F91 - F93
Course: MATH  070
Test: MATH 03: INTERMEDIATE ALGEBRA C
Subgroup: TOTAL
N=171, R = 0.26
```

```
A |
B |
C |    1      2  11   16176B5 A3776   1311
C |
R |
  |
O |
U |
T |
C |
O |
M |
E |
D |
F |
N |   21   212255531CAB8 3414313  1
C |
W |
  |
  +---+----+----+----+----+----+----+----+----+
  0   5   10   15   20   25   30   35   40   45

Trial Cut Score = 21
```

Figure 5.
Math 102 Success by MDTP3 – Intermediate Algebra Test

```
College of the Canyons                          06/15/94  **APRS**
                                                11:05:41   Page 2
SCATTER DIAGRAM
Data: Math 03 F91 - F93
Course: MATH  102
Test: MATH 03: INTERMEDIATE ALGEBRA C
Subgroup: TOTAL
N=70, R = 0.08
```



```
          A|
          B|        1   31315  343223      11      1
          C|
          C|
          R|

  OUTCOME

          D|
          F|        1    1  12  163345 1  3    211 1
          N|
          C|
          W|


            0    5   10   15   20   25   30   35   40   45
```

Trial Cut Score = 29

-8-

Figure 6.
Math 102 Success by MDTP4 - Pre-Calculus Test

College of the Canyons   06/15/94 **APRS**
                                                          10:51:27   Page 2
SCATTER DIAGRAM
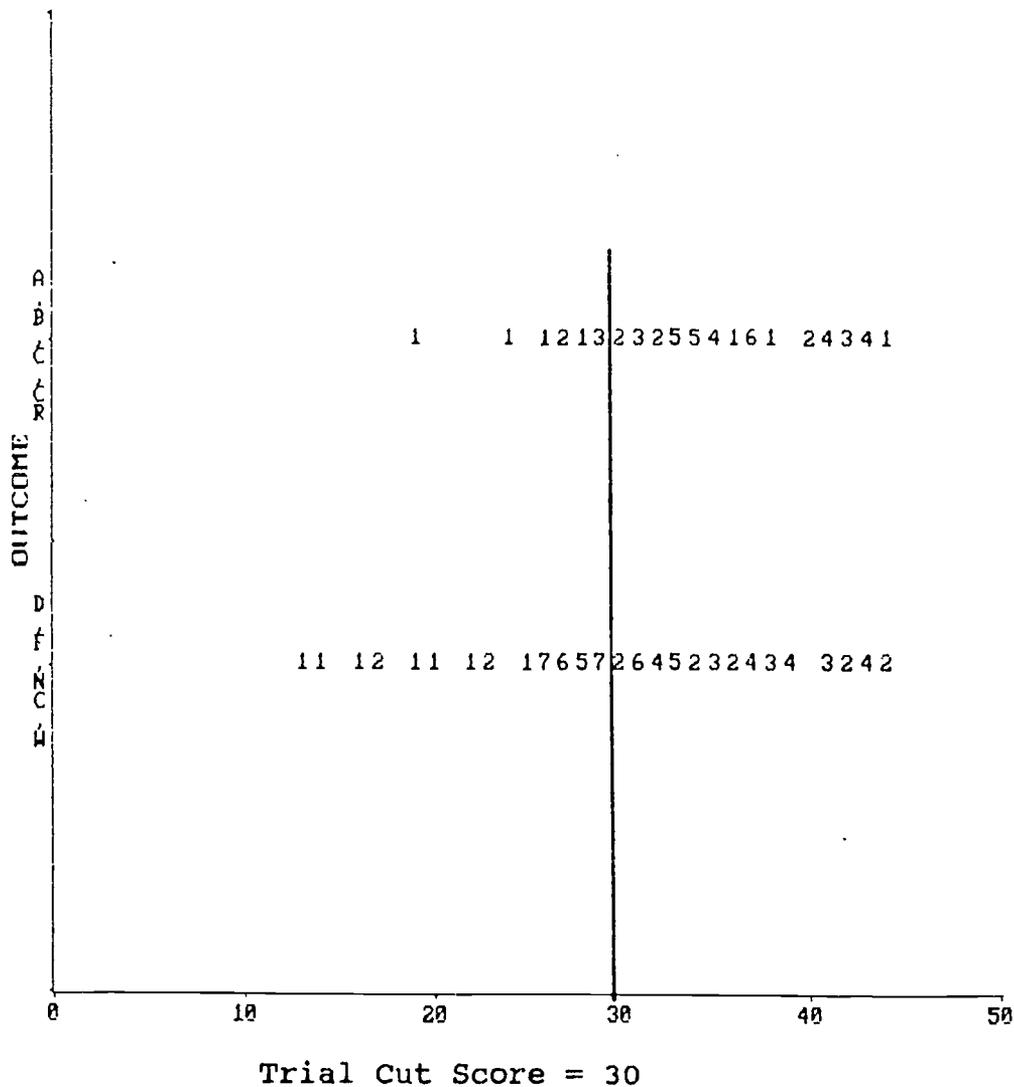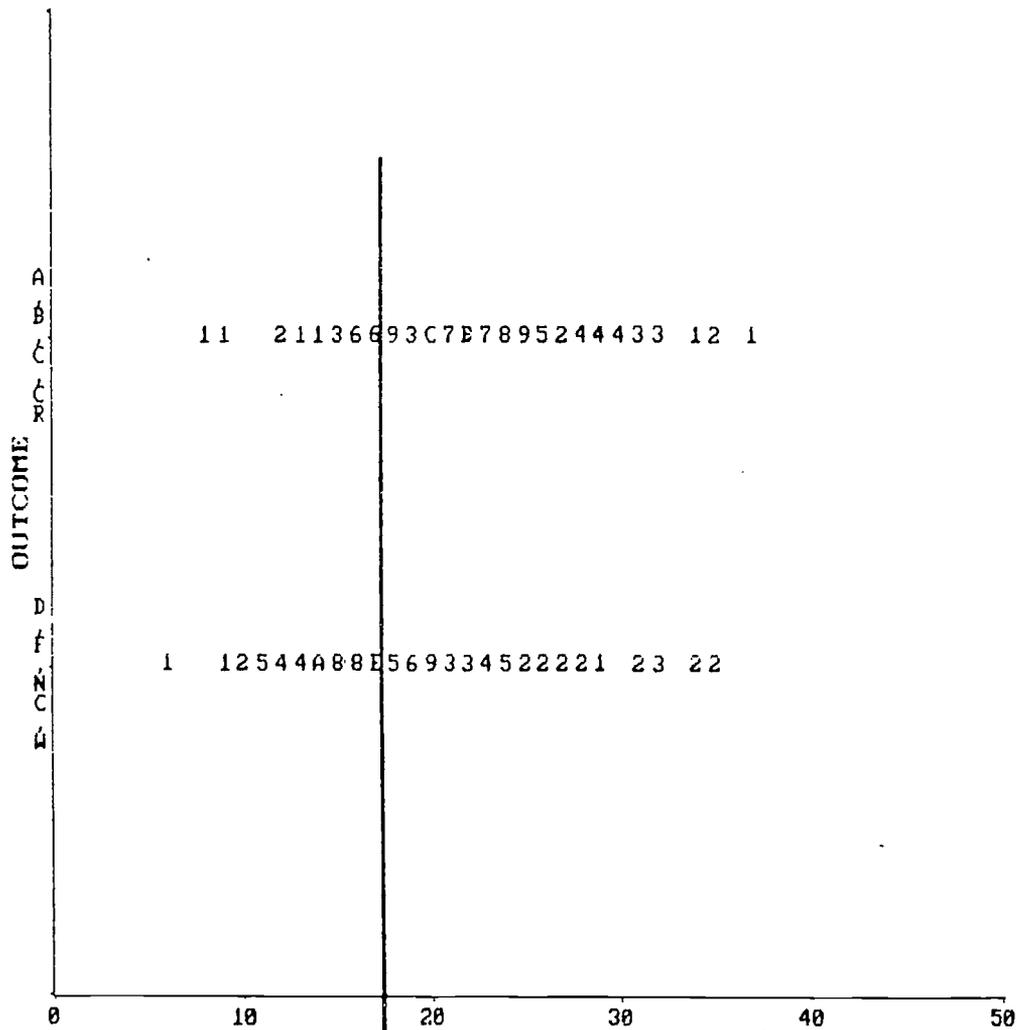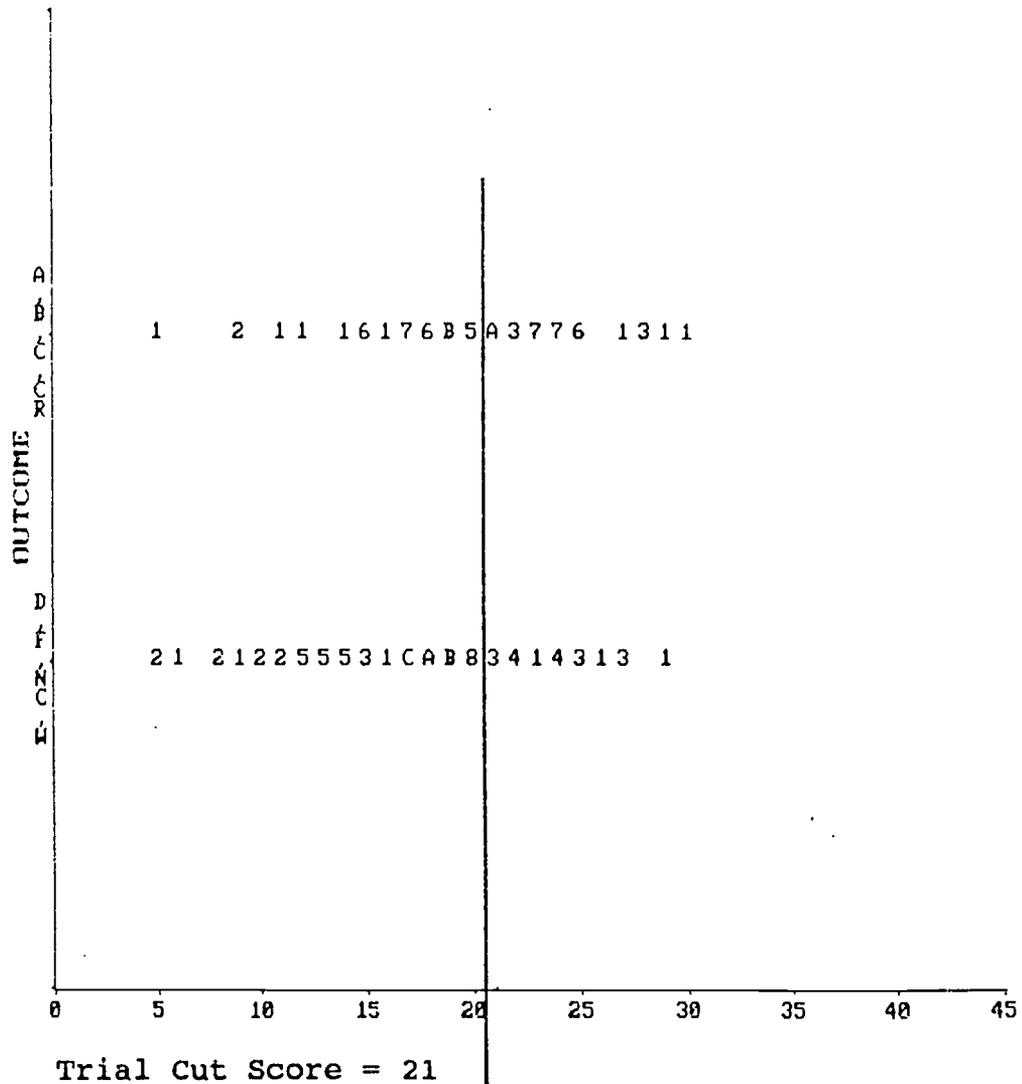Data: Math 04 F91 - F93
Course: MATH   102
Test: MATH 04: PRECALCULUS C
Subgroup: TOTAL
N=23, R = 0.19

Trial Cut Score = 19

32

Figure 7.
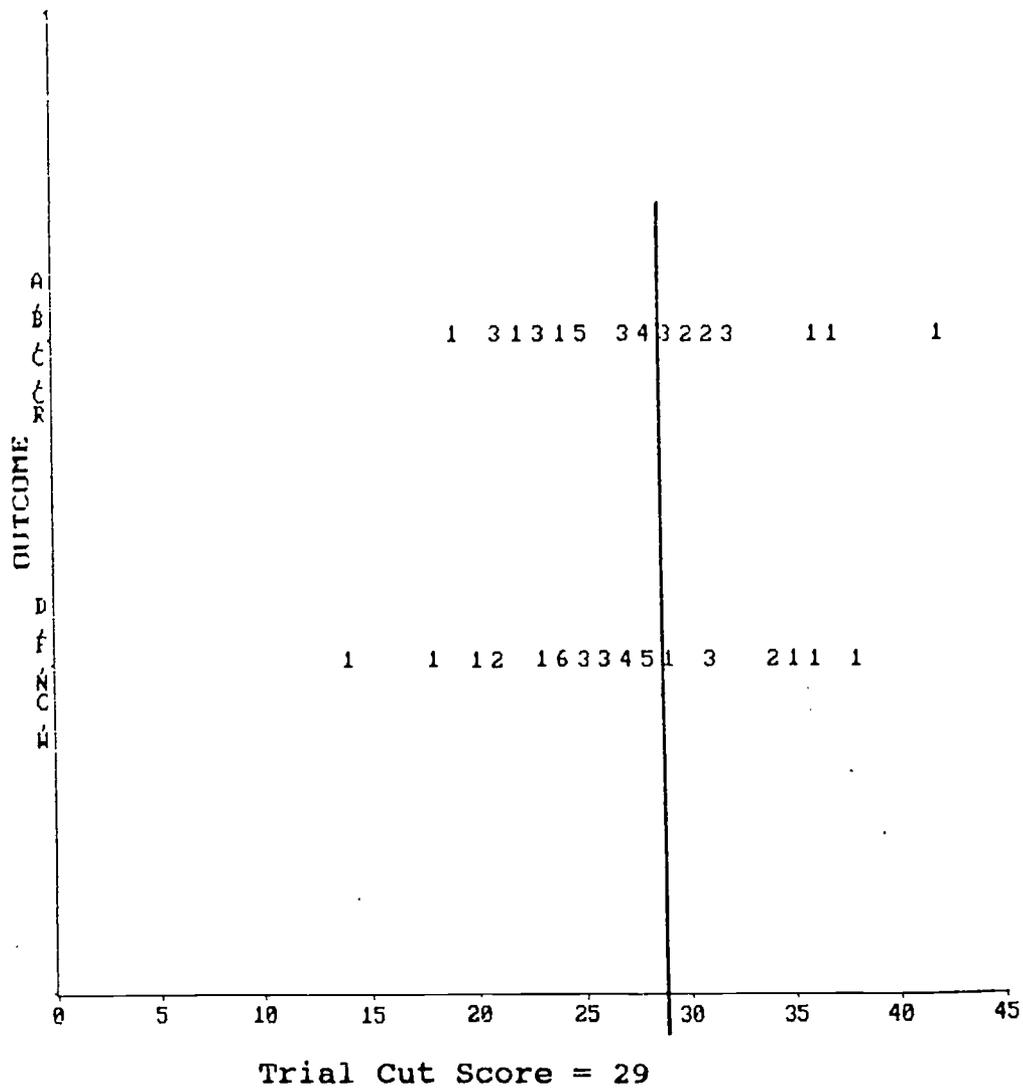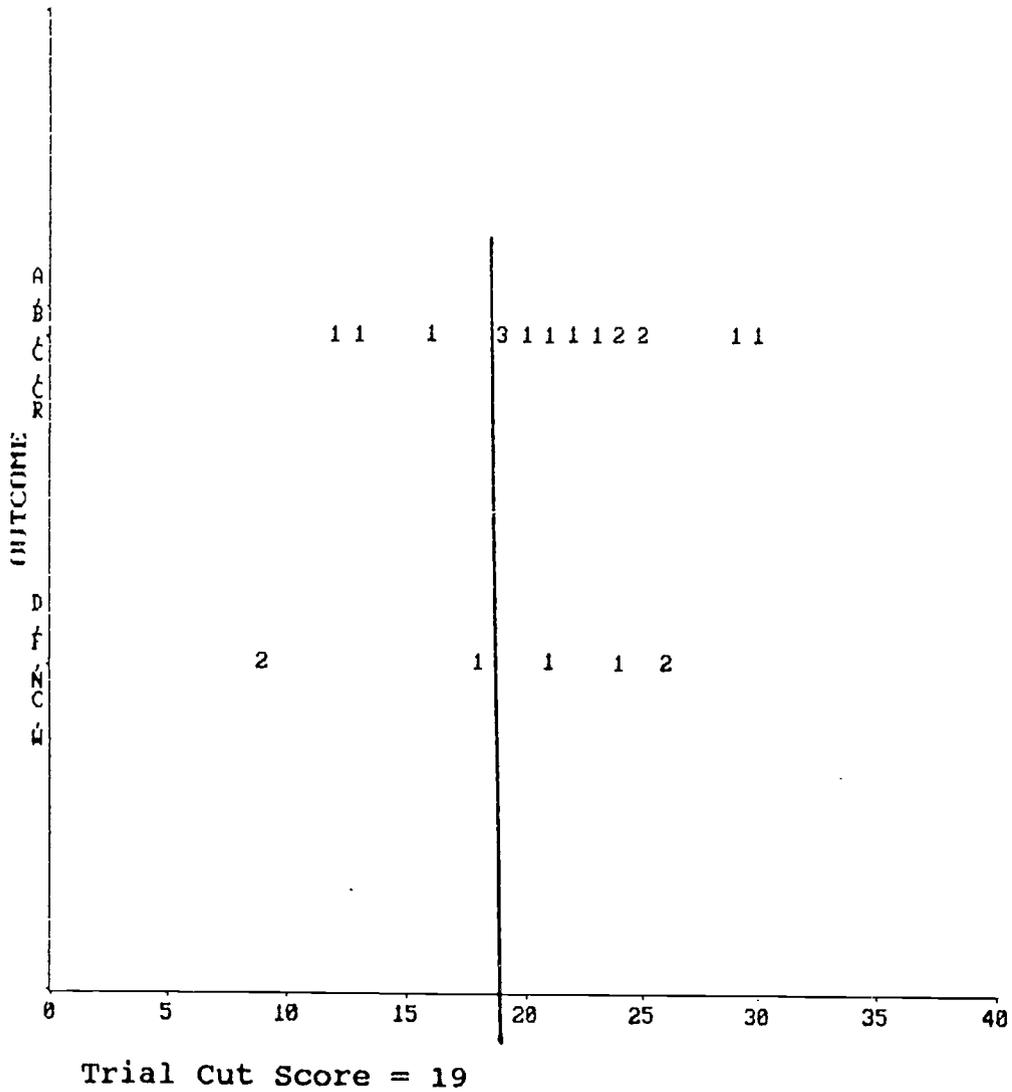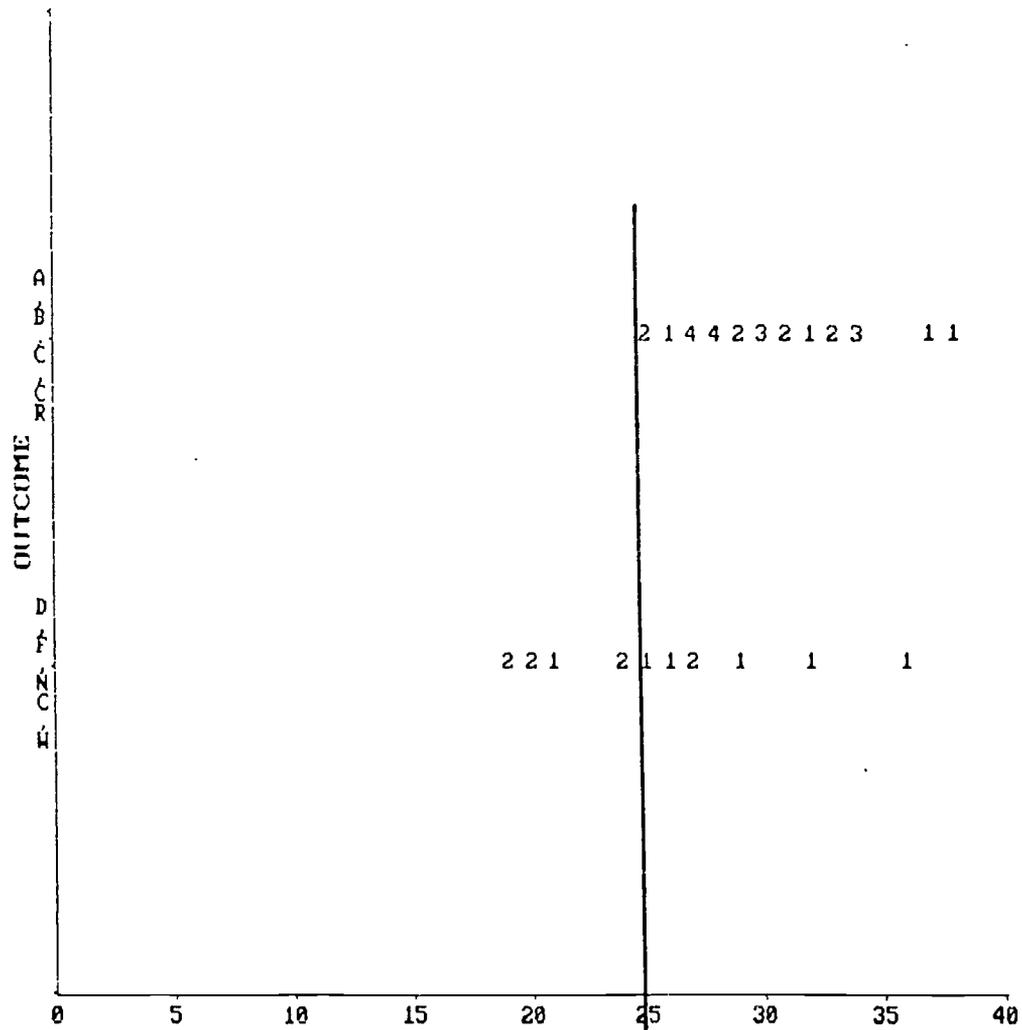Math 211 Success by MDTP4 - Pre-Calculus Test

College of the Canyons

SCATTER DIAGRAM
Data: Math 04 F91 - F93
Course: MATH 211
Test: MATH 04: PRECALCULUS C
Subgroup: TOTAL
N=40, R = 0.52

```
O
U
T
C
O
M
E

A
B   2 1 4 4 2 3 2 1 2 3     1 1
C
C
R




D
F       2 2 1    2 1 1 2  1    1      1
N
C
U
    +--+--+--+--+--+--+--+--+
    0  5  10 15 20 25 30 35 40
```

Trial Cut Score = 25

-10-

53

The scatterplots were partitioned using a variety of possible cut scores. The partitions produced placement classification tables for each trial cut score. The table partitions the data from the scatterplot into four quadrants. The upper right and lower left quadrants represent correct placements. The other two quadrants represent placement errors.

The analysis showed that there were several cut scores for each course that were optimum in placement accuracy. The recommended cut scores shown in Table 1 were set in the lower part of the optimum range for each course. For students who score from 0 to 9 on the MDTP3 and MDTP4, we recommend that they take the lower level math test. The low score represents performance at the level of chance. The student will have a better chance of receiving an accurate math course placement recommendation from the lower level test.

Table 2 provides the currently used cut scores, without the use of sub-scores.

Table 1.
Recommended MDTP Placement Test Cut Scores by Course

Test	Score Range	Recommended Placement	% of Study Sample in Score Range	N
MDTP1	0 - 29	Math 025	53.2%	302
	30 - 50	Math 060	46.8%	266
MDTP2	0 - 17	Math 025	29.2%	104
	18 - 33	Math 060	57.0%	203
	34 - 50	Math 070	13.8%	49
MDTP3	0 - 9	Take MDTP2	6.6%	26
	10 - 20	Math 060	45.3%	177
	21 - 28	Math 070	34.5%	135
	29 - 45	Math 102	13.6%	53
MDTP4	0 - 9	Take MDTP3	4.7%	5
	10 - 18	Math 070	22.7%	24
	19 - 24	Math 102	29.2%	31
	25 - 40	Math 211	43.4%	46

Table 2.
Current MDTP Test Cut Scores by Course

Test	Score Range	Recommended Placement	% of Study Sample in Score Range	N
MDTP1	0 - 25	Math 025	37.5%	213
	26 - 50	Math 060	62.5%	355
MDTP2	0 - 13	Math 025	12.1%	43
	14 - 25	Math 060	49.7%	177
	26 - 50	Math 070	38.2%	136
MDTP3	0 - 16	Math 060	31.2%	122
	17 - 19	Math 070	16.1%	63
	20 - 23	Math 140	19.5%	76
	24 - 45	Math 102	33.2%	130
MDTP4	0 - 12	Math 060	10.4%	11
	13 - 15	Math 070	6.6%	7
	16 - 17	Math 140	5.6%	6
	18 - 23	Math 102	28.3%	30
	24 - 40	Math 211	49.1%	52

Placement Accuracy. Tables 3 through 9 are placement
classification tables that show the relationships between
admission status (that would have resulted from use of the
recommended placement rules) and actual student performance
observed in the course. Correct classification are
represented in the upper right and lower left cells of the
table, the sum of these cells represents the total of
correct placement. The percentage of correct
classifications is shown as a footnote to each table. In
addition, the footnotes show the net gain in correct
placements that would result from use of the recommended cut
score and the percentage of students eligible (selection
ratio) under this placement rule.

Table 3.
Percentage of Students by
Math 060 Success and Admission Status
MDTP1

```
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Database: Math 01 F91 - F93  (Filter: NONE)
Course: MATH 060
Test: MATH 01: ALGEBRA READINESS
Subgroup: TOTAL  (N = 134)
```

	NOT ELIG < 30	ELIGIBLE >= 30	
SUCCESS A,B,C,CR	9 6.7% r 17.3% c 20.0%	43 32.1% r 82.7% c 48.3%	52 38.8% r 100.0%
NOT SUCC D,F,NC,W	36 26.9% r 43.9% c 80.0%	46 34.3% r 56.1% c 51.7%	82 61.2% r 100.0%
	45 33.6% c 100.0%	89 66.4% c 100.0%	134 100.0%

Correct Placements: 59.0%
Base Rate(non-succ):   61.2%
Gain in Accuracy: -2.2%

Selection Ratio: 66.4%
Diff in Succ Ratio: 28.3%

Table 4.
Percentage of Students by
Math 060 Success and Admission Status
MDTP2

```
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Database: Math 02 F91 - F93  (Filter: NONE)
Course: MATH 060
Test: MATH 02: ELEMENTARY ALGEBRA C
Subgroup: TOTAL  (N = 226)
```

	NOT ELIG < 18	ELIGIBLE >= 18	
SUCCESS A,B,C,CR	21 9.3% r 18.1% c 26.9%	95 42.0% r 81.9% c 64.2%	116 51.3% r 100.0%
NOT SUCC D,F,NC,W	57 25.2% r 51.8% c 73.1%	53 23.5% r 48.2% c 35.8%	110 48.7% r 100.0%
	78 34.5% c 100.0%	148 65.5% c 100.0%	226 100.0%

Correct Placements: 67.3%
Base Rate (success):   51.3%
Gain in Accuracy: 15.9%

Selection Ratio: 65.5%
Diff in Succ Ratio: 37.3%

-15-

Table 5.
Percentage of Students by
Math 070 Success and Admission Status
MDTP2

```
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Database: Math 02 F91 - F93  (Filter: NONE)
Course: MATH 070
Test: MATH 02: ELEMENTARY ALGEBRA C
Subgroup: TOTAL  (N = 115)
```

```
                NOT ELIG  ELIGIBLE
                 < 34      >= 34
                |---------|---------|
                                            Correct Placements:     60.0%
                  28    |    24    |   52   Base Rate(non-succ):    54.8%
SUCCESS         | 24.3% |  20.9%   |  45.2% Gain in Accuracy:        5.2%
A,B,C,CR        | r 53.8% | r 46.2% |r 100.0%
                | c 38.4% | c 57.1% |
                |         |         |
                |---------|---------|        Selection Ratio:        36.5%
                  45    |    18    |   63    Diff in Succ Ratio:     18.8%
NOT SUCC        | 39.1% |  15.7%   |  54.8%
D,F,NC,W        | r 71.4% | r 28.6% |r 100.0%
                | c 61.6% | c 42.9% |
                |         |         |
                |---------|---------|
                  73        42        115
                 63.5%     36.5%     100.0%
                c 100.0%  c 100.0%
```

Table 6.
Percentage of Students by
Math 070 Success and Admission Status
MDTP3

```
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Database: Math 03 F91 - F93  (Filter: NONE)
Course: MATH 070
Test: MATH 03: INTERMEDIATE ALGEBRA C
Subgroup: TOTAL  (N = 171)
```

```
                NOT ELIG  ELIGIBLE
                 < 21      >= 21
                |---------|---------|
                                            Correct Placements:     63.7%
                  42    |    39    |   81   Base Rate(non-succ):    52.6%
SUCCESS         | 24.6% |  22.8%   |  47.4% Gain in Accuracy:       11.1%
A,B,C,CR        | r 51.9% | r 48.1% |r 100.0%
                | c 37.5% | c 66.1% |
                |         |         |
                |---------|---------|        Selection Ratio:        34.5%
                  70    |    20    |   90    Diff in Succ Ratio:     28.6%
NOT SUCC        | 40.9% |  11.7%   |  52.6%
D,F,NC,W        | r 77.8% | r 22.2% |r 100.0%
                | c 62.5% | c 33.9% |
                |         |         |
                |---------|---------|
                  112       59        171
                 65.5%     34.5%     100.0%
                c 100.0%  c 100.0%
```

BEST COPY AVAILABLE

Table 7.
Percentage of Students by
Math 102 Success and Admission Status
MDTP3

```
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Database: Math 03 F91 - F93  (Filter: NONE)
Course: MATH 102
Test: MATH 03: INTERMEDIATE ALGEBRA C
Subgroup: TOTAL  (N = 70)
```

	NOT ELIG < 29	ELIGIBLE >= 29	
SUCCESS A,B,C,CR	21 30.0% r 61.8% c 43.8%	13 18.6% r 38.2% c 59.1%	34 48.6% r 100.0%
NOT SUCC D,F,NC,W	27 38.6% r 75.0% c 56.3%	9 12.9% r 25.0% c 40.9%	36 51.4% r 100.0%
	48 68.6% c 100.0%	22 31.4% c 100.0%	70 100.0%

```
Correct Placements:     57.1%
Base Rate(non-succ):    51.4%
Gain in Accuracy:        5.7%


Selection Ratio:        31.4%
Diff in Succ Ratio:     15.3%
```

Table 8.
Percentage of Students by
Math 102 Success and Admission Status
MDTP4

```
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Database: Math 04 F91 - F93  (Filter: NONE)
Course: MATH 102
Test: MATH 04: PRECALCULUS C
Subgroup: TOTAL  (N = 23)
```

	NOT ELIG < 19	ELIGIBLE >= 19	
SUCCESS A,B,C,CR	3 13.0% r 18.8% c 50.0%	13 56.5% r 81.3% c 76.5%	16 69.6% r 100.0%
NOT SUCC D,F,NC,W	3 13.0% r 42.9% c 50.0%	4 17.4% r 57.1% c 23.5%	7 30.4% r 100.0%
	6 26.1% c 100.0%	17 73.9% c 100.0%	23 100.0%

```
Correct Placements:     69.6%
Base Rate (success):    69.6%
Gain in Accuracy:        0.0%


Selection Ratio:        73.9%
Diff in Succ Ratio:     26.5%
```

-17-

Table 9.
Percentage of Students by
Math 211 Success and Admission Status
MDTP4

```
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Database: Math 04 F91 - F93  (Filter: NONE)
Course: MATH 211
Test: MATH 04: PRECALCULUS C
Subgroup: TOTAL  (N = 40)
```

```
              NOT ELIG  ELIGIBLE
                < 25      >= 25
               |---------|---------|
               |         |         |              Correct Placements:  82.5%
               |    0    |   26    |    26        Base Rate (success): 65.0%
    SUCCESS    |  0.0%   |  65.0%  |   65.0%      Gain in Accuracy:    17.5%
    A,B,C,CR   | r 0.0%  |r 100.0% | r 100.0%,
               | c 0.0%  | c 78.8% |
               |         |         |
               |---------|---------|
               |         |         |              Selection Ratio:     82.5%
               |    7    |    7    |    14        Diff in Succ Ratio:  78.8%
    NOT SUCC   | 17.5%   |  17.5%  |   35.0%
    D,F,NC,W   | r 50.0% | r 50.0% |r 100.0%
               |c 100.0% | c 21.2% |
               |         |         |
               |---------|---------|
                    7        33        40
                  17.5%    82.5%    100.0%
                c 100.0%  c 100.0%
```

The following line graphs provide a visual depiction of three of the major factors considered when selecting the appropriate cut scores: (1) percentage of correct placements; (2) percentage of false positives - or those who were eligible but who received an unsuccessful final grade; and (3) percentage of false negatives - or those who were ineligible but received a successful final grade. One common error in selecting cut scores is to only look at the percentage of correct placements. By doing so, it encourages cut scores that are too high. Figures 8 through 14 show the recommended cut scores.

Figure 8.
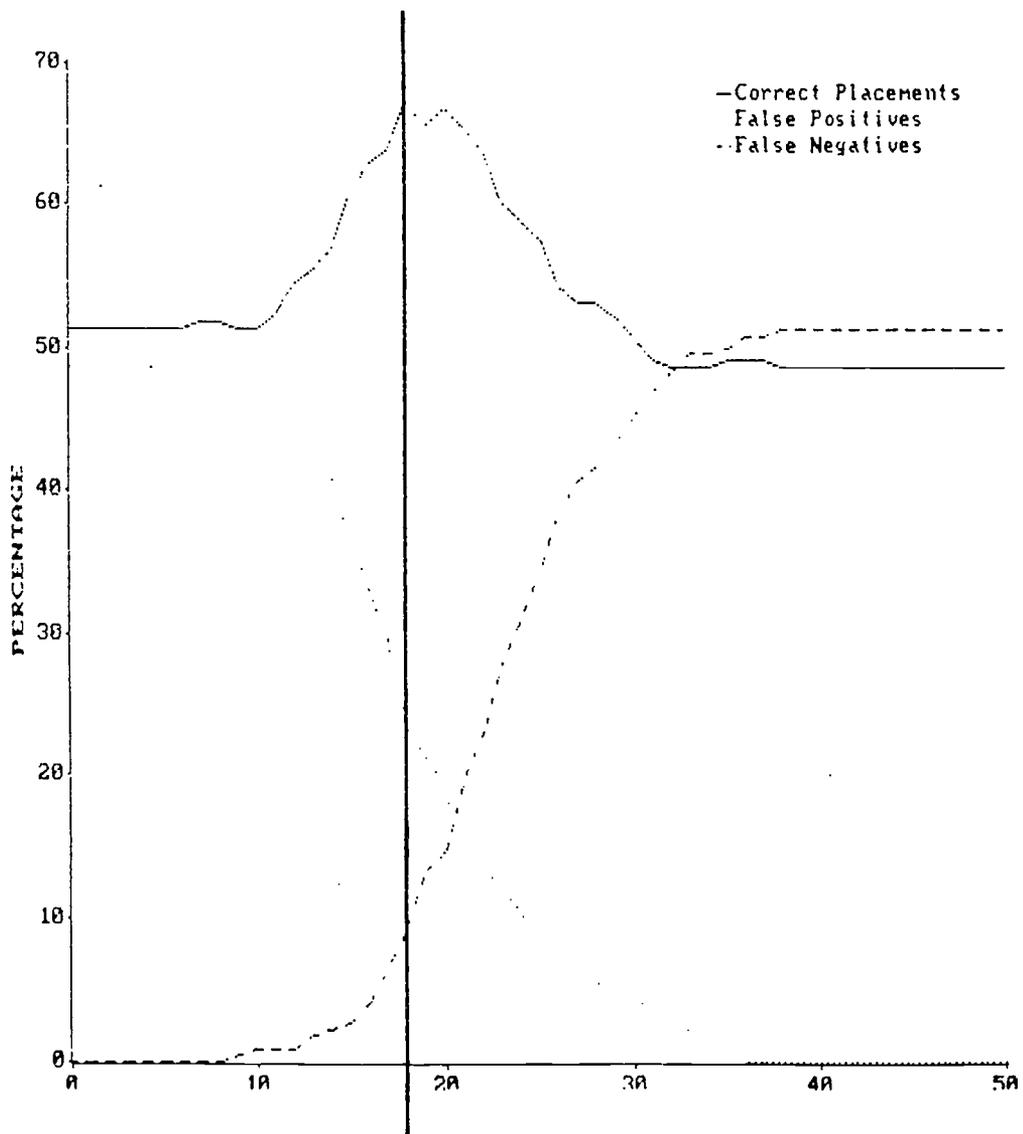Math 060 Recommended Cut Score of 30
MDTP1

College of the Canyons   06/13/94 **APRS**
                                                12:54:16   Page 1
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Data: Math 01 F91 - F93
Course: MATH 060
Test: MATH 01: ALGEBRA READINESS
Subgroup: TOTAL
N=134

—Correct Placements
·False Positives
- ·False Negatives

-20-
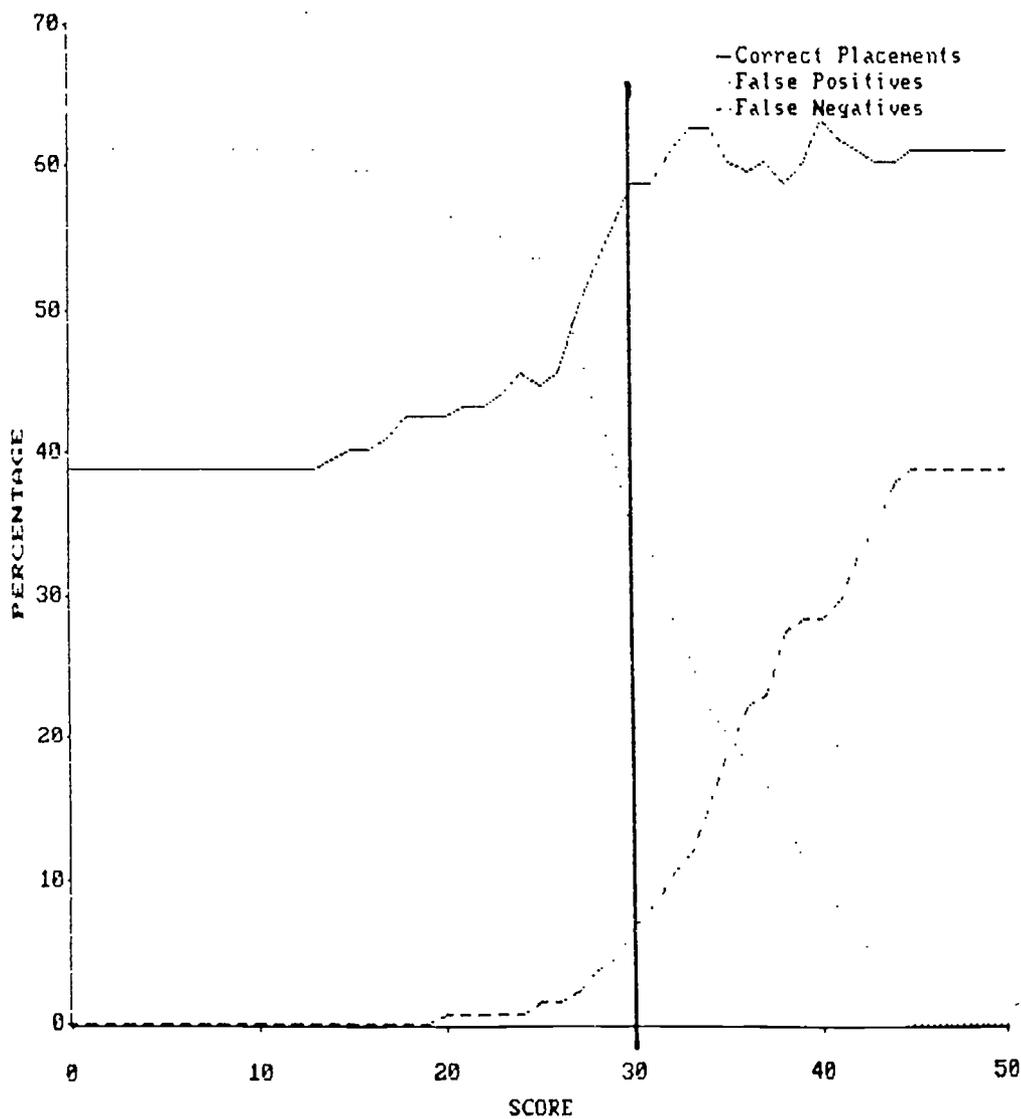
Figure 9.
Math 060 Recommended Cut Score of.18
MDTP2

College of the Canyons   06/13/94 **APRS**
                                                          12:57:24   Page 1
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Data: Math 02 F91 - F93
Course: MATH 060
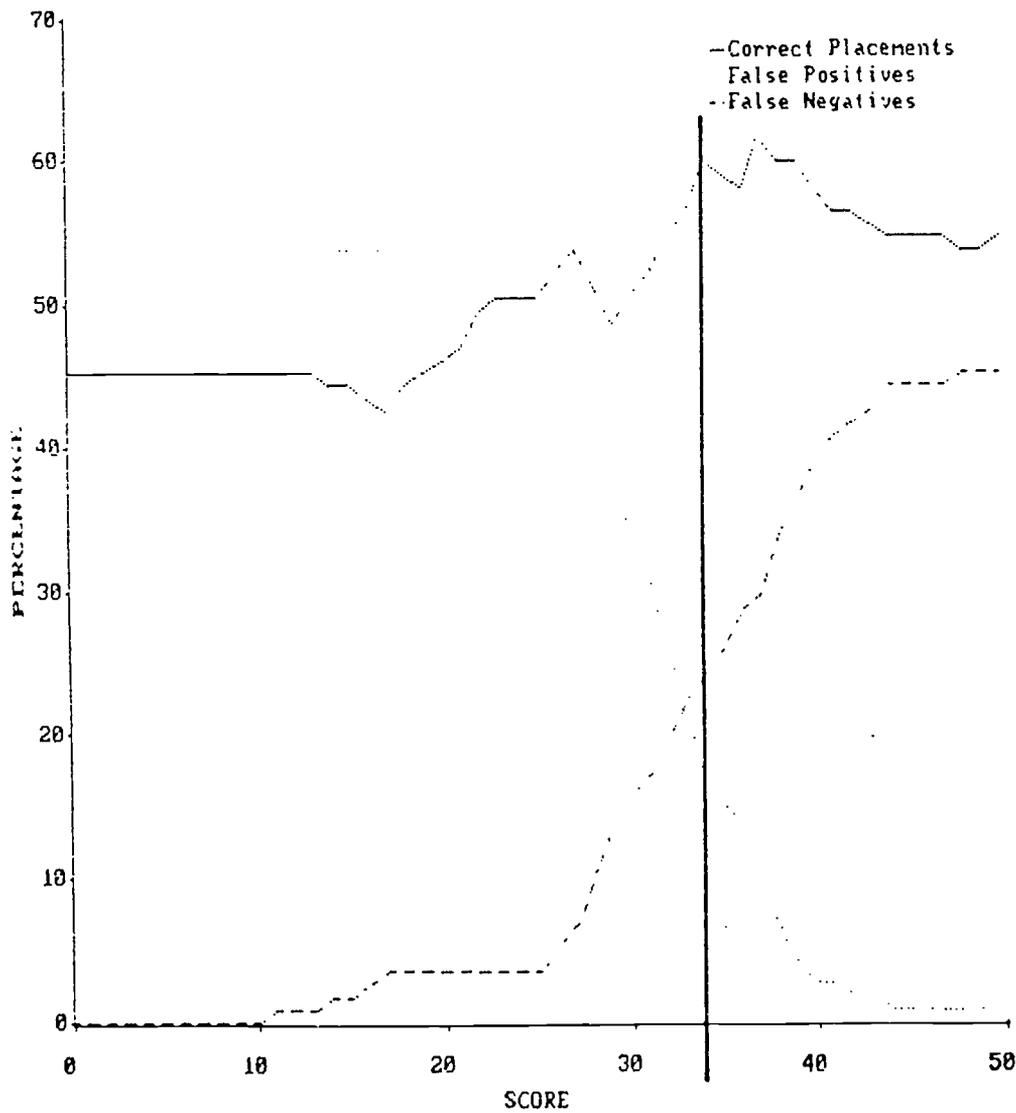Test: MATH 02: ELEMENTARY ALGEBRA C
Subgroup: TOTAL
N=226

—Correct Placements
 False Positives
·-False Negatives

Figure 10.
Math 070 Recommended Cut Score of 34
MDTP2

-22-

45

Figure 11.
Math 070 Recommended Cut Score of 21
MDTP3

```
College of the Canyons                              06/13/94  **APRS**
                                                    13:02:27  Page 1
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Data: Math 03 F91 - F93
Course: MATH  070
Test: MATH 03: INTERMEDIATE ALGEBRA C
Subgroup: TOTAL
N=171
```
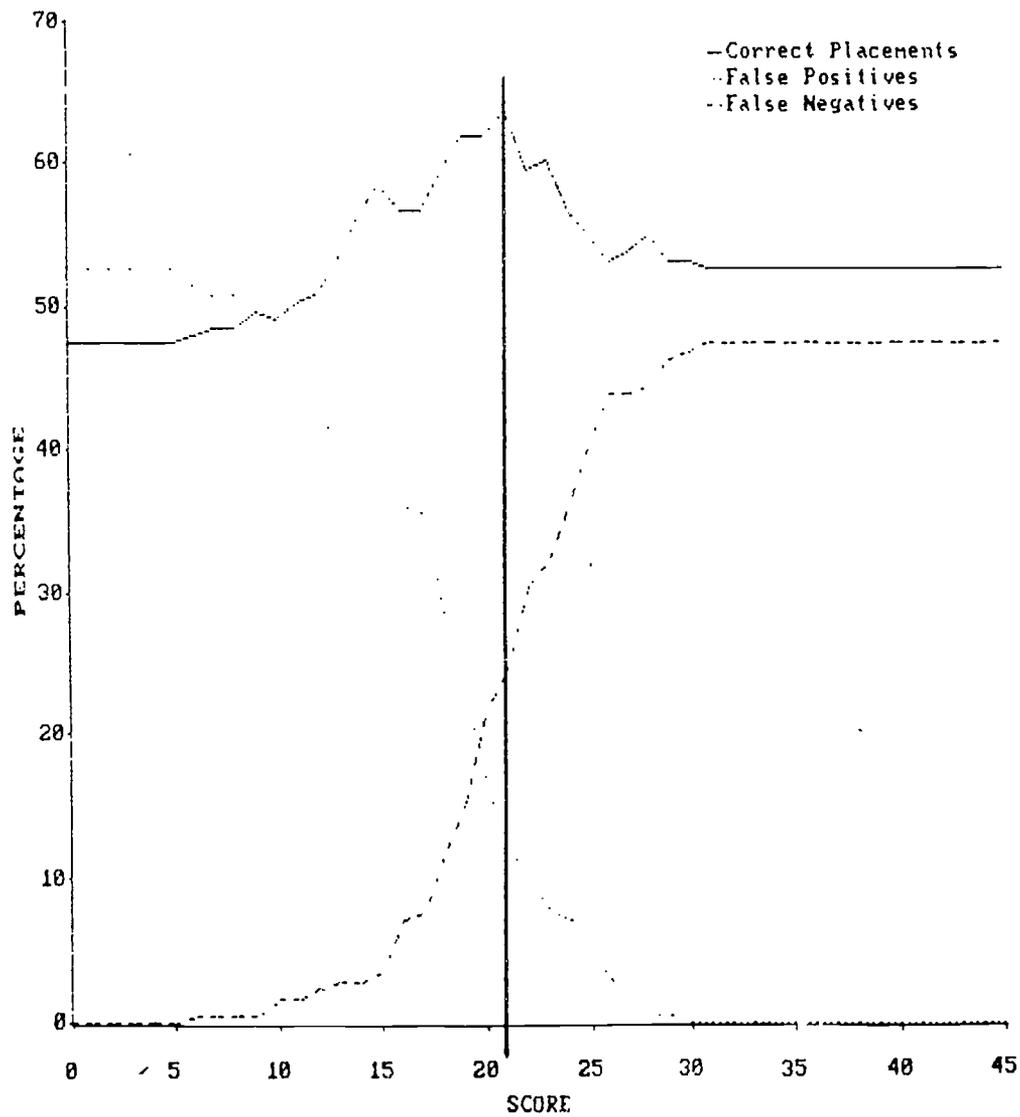

Legend:
- —Correct Placements
- ··False Positives
- ·-False Negatives

X-axis: SCORE
Y-axis: PERCENTAGE

Figure 12.
Math 102 Recommended Cut Score of 29
MDTP3

College of the Canyons   06/13/94 **APRS**
                                                         13:04:15   Page 2
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Data: Math 03 F91 - F93
Course: MATH 102
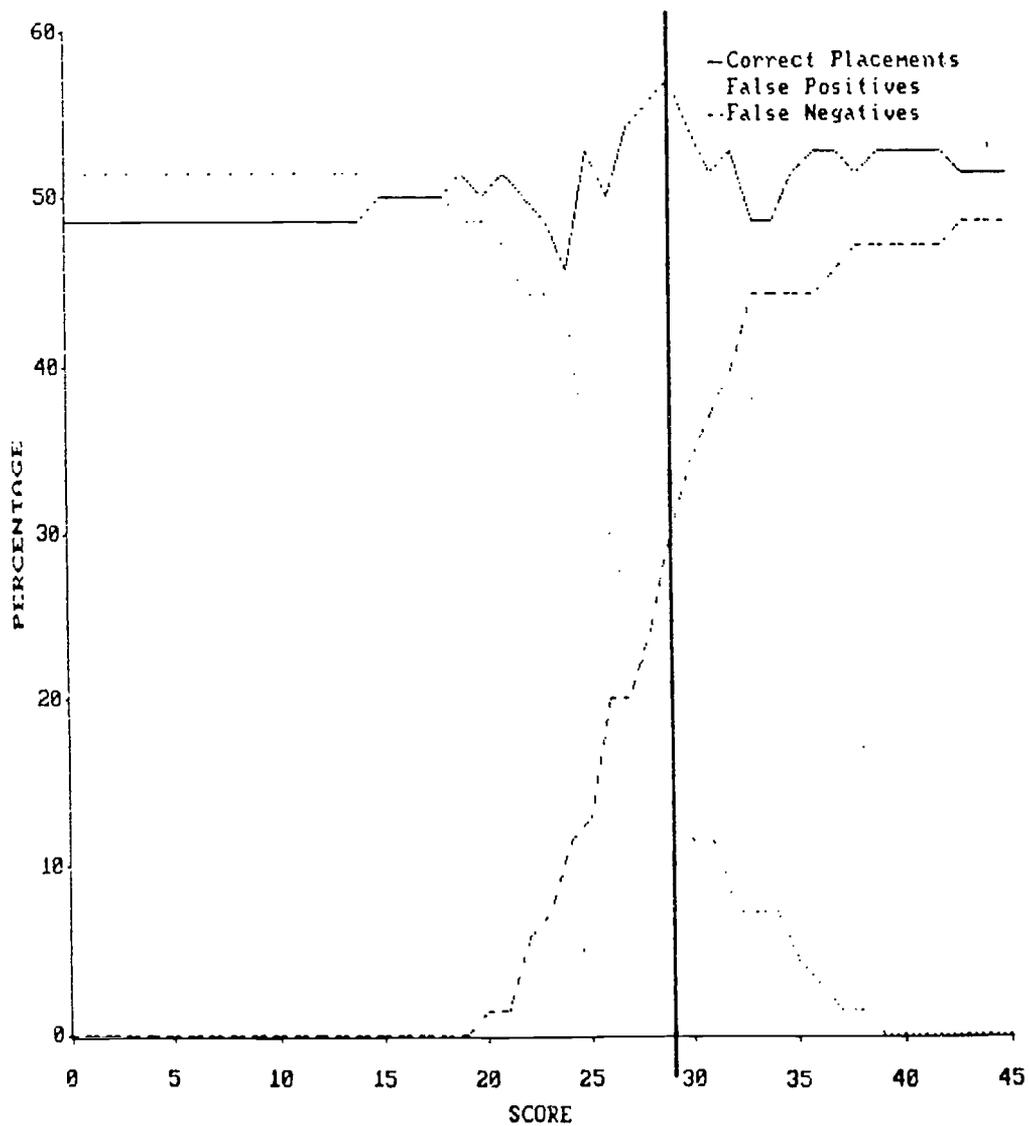Test: MATH 03: INTERMEDIATE ALGEBRA C
Subgroup: TOTAL
N=70

—Correct Placements
False Positives
..False Negatives

-24-

Figure 13.
Math 102 Recommended Cut Score of ·19
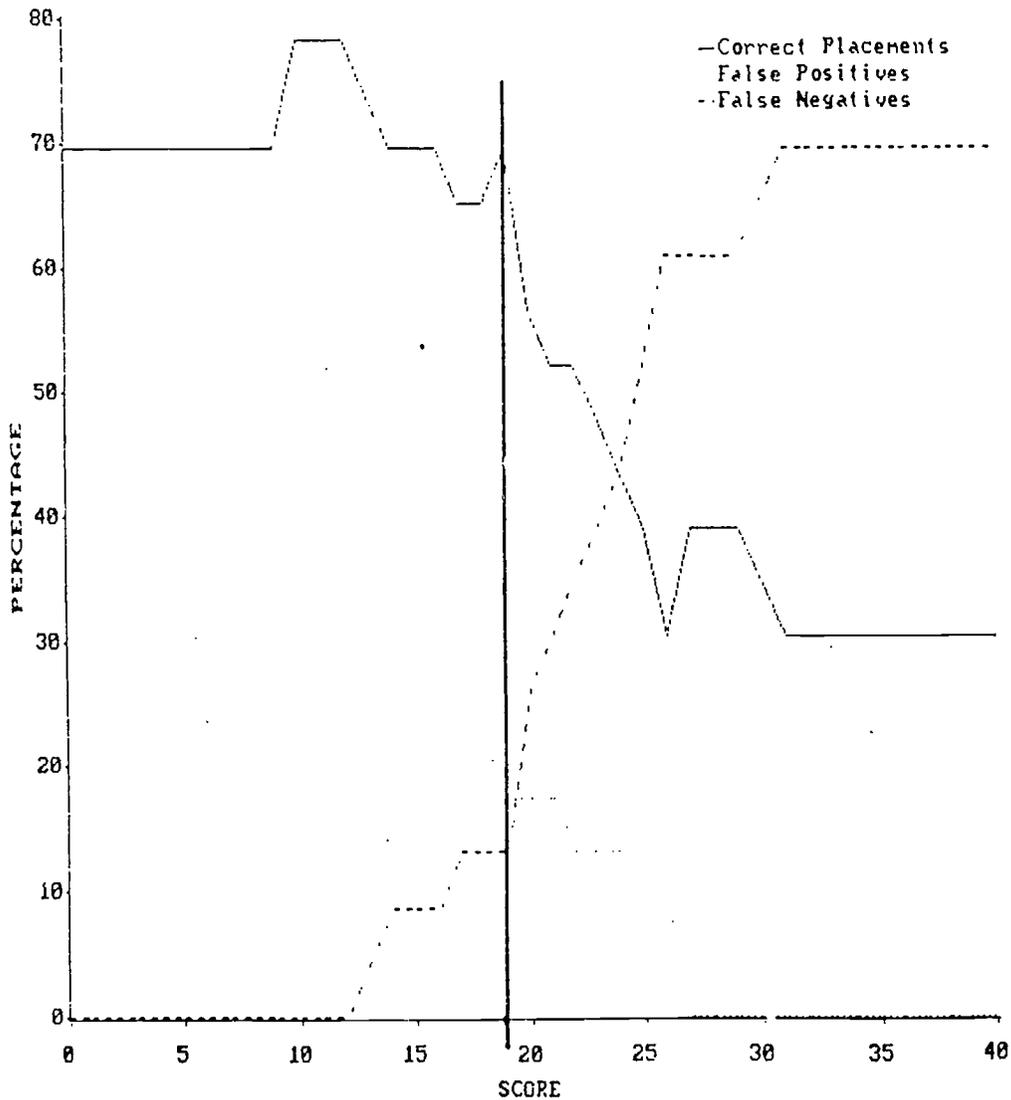MDTP4

College of the Canyons   06/13/94   **APRS**
                                                               13:09:04   Page 2
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Data: Math 04 F91 - F93
Course: MATH 102
Test: MATH 04: PRECALCULUS C
Subgroup: TOTAL
N=23

-25-

Figure 14.
Math 211 Recommended Cut Score of 25
MDTP4

College of the Canyons   06/13/94 **APRS**
                                                          13:11:01   Page 3
CLASSIFICATION TABLES FOR OPTIMAL CUT SCORES
Data: Math 04 F91 - F93
Course: MATH 211
Test: MATH 04: PRECALCULUS C
Subgroup: TOTAL
N=40

—Correct Placements
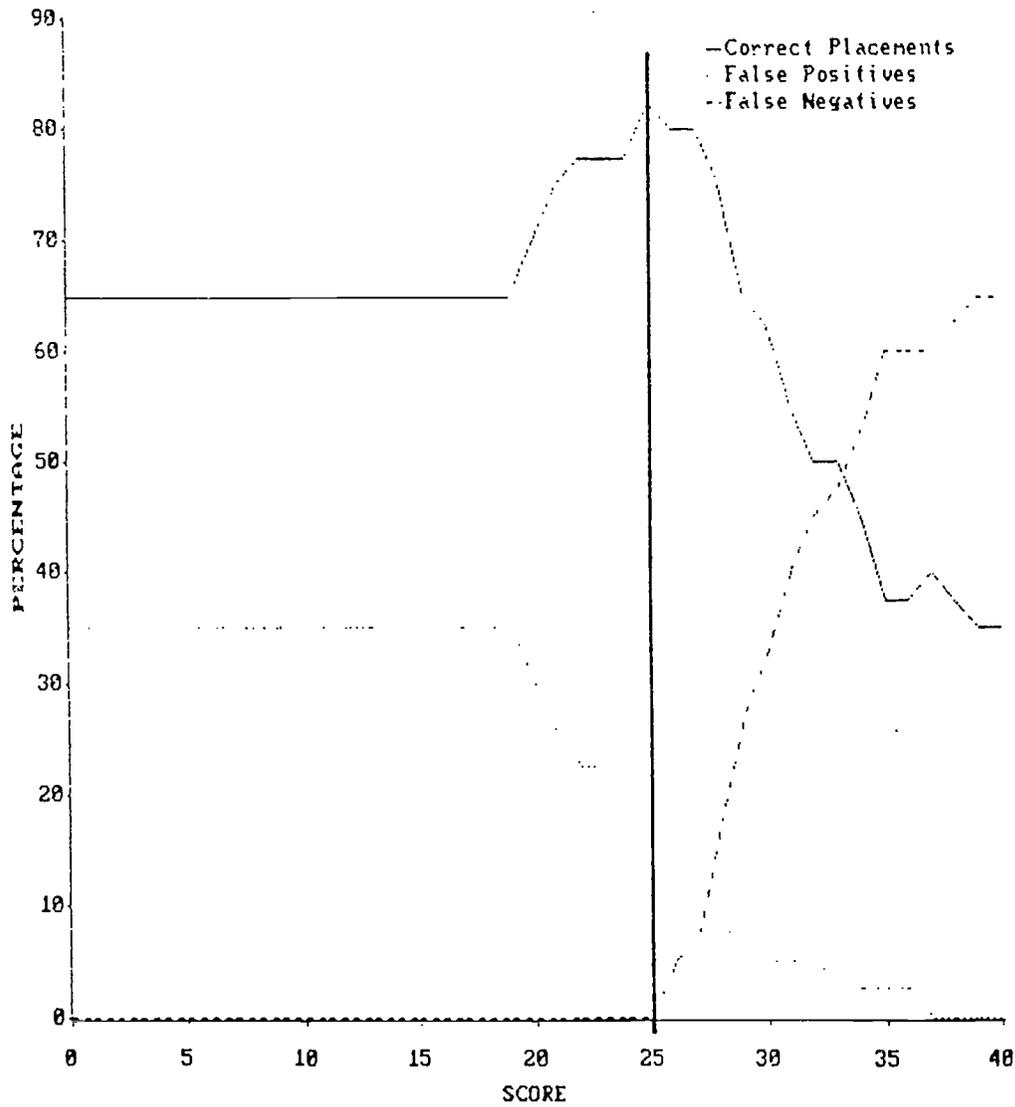· False Positives
--False Negatives

-26-

Table 10 provides supplemental information in support of the relationship between test scores and grades. Specifically, the mean test scores for key criterion (grade) defined groups -- for students earning an A or B grade, a C grade, a grade of D or F, and those receiving Ws -- are presented. The mean test scores for the highly successful students (those witn A or B grades) is clearly greater than the mean values for students who earned C grades, who in turn tended to have higher scores than those with D or F grades. While the pattern is not a perfect linear relationship, these data are consistent with the overall linear relationships between test scores and course grades, and also support the reasonableness of the recommended cut score levels.

Table 10.

**Mean Score for Key Grade-Based Criterion Groups,
By Course**

| Test/Course | Final Grade Earned | | | |
	A/B	C	D/F	W
MDTP1				
Math 025	19.85	17.43	16.83	16.91
Math 057	27.71	*	25.91	25.33
Math 060	35.86	32.76	33.15	29.96
MDTP2				
Math 025	*	*	9.50	*
Math 060	22.84	21.79	19.38	18.23
Math 070	33.13	30.50	32.00	29.29
MDTP3				
Math 060	13.12	11.91	11.07	13.00
Math 070	20.31	19.62	18.17	16.75
Math 102	27.74	27.00	27.73	25.95
Math 103	28.60	31.38	25.00	25.00
Math 140	23.43	23.00	22.67	27.60
Math 240	31.40	*	*	*
MDTP4				
Math 060	*	*	*	*
Math 070	16.40	*	*	*
Math 102	23.33	18.71	17.83	*
Math 103	25.67	17.20	*	*
Math 140	23.67	*	*	*
Math 211	30.65	28.00	*	24.40
Math 240	*	*	*	*

* N is 5 or less.

Since the study samples represent only a portion of the
students who actually took each of the MDTP tests during
these five semesters, we questioned what proportion of the
total groups would have fallen into each of the recommended
cut score ranges. Table 11 provides the breakdowns.

Table 11.

Recommended MDTP Cut Scores by Course
All Tested Students, Fall 1991 to Fall 1993

Test	Score Range	Recommended Placement	% of Total Tested	N
MDTP1	0 - 29	Math 025	71.6%	1563
	30 - 50	Math 060	28.4%	619
MDTP2	0 - 17	Math 025	42.4%	492
	18 - 33	Math 060	48.5%	563
	34 - 50	Math 070	9.1%	106
MDTP3	0 - 9	Take MDTP2	10.2%	87
	10 - 20	Math 060	48.9%	417
	21 - 28	Math 070	28.7%	245
	29 - 45	Math 102	12.2%	104
MDTP4	0 - 9	Take MDTP3	5.8%	13
	10 - 18	Math 070	28.9%	65
	19 - 24	Math 102	24.0%	54
	25 - 40	Math 211	41.3%	93

A smaller percentage of the total group of the MDTP1 and MDTP2 test takers fell into the Math 060 score ranges than was true of the study sample (MDTP1: 28.4% versus 46.8% and MDTP2: 48.5% versus 57.0%).

DISCUSSION

This study provides clear evidence supporting the reasonableness of the recommended cut scores for each of the four math placement tests. The cut scores should be monitored and adjusted as needed.

A thorough review of these findings by all involved faculty and Student Services personnel is encouraged.

RECOMMENDATIONS

1.   Eliminate the use of sub-scores in placement.   The college currently uses a cut score system for the MDTP tests which is an adaptation of the system initially used by Santa Barbara City College (SBCC). The system makes use of both an overall score and scores on sub-sets of questions within a test to make a judgement about course placement.

In discussing the development of the scoring system with Robert Elmore at SBCC, he indicated that their college had run scatter diagrams to develop the best overall cut scores back in 1985-86, but had never carried out any validation research on the sub-scores. SBCC no longer uses

the sub-scores in their math placement process.

The sub-scores offer additional information about the specific areas of strength or weakness. The sub-scores essentially become mini-placement tests and as such would require extensive validation study.

2. <u>Provide sub-score feedback to students</u>. Each test contains several questions designed to test the math knowledge or ability of a student in a given area. The sub-tests are then added together to form an overall placement test score.

The college should provide each student with a report on the diagnostic sub-scores he/she receives on the MDTP test. The CAPP system provides the option of printing a personal letter to a student which provides diagnostic feedback as to the strengths and deficiencies found (ASAP Manual, page 75). The letter includes the students overall math score and provides feedback on the areas in which the student did well and the areas in which he/she needs review. The letter also provides comparative information for each of the sub-scales, indicating the total possible points available and the level that is considered a mastery level. For example, a student who took the Pre-calculus test may do well in rational expressions and linear equations but may need review in exponents and radicals,

polynomials, functions, trigonometry, logs and exponential functions and word problems. The letter also provides space for the college to indicate where assistance is available to the student, should they not be able to enroll in a recommended math course that semester.

3. Provide sub-score information to faculty. The matriculation program could provide valuable assistance to individual math faculty if they were able to provide them with copies of Diagnostic Sub-scores letters for each of the students enrolled in their class. The test results provide a faculty member with a clear indication of the areas in which the class has strengths and the areas in which it needs assistance.

CUTMDTP.FW4