Cosumnes River College

Math Assessment Test Cut-Score Validation Study

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Office of Institutional Effectiveness

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Background

The math assessment placement test at Cosumnes River College utilizes test cut-scores within various math subjects to place students in the appropriate level of math, from arithmetic (Math 20) to transfer level calculus (Math 400). These cut-scores are thought to indicate the minimum level of student preparedness required for a given course level. In order for these cut-scores to be an accurate indication of student preparedness, they must have *consequential validity*. Consequential validity is defined as the extent to which a test or procedure results in a predefined desirable outcome. In this case, the desirable outcome is placement of a student *at the appropriate course level* (not too high or too low). The California Community College Chancellor's Office (CCCCO) requires that 75% of students be placed at the appropriate course level for cut-scores to have adequate consequential validity. With this requirement in mind, the Office of Institutional Effectiveness, in conjunction with the faculty of math and the Dean of Science, Math, and Engineering, sought to assess the consequential validity of the math assessment cut-scores and identify any potential disproportionate impact of test placement.

Method

Two surveys were designed on the basis of standard validation procedures outlined by the CCCCO[1]. A student survey was designed to ask students (1) how they placed in the course (e.g., through the assessment process or some other means) and (2) whether or not they had been appropriately placed in the course (Appendix A). Students indicated their appropriateness of placement by checking one of three responses: "I should be in a course higher (more advanced) than this one" (placed *too low*); "I am in the right class" (placement at the *appropriate level*); or "I should be in a course lower (less advanced) than this one" (placed *too high*). The second survey took the form of a roster provided to faculty. On this roster, faculty were asked to rate the adequacy of each student's placement by writing a "+" ("Student should be in a class higher (more advanced) than this one"; placed *too low*), "0" ("Student is in the right class"; placement at the *appropriate level*), or "-" ("Student should be in a class lower (less advanced) than this one"; placed *too high*) next to each student's name. Instructors were provided a packet of surveys for each class with an enclosed letter containing instructions for administration (See Appendix B). A total of 3,855 student surveys and 102 faculty surveys were administered (response rates are summarized in the next section). Note that surveys were administered to students via email in three online Statistics courses (STAT 300).

After the surveys were completed, they were returned to the Office of Institutional Effectiveness. The first step in analysis was to evaluate the *construct validity* of the student/faculty surveys. A survey is thought to have construct validity if it measures what it is intended to measure. In this case, the surveys were supposed to measure the adequate placement of a students in math. Next, the survey results were tabulated by placement level (See *Table 1* for a description of cut-scores, placement levels, and corresponding courses). In order for a cut-score within a given placement level to have consequential validity, 75% of students who placed in through the assessment process would need to be self-rated and rated by faculty as at the appropriate level.

[1] http://extranet.cccco.edu/Portals/1/SSSP/Matriculation/Assessment/CutScore.pdf

Table 1. *Accuplacer Placement Levels and Cut-Scores*

Level	Subject/Cut-Score	Course Placement
1	*Arithmetic*: 0-43	Math 20
2	*Arithmetic*: 44-75	Math 30
4	*Arithmetic*: 75+ *Elementary Algebra*: 51-67	Math 100, 101
5	*Elementary Algebra*: 68+ *College Algebra*:	Math 110, 120, 125, 144
7	*College Algebra:* 76-92	Math 300, 310, 335, 343, Stat 300
8	*College Algebra:* 93-102	Math 350, 370
9	*College Algebra:* 103+	Math 400

Note. *Stat 300 is a recommended course for placement Levels 7, 8, and 9.However for the purposes of the present analysis, they were only included in the lowest placement group.

Results

Respondents

Of the 3,855 students, a total of 527 did not complete the student survey and were not rated by faculty. Moreover, a total of 683 students were rated by faculty but did not complete the student survey, and five students completed the survey but were not rated by faculty. Of the total number of administered surveys, only students who indicated that they had placed into a given math course by assessment were included in the present study. A total of 1,363 students completed the student survey and indicated that they had been placed in through the assessment process. Of these students, 1,362 were also rated by faculty. Thus, in later calculations 1,363 and 1,362 were used as denominators in determining the total percentage of adequately placed students for student and faculty ratings, respectively.

Construct Validity

Prior to calculating the percentage of appropriately placed students, the construct validity of the student and faculty surveys was assessed. Student ratings of the appropriateness of placement (too high, too low, or appropriate) were correlated with corresponding faculty ratings. If the two measures significantly correlated, then one could conclude that they were measuring the same construct, in this case the appropriateness of placement. The two ratings were significantly correlated, $\chi^2(4) = 103.97$, $p < .001$, such that there was 65.3% agreement between faculty and students on placement level appropriateness.

Consequential Validity

Next, the percentage of students who rated themselves and were rated by faculty as placed appropriately, too high, or too low was calculated by placement level (see *Table 2*). Overall 80.1% of students were rated by faculty as at the appropriate level. However, only 73.4% of students rated themselves as at the appropriate level. This below threshold rate for students appears to be driven by responses in placement levels 1, 2, and 5, where a total of 70.5% of students rated themselves as appropriately placed compared to 79.5% of faculty ratings. Students within these levels were much more likely to indicate that they had been placed *too low* than *too high*.

Additionally, four out of the seven levels (4, 7, 8, and 9) faculty and student ratings both exceeded the threshold of 75% specified by the CCCCO. Student ratings in placement levels 1, 2, and 5 did not reach or exceed the threshold of 75%. The faculty-evaluated placement level 2 was below the threshold of 75%. At levels 1 and 2, 29.5% (28.8% and 30%, respectively) of the student ratings indicated that the students were placed *too low* (they should be a in a higher, more advanced, course).

Table 2. *Student/Faculty Ratings of Placement Level by Assessment Level.*

	Appropriate		Too Low		Too High		Total Responses	
Level	***Student***	***Faculty***	***Student***	***Faculty***	***Student***	***Faculty***	***Student***	***Faculty***
1	**68.5%**	86.5%	28.8%	4.5%	2.7%	9.0%	111	111
2	**70.0%**	**74.1%**	30.0%	11.2%	0.0%	14.7%	170	170
4	77.4%	79.7%	20.3%	4.0%	2.4%	16.3%	424	424
5	**71.2%**	79.8%	24.0%	5.7%	4.8%	14.5%	496	495
7	75.7%	86.9%	22.4%	8.4%	1.9%	4.7%	107	107
8	77.5%	75.0%	20.0%	7.5%	2.5%	17.5%	40	40
9	80.0%	86.7%	20.0%	0.0%	0.0%	13.3%	15	15
Overall	**73.4%**	**80.1%**	**23.7%**	**5.9%**	**2.9%**	**14.0%**	**1,363**	**1,362**

Note. The "Appropriate" column presents the percentage of students who rated themselves or were rated by faculty as at the appropriate level. The "Too Low" column presents the percentage of students who rated themselves or who were rated by faculty as having been placed too low (should be in a higher course). The "Too High" column presents the percentage of students who rated themselves or who were rated by faculty as having been placed too high (should be in a lower course). Bold percentages are below the CCCCO established threshold of 75% for appropriate placement.

Disproportionate Impact of Test Placement

A *Proportionality Index* (PI) was calculated in order to assess disproportionate impact of assessment test placement within specific demographic groups. This analysis used only students who were placed by assessment test. The PI was calculated for a demographic group by dividing the group's proportion representation among students who tested into a given math course by that group's proportion representation in the overall population of students who placed by assessment test. In this case, a PI ratio of one would indicate that the subgroup is represented at the same rate in a given placement level as they are in the overall placement test population. A ratio of less than one indicates that the subgroup is underrepresented in the level compared to their representation in the overall population, and a ratio of more than one indicates an overrepresentation. *Table 3* displays the Proportionality Index by math level and student subgroup (see next page).

Analysis revealed that there was disproportionate impact of test placement among ethnic groups. Among students who placed by assessment test, Hispanic and African American students were underrepresented in the higher math levels; African American students were underrepresented in math levels 5 and higher and overrepresented in the lower math levels (levels 1, 2, and 4), and Hispanic students were underrepresented in math 7, 8, and 9. Conversely, Asian/Filipino/Pacific Islander students were underrepresented in the lower math levels (levels 1, 2, and 4) and overrepresented in the higher math levels (levels 5, 7, 8, and 9). White students were underrepresented in the higher levels (levels 7 and 8).

There were also distinctive differences by gender and age group among students who placed by assessment test. Students who are female were underrepresented in the two highest math levels (levels 8 and 9), and slightly overrepresented in math levels 1 and 2. The opposite was true for students who are male; they were underrepresented in the lowest math level and overrepresented in the two highest math levels. Students whose gender was not reported were underrepresented for math levels 1 and 4; they were overrepresented in math levels 4 and 7. (Caution: The number of students whose gender was unknown is much smaller than their male and female peers; therefore, findings of disproportionate impact may be overstated). When comparing age groups, students who are 25 and older are more than twice as likely to be placed in the lowest math levels (levels 1 and 2), and are underrepresented in higher math levels (levels 5 and 9). Students under the age of 25 were slightly overrepresented in the highest level of math.

Table 3. *Proportionality Index: Math Levels by Student Subgroups – Race/Ethnic Groups, Gender, and Age Group*

Proportionality Index Table	**Math Level**						
Student Subgroup	**1**	**2**	**4**	**5**	**7**	**8**	**9**
African American	2.18	1.42	1.23	0.62	0.36	0.32	0.00
Asian/Filipino/Pacific Islander	0.71	0.76	0.79	1.14	1.43	1.84	1.76
Hispanic/Latino	1.10	1.24	1.16	0.87	0.68	0.74	0.22
Multi-Race/Unknown/Other	0.94	1.00	0.77	1.11	1.71	0.33	0.87
White	0.91	0.89	1.12	1.04	0.75	0.50	1.34
Female	1.27	1.14	0.97	0.99	0.96	0.45	0.26
Male	0.73	0.87	1.02	1.01	1.03	1.61	1.80
Unknown	0.61	0.40	1.45	0.96	1.27	0.00	0.00
Under 25	0.85	0.85	1.00	1.08	0.99	1.03	1.14
25 or older	2.02	2.08	1.00	0.44	1.05	0.80	0.00

Note. A zero value indicates the student subgroup was not represented in the outcome/level.

Conclusions

Overall 80.1% of students were rated by faculty as at the appropriate level. However, only 73.4% of students rated themselves as at the appropriate level. This below threshold rate for students appears to be driven by responses in placement levels 1, 2, and 5, which featured a 79.5% faculty rating compared to a 70.5% student rating with larger proportion of students indicating they were placed too low. Additionally, faculty ratings of students placement did not meet the threshold for the second lowest math level (level 2; Math 30).

Importantly, there also appears to be disproportionate impact in the placement of specific student groups. Students who are African American or Hispanic/Latino, female students, and students who are older (25 or older) were more likely to be placed by assessment test into basic skills mathematics. Moreover, African American and Hispanic students were significantly less likely to be placed in the higher math levels. In light of these findings, the math department should conduct a study to explore the impact of changing cut-scores on these equity differences in test placement.

Finally, it should be noted that the sample sizes were low for levels 8 and 9, and therefore may not adequately reflect the appropriateness of test placement.

Recommendations

Given the results of this study, it is the recommendation of the Office of Institutional Effectiveness that the Math department engage in one or more of the following:

- Review and adjust the cut scores, particularly for the first five placement levels and conduct the consequential validity and disproportionate impact study again after their implementation.
- Evaluate the implementation of other multiple measures (e.g., using self-reported high school GPA) to enhance consequential validity and minimize disproportionate impact.
- Conduct further research to identify how the faculty/student ratings relate to final grade in order to determine which ratings are more or less indicative of adequate test placement.

Appendix A

Cosumnes River College Math Assessment Validation Survey

Please complete this survey even if you have filled it out for another class. Your responses will be kept strictly confidential.

Name: _____ **Math Course**: _____

ID:

0	0	0	0	0	0	0
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9

1. How did you qualify for this class? *Please select one answer choice.*

A. Cosumnes River College assessment placement

B. Assessment placement from another Los Rios college (e.g. Sacramento City, American River, Folsom Lake)

C. Completed prerequisite course at CRC

D. Completed prerequisite course at another college

E. Successfully challenged the prerequisite

F. Other (please specify) _____

2. Which of the following is most true of your placement in this class? *Please select one answer choice.*

A. I should be in a course higher (more advanced) than this one.

B. I am in the right class.

C. I should be in a class lower (less advanced) than this one.

Appendix B

Dear Math Faculty,

This semester we are conducting a validation study of the Math assessment/placement tests' cut scores. To accomplish this task, two surveys need to be administered: one for the students and one for Math faculty.

Between September 18th and September 29th, **please distribute and collect the enclosed student survey**. The survey should take about 10 minutes of class time to complete. The survey will ask students how they qualified for the class and if they feel they were appropriately placed in the class. This methodology is one of the most commonly used forms of test validation and is recommended by the California Community Colleges Chancellor's Office. The survey data will be analyzed and reported by the Research Office.

Prior to administering the student survey in your class, please read or paraphrase the following statement:

"*I am about to give a quick survey that will ask you how you were placed into this class and if you feel you were appropriately placed. You will need to provide your name, student I.D., and the name of the Math course in which you are currently enrolled [i.e., MATH 30, MATH 400, or STAT 300]. Then answer the two questions that follow. Please only select one answer per question.*
The results from this survey help validate our Math placement tests so that a student's placement score accurately reflects the skills needed in different class levels. Your participation is appreciated and your responses will be kept strictly confidential."
As faculty, your survey is in the form of a roster. Please use it to indicate the preparedness of each student in your class. To do this, please place one of the following symbols next to each student's name on the provided roster:

Symbol	**Meaning**
"+" (a plus sign)	**Student should be in a class higher (more advanced) than this one.**
"0" (a zero)	**Student is in the right class.**
" - " (a minus sign)	**Student should be in a class lower (less advanced) than this one.**

Please return these materials no later than Wednesday, October 4, 2017:
To the Research Office, LRC 121. Please contact Paul Meinz at 691-7723/meinzp@crc.losrios.edu or Sabrina Sencil at 691-7835/sencils@crc.losrios.edu with any questions. Thank you very much for participating in the study.

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