

MDTP Assessment Test Validations

- a renewal study to document evidence of valid use

Office of Institutional Research
Office of Matriculation and Student Development
Mathematics Department
Cabrillo College
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RATIONALE

The MDTP placement tests were approved for use beginning fall 1992. As required by Title V, the Chancellor's Office for California Community Colleges requires colleges to review all assessment tests every six years by documenting evidence of valid use. According to the most recent issue, "Standards, Policies and Procedures for the Evaluation of Assessment Instruments Used in the California Community Colleges," for a second party and locally managed test, such as MDTP, the documentation process includes

- 1) Content Validity Evidence,
- 2) Consequential Validity Evidence,
- 3) Cut Score Evidence, and
- 4) Disproportionate Impact Evidence (p43).

METHODOLOGY

The definitions for these four areas are explained in the above mentioned document starting on page 22. To conduct the study, the Office of Matriculation and Student Development (Matriculation Office) and the Mathematics Department worked with the Office of Institutional Research (OIR) to identify the research instruments and mode of data collection. The Matriculation Office assisted with administering a Mid-term Student/Faculty Evaluation (n = 1,400, valid n = 483), (see Attachment II). These surveys were given to all students who were enrolled in Math, English, and Reading classes at Cabrillo in fall 1997, as well as instructors who taught these classes. The Mathematics Department provided expertise and manpower in reviewing Pre-Course and Test Skills Match and Items to Skills Fit, which are the two areas for Content Validity Evidence. (see Attachment I for actual results).

Due to the restraint in time and resources, Cabrillo could not generate separate surveys for students and faculty. Cabrillo opted to use a Mid-term Student/Faculty Evaluation instrument that has been used by other colleges, which allows questions for students and questions for faculty to be printed on the same instrument. After discussing the results of the survey with the consultants hired by the state, the data from this instrument was deemed reliable for use for Consequential Validity Evidence as well as a reference for Cut Score Evidence. (see Attachment III). From all evidence, the responses from students were independent to those from instructors.

To study cut-score and Disproportionate Impact Evidence, OIR relied on the Cabrillo Datawarehouse for data from the students' Math course outcomes for Fall 1997 and Spring 1998.

Table 1 is a matrix helps with understanding the above discussion:

Table 1, Division of Labor for Validating MDTP Placement Test:

Items to Study	Responsibility	Mode of Data Collection	Scope
Content Validity Evidence	Mathematics Department	Two-way, Independent Scoring Instrument	Four faculty
Consequential Validity Evidence	Matriculation OIR	Mid-term Student/Faculty Evaluation	All students and instructors in Math, English, and Reading
Cut-score Evidence	OIR	Datawarehouse	Assessed students who enrolled in Math classes based on placement
Disproportionate Impact Evidence	OIR	Datawarehouse	Assessed students who enrolled in Math classes based on placement and statistics of college in general as a comparison.

FINDINGS

Consequential Validity

Table 2 shows that for every level of Math courses, over 75% of the students reported to be satisfied with their placement. The same rate of satisfaction was found in instructors' evaluation.

Table 2, Consequential Validity

	Basic Math		Math 154		Math 152		Transfer		Total	
Students' Evaluation										
	#	%	#	%	#	%	#	%	#	%
Not Qualified		0%	2	1%	2	1%		0%	4	1%
Not Completely	2	4%	10	6%	13	6%	3	5%	28	6%
Barely Qualified	8	17%	12	7%	18	9%	5	8%	43	9%
Qualified	28	61%	124	71%	143	71%	49	79%	344	71%
Overqualified	8	17%	26	15%	25	12%	5	8%	64	13%
Totals:	46		174		201		62		483	
Faculty's Evaluation										
	#	%	#	%	#	%	#	%	#	%
Very Weak Ability		0%	1	1%	5	2%	8	13%	14	3%
Weak Ability	4	9%	17	10%	13	6%	4	6%	38	8%
Moderate Ability	19	40%	52	30%	72	36%	26	42%	169	35%
Strong Ability	13	28%	60	35%	64	32%	16	26%	153	32%
Very Strong Ability	11	23%	42	24%	47	23%	8	13%	108	22%
Totals:	47		172		201		62		482	

Data Validation

An examination of actual course attendance based on placement recommendation revealed that over 95% of the students enrolled in the courses as recommended, provided that they did enroll at Cabrillo College that fall. This examination was important in that there would not be any data contamination if students did not follow placement recommendations at all. Further, for the rest of the study, unless it is otherwise noted, subjects under study did not include those who were placed in classes with the consideration of Multiple Measures.

Cut-Score Validity

The following table shows the success rate of the students who enrolled in the math courses that were recommended to them based on their placement test scores, barring the influence of multiple measures.

Table 3, Cut-Score Validity (Fall 1997 Data only):

Placement Levels Examined	Placement Tests	Cut-score Range	Correlation to Students Self-evaluation	Correlation to Faculty Evaluation	success rates:
Basic Math (n = 16)	Algebra Readiness	0 – 23	n/a	n/a	75.9%
Math 154 (n = 139)	Algebra Readiness	24-50	.23	.32	77.0%
Math 152/3 (n = 91)	Algebra Test	12 – 23	.28	.48	74.7%
Transfer Math (n = 35)	Algebra Test	24 – 45	.02	.44	71.4%

Grades: A, B, C, D, NC, and F.

Table 4, Detailed View of Grades and Success and Retention Rates (Fall 97 & Spring 98):

	BASC MATH		MATH154		MATH152		MATHTRAN		Group Total	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %
A	3	4.4%	55	23.3%	27	19.0%	14	24.6%	99	19.7%
B	1	1.5%	47	19.9%	33	23.2%	14	24.6%	95	18.9%
C			41	17.4%	28	19.7%	8	14.0%	77	15.3%
CR	35	51.5%							35	7.0%
D			22	9.3%	12	8.5%	6	10.5%	40	8.0%
F			22	9.3%	16	11.3%	5	8.8%	43	8.5%
NC	17	25.0%					1	1.8%	18	3.6%
W	12	17.6%	49	20.8%	26	18.3%	9	15.8%	96	19.1%
Total	68	100.0%	236	100.0%	142	100.0%	57	100.0%	503	100.0%
success rate w/o W		69.6%		76.5%		75.9%		75.0%		75.2%
success rate w/ W		57.4%		60.6%		61.9%		63.1%		60.8%
Drop Out Rate:		17.6%		20.8%		18.3%		15.8%		19.1%

Table 3 shows that the correlation for Math 154 was less than ideal, as compared against the subjective correlation coefficient of .35 as used by many other colleges. This prompted the examination of a cross-tabulation of Math 154 outcome and students' original placement test scores (Table 5). This examination revealed that those students who obtained an original score of less than 26 were receiving more D and F grades than those with higher scores. This became especially obvious when the numbers of students receiving higher grades increased as their placement test scores went up.

Table 5, Cross-tabulation of Math 154 Outcome vs. Original Placement Test Scores:

Original Scores	Quantified Grades					Total
	.00	1.00	2.00	3.00	4.00	
23	4				1	5
24	7		5	3	2	17
25	7	5	3		2	17
26	4	1	3	1	1	10
27	5	1	2	4	3	15
28	6	1	4		1	12
29	2	4	4	6	2	18
30	6	1	3	1		11
31	8	2	1	3	4	18
32	7		1	3	1	12
33	1	1	4	2	4	12
34	4		2	4	4	14
35	4		3	3	1	11
36	3	1	1	2	4	11
37	2		2	4	4	12
38	2	1		3	2	8
39	2	2		2	2	8
40	2		1		3	6
41	1	1		3	3	8
42					3	3
43	1		1	2	2	6
44			1		2	3
45				1	2	3
46					2	2
47		1				1
Total	78	22	41	47	55	243

Note: Quantified Grades refer to the following conversion: A = 4.00, B = 3.00, C = 2.00, D = 1.00, all other scores = .00.

A meeting was held with the Math department and the above observation was discussed. People present at the meeting also discussed the outcome of faculty content/cut-score. The faculty felt that the Algebra Readiness Test did not test students' abilities in Fractions and Percents, which were essential for the course success in Math 154. It was possible that those who did not have good skills in these areas obtained lower placement scores, and consequentially, received lower course grades.

It was therefore decided by people at the meeting that the cut-score for Algebra Readiness be raised from 23 to 26 for Math 154. The new cut-score table is as follows:

Table 6, New Cut-score Table:

Placement Levels Examined	Placement Tests	Cut-score Range
Basic Math	Algebra Readiness	0 – 25
Math 154	Algebra Readiness	26-50
Math 152/3	Algebra Test	12 – 23
Transfer Math	Algebra Test	24 – 45

Table 7 and Table 8 presented the cross-tabulation results between the outcome of Math 152 and Transfer Math and students' original placement test scores. Since the correlation coefficients for both Math 152 and Transfer Math were favorable, these two tables are for reference only.

Table 7, Cross-tabulation of Math 152 Outcome vs. Original Placement Test Scores
(For Reference Only)

Original Scores	Quantified Grades					Total
	.00	1.00	2.00	3.00	4.00	
10	1		1		2	4
11		1				1
12	7	1	2	2	3	15
13	6	2	3	5	1	17
14	5	2	4	3	2	16
15	4		2	4	7	17
16	7		5	4	2	18
17	5	3	2	2	1	13
18	2	1	2	3	1	9
19	3	2		2	1	8
20			3	2	4	9
21	1		4	5	2	12
22	1					1
23				1	1	2
Total	42	12	28	33	27	142

Note: Quantified Grades refer to the following conversion: A = 4.00, B = 3.00, C = 2.00, D = 1.00, all other scores = .00.

Table 8, Cross-tabulation of Transfer Math Outcome vs. Original Placement Test Scores
(For Reference Only)

Original Scores	Quantified Grades					Total
	.00	1.00	2.00	3.00	4.00	
21					1	1
22	1	1		1		3
23	1	1		2	4	8
24	2	2	1	1	1	7
26	1			2	3	6
27	2		2	3	1	8
28	1			1		2
29	2	1			1	4
30			2	1		3
31	2				1	3
32	1	1	1			3
33	2				1	3
34			1			1
35					1	1
38			1			1
39				1		1
41				1		1
Total	15	6	8	13	14	56

Note: Quantified Grades refer to the following conversion: A = 4.00, B = 3.00, C = 2.00, D = 1.00, all other scores = .00.

Disproportionate Impact

Table 9 shows a disproportionate number of Hispanic students concentrated in Basic Math and that fewer of them were in transfer level math. Math faculty pointed out that this was possibly due to the math curriculum designs at local feeder high schools of Aptos High and Watsonville High where students self-selected into two separate types of math programs: 1) interactive math, and 2) traditional math. From most recent data from Aptos High, more Hispanic students selected Interactive Math (54.2% Hispanic) than Traditional Math (35.3% Hispanic), and more Hispanic students were failing in that program (39.4% receiving D and F) than in Traditional Math (27.7%). This does not necessarily mean that the interactive math program is not functional. Factors such as 12th grade Hispanic students being general ill-prepared for math courses may also have played a role.

Table 9, Disproportionate Impact Data for Ethnicity:

	BASC MATH		MATH154		MATH152		MATHTRAN	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Af. Am.	1	1.4%	2	.8%	2	1.4%		
Am. Ind.	1	1.4%	4	1.6%	5	3.5%	1	1.8%
Asian	4	5.5%	14	5.8%	10	7.0%	7	12.3%
Hispanic	32	43.8%	43	17.7%	28	19.7%	2	3.5%
Other			7	2.9%	10	7.0%	1	1.8%
Unknown	2	2.7%	9	3.7%	9	6.3%	5	8.8%
White	33	45.2%	164	67.5%	78	54.9%	41	71.9%

Table 9b. Detailed view of the Shaded Cells in Table 9.

	Basic Math		Transfer Math	
	Hispanic	White	Hispanic	White
<13	1	1		2
14-17	2	2	1	5
18-20	15	14	1	25
21-25	5	6		5
26-30	2	3		3
31-40	5	4		1
41-50		2	2	41
61+	2	1		
Group Total	32	33	4	82

Table 10 revealed that fewer females were placed in Math 154 and Transfer Math courses, while the distribution of females in other math courses was close to the college’s gender ratio of 58.3% of females. An examination of Table 11, the gender distribution by ethnicity by class, showed that fewer Hispanic females were placed into Math 154. For transfer math, the number was too small to make a determination, but it was still observed that the distribution of gender among Asian students was disproportionate.

Table 10, Disproportionate Impact Data by Gender:

	BASC MATH		MATH154		MATH152		MATHTRAN	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Unknown	1	1.4%	1	.4%			1	1.8%
Male	28	38.4%	118	48.8%	62	44.6%	27	47.4%
Female	44	60.3%	123	50.8%	77	55.4%	29	50.9%

Table 10b, Detailed View of Shaded Cells in Table 10.

	MATH154			MATHTRAN		
	male	female	Group Total	male	female	Group Total
<13	5	4	9		2	2
14-17	23	28	51	2	4	6
18-20	50	54	104	17	17	34
21-25	14	12	26	4	5	9
26-30	9	7	16	4		4
31-40	8	6	14		1	1
41-50	2	5	7			
51-60		1	1			
61+	7	6	13			
Group Total	118	123	241	27	29	56

Table 11, Disproportionate Impact Data for Gender and Ethnicity

		Males	Females	TOTAL
BASC MATH	Af. Am.		1	1
	Am. Ind.		1	1
	Asian	2	2	4
	Hispanic	13	19	32
	Unknown	1	1	2
	White	12	20	32
	TOTAL	28	44	72
MATH154	Af. Am.	1	1	2
	Am. Ind.	2	2	4
	Asian	7	7	14
	Hispanic	23	20	43
	Other	4	3	7
	Unknown	4	3	7
	White	77	87	164
TOTAL	118	123	241	
MATH152	Af. Am.	1	1	2
	Am. Ind.	1	4	5
	Asian	4	6	10
	Hispanic	17	11	28
	Other	4	6	10
	Unknown	3	3	6
	White	32	46	78
TOTAL	62	77	139	
MATHTRAN	Am. Ind.	1		1
	Asian	6	1	7
	Hispanic		2	2
	Other		1	1
	Unknown	4		4
	White	16	25	41
	TOTAL	27	29	56

Table 13 deals with the distribution of students placed in math courses by age. As a rule of thumb, the distribution of age should be even for basic math, but the data showed more than half of the students in basic math were younger than 25.

Table 13, Disproportionate Impact Data by Age:

	BASC MATH		MATH154		MATH152		MATHTRAN	
AGE	Count	Col %	Count	Col %	Count	Col %	Count	Col %
<13	2	2.7%	9	3.7%	4	2.8%	2	3.5%
14-17	5	6.8%	51	21.0%	35	24.6%	6	10.5%
18-20	32	43.8%	105	43.2%	76	53.5%	35	61.4%
21-25	12	16.4%	26	10.7%	9	6.3%	9	15.8%
26-30	5	6.8%	16	6.6%	5	3.5%	4	7.0%
31-40	9	12.3%	14	5.8%	2	1.4%	1	1.8%
41-50	3	4.1%	7	2.9%	1	.7%		
51-60			1	.4%				
61+	5	6.8%	13	5.3%	7	4.9%		

For further information, please contact OIR at 831/479-5719.

Purpose	Procedure	File names
<p>For Consequential Validity, use the survey data after selecting the first timers and those who were assessed after May 31, 1997</p>	<p>File 'mathall.dbf' was created earlier from surveys which was linked to the math classes they took in the</p> <p>Foxpro used to link 'mathall.dbf' to assessment score file 'fa97new.dbf' to pull out all variables needed for both Consequential and Cut-score: Ssn, sex, age, ma_pldate (6/1/97 the day Mtest 2 was dumped), ma_plvl, scr41valu(mmeasures), ad_status(like enroll status).</p> <p>Eyeballing data showed duplicated ssns. Decision: take out those w/o ma_pldate SPSS used to clean up ssns w/o no value, gender, race, etc.</p> <p>Lefttrim leading spaces for ethnicit:</p> <p>STRING race (A8). COMPUTE race = LTRIM(ethnicit, ' ') . EXECUTE .</p> <p>Recode race into the same variable of race:</p> <p>RECODE race ('1'='Am. Ind') ('2'='Asian') ('3'='Asian') ('4'='Af. Am') ('5'='White') ('6'='Hispanic') ('7'='Asian') ('8'='Other') ('0'='Unknown') (' '= 'Unknown') . EXECUTE .</p>	<p>Finldata.dbf n=484</p>
<p>For Cut-score (Range?) Validity: Use grades from datawarehouse and link to the file above by ssn.</p>	<p>The file 'finldata.dbf' was used by Foxpro to pull in m1_corr and m3_corr data in order to screen out those got placed into classes after getting points from mm. This file contains some duplicated counts. Students who took m2 test (ma_pldate <19970601) were not selected.</p> <p>SPSS to select out the influence of Multiple Measures: ((m1_corr = 23 & sc41valu >= 1) or (m1_corr = 22 & sc41valu = 2)) or ((m3_corr = 11 & sc41valu >= 1) or (m3_corr = 10 & sc41valu = 2) or (m3_corr = 23 & sc41valu >= 1) or (m3_corr = 22 & sc41valu = 2)). Tried 'ne', only caught 3. Reverse Select on Filter variable is needed for the above procedure.</p>	<p>Finlgrde.dbf N=378</p>

<p>Data from F97 were too small, add S98</p>	<p>Used Foxpro (assessment file sp98new.dbf::dw_enroll.dbf) to pull out ssns, math tests scores, mm score41) SPSS selected those 'ad_stat' = 1 (first time students). SPSS selected only those who got in classes with 'mm' as a factor, using the script above. The selected resulted in 1, 0 and blanks. Change the filter_\$ to 'mm_guys' and then selected those who were either 0 or blanks, after recoding 'mm_guys' into the same variable with blanks and 0 = 0. Otherwise, selection command did not recognize blanks. This resulted in a total of 179 students left.</p>	<p>S98math.dbf N = 378 N = 179</p>
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Combine Grades from F97 with S98	<p>Examine the variable names to make sure they agree with one another before using Fox Pro to extract them into one file.</p> <p>Also, need to verify that students actually enrolled in the courses that belong to the level recommended to be placed (ma_lvl = the actual math course level). To do this, SPSS script is as follows:</p> <pre> RENAME VARIABLES (crs_titl=CRS_ENRL) . RECODE crs_enrl ('MATH254'='BASC MATH') ('MATH254A'='BASC MATH') ('MATH256'='BASC MATH') ('MATH154'='MATH154') ('MATH158G'='MATH154') ('MATH152'='MATH152') (ELSE='MATHTRAN') . EXECUTE . USE ALL. COMPUTE filter_\$=((ma_lvl = 11 & crs_enrl = 'BASC MATH') or (ma_lvl = 21 & crs_enrl = 'MATH154') or (ma_lvl = 33 & crs_enrl = 'MATH152') or (ma_lvl = 44 & crs_enrl = 'MATHTRAN')) . VARIABLE LABEL filter_\$ "(ma_lvl = 11 & crs_enrl = 'BASC MATH') or (ma_lvl ="+ "21&crs_enrl='MATH154') or (ma_lvl = 33 & crs_enrl = '... (FILTER)". VALUE LABELS filter_\$ 0 'Not Selected' 1 'Selected'. FORMAT filter_\$ (f1.0). FILTER BY filter_\$. EXECUTE . </pre> <p>The above will not delete those who went against placement advice and enrolled in a wrong level. To do that, simplify the select command:</p> <pre> FILTER OFF. USE ALL. SELECT IF((ma_lvl = 11 & crs_enrl = 'BASC MATH') or (ma_lvl = 21 & crs_enrl = 'MATH154') or (ma_lvl = 33 & crs_enrl = 'MATH152') or (ma_lvl = 44 & crs_enrl = 'MATHTRAN')) . EXECUTE . </pre> <p>This resulted in the file having 172 left.</p> <p>Now, combine F97 and S98 data to run cut-score: Lovingly, ethnicity in CAP file for S98 was missing a digit! Therefore, FoxPro linked S98math.dbf to Student</p>	S98math.dbf N=172
	<p>The above will not delete those who went against placement advice and enrolled in a wrong level. To do that, simplify the select command:</p>	S98math2.dbf N=172
	<pre> FILTER OFF. USE ALL. SELECT IF((ma_lvl = 11 & crs_enrl = 'BASC MATH') or (ma_lvl = 21 & crs_enrl = 'MATH154') or (ma_lvl = 33 & crs_enrl = 'MATH152') or (ma_lvl = 44 & crs_enrl = 'MATHTRAN')) . EXECUTE . </pre> <p>This resulted in the file having 172 left.</p> <p>Now, combine F97 and S98 data to run cut-score: Lovingly, ethnicity in CAP file for S98 was missing a digit! Therefore, FoxPro linked S98math.dbf to Student</p>	F97s98m.dbf N = 539

<p>Compare to those who got in with lower scores!</p>	<p>Used Fox pro to pull out grades. (sp98new.dbf::enroll.dbf) – same way to arrive the original S98math.dbf.</p> <p>Excel and SPSS used to manually pull out those with math scores and grades from ‘finlgrde.dbf’ to combine with ‘s98comp.dbf’ to create ‘978comp.dbf’, which serves as the file to examine those who scored low but somehow got into the higher courses with or without multiple measures. SPSS to convert ‘crs_lvl’ variable to ‘mathlvl’ variable:</p> <pre> STRING mathlvl (A8) . RECODE crs_titl ('MATH10'='MATHTRAN') ('MATH11'='MATHTRAN') ('MATH12'='MATHTRAN') ('MATH13'='MATHTRAN') ('MATH152'=Copy) ('MATH152S'='MATH152') ('MATH153'='MATH152') ('MATH154'=Copy) ('MATH154S'='MATH154') ('MATH158'='MATH154') ('MATH158S'='MATH154') ('MATH158G'='MATH154') ('MATH18'='MATHTRAN') ('MATH254A'='BASC MATH') ('MATH254'='BASC MATH') ('MATH255'='BASC MATH') ('MATH255S'='BASC MATH') ('MATH256'='BASC MATH') ('MATH256S'='BASC MATH') ('MATH4'='MATHTRAN') ('MATH5A'='MATHTRAN') ('MATH5B'='MATHTRAN') ('MATH5C'='MATHTRAN') INTO mathlvl . EXECUTE . </pre> <p>To select those who did not belong to the right course, SPSS: (m3_corr < 24 & mathlvl = 'MATHTRAN') or (m3_corr < 12 & mathlvl = 'MATH152') OR (M3_CORR < 12 & MATHLVL = 'MATH154') OR (M1_CORR < 24 & MATHLVL = 'MATH154') OR (M1_CORR < 12 & MATHLVL = 'MATH254')</p> <p>The above generated too small a population (n=68). Therefore, Excel and SPSS were used to identify more students whose ‘ad_stat’ = 1 and their m1, m3, sc41 values. This file was called ‘othrcmp’ n = 2,392. Foxpro extracted “othrcmp2.dbf” = 1,430. SPSS used to select those who did not belong to the right course, n = 113. This shall be combined with file ‘978cmp.dbf’. SPSS used to identify those who enrolled without ‘mm’ influence: withmm = 1 = with mm influence.</p>	<p>S98comp.dbf N = 378 978comp.dbf n = 730 n = 68 othrcmp.dbf n = 2392 othrcmp2.dbf n = 1430 n = 181 n = 171</p>
<p>Back to comparing with those who answer Q2 and Q4, because the above matrix did not work and if correlated btwn Mx_corr and Grade2, r is very low.</p>	<p>In SPSS, select out the levels first and then run frequency of associated variables, plus a correlation of Q2, Q4, Grade2: SPSS, Select if: mathenrl = 'BASC MATH' & mm_prblm='mm_no' & grade NE 'W'</p>	<p>Same file f98s98m.dbf</p>

Current Math Placement Tests Placement Arrangement to be Validated: (as of August 1998)

	Test Names	Test score	Placement*	Placement of Courses
	Algebra Readiness Test (M1)	0 – 23	11	Math 254/math255
	Algebra Readiness Test (M1)	24-50	21	Math 154
	Algebra Test (m3)	0 – 11	11	Take Alg. R. Test above
	Algebra Test (m3)	12 – 23	33	Math 152/153
	Algebra Test (m3)	24 – 45	44	Transfer Math (4, 12, 13, 16, etc.)

* must run frequency for each new semester file, just in case levels may differ or increase. Run Crosstab (ma_lvl :: m1_corr/m3_corr) to find out if ma_lvl follows this criterion.

Note: Multiple Measures (variable name: score41) come in points of 1, 2, 3, etc, which are regarded as 1, 2, 3 points on top of the math placement test scores.