

## OEA College Readiness Mathematics Test (CRMT) Development Plan

March 2007

### INTRODUCTION

The Washington State Mathematics Placement Testing (MPT) program was created by a consortium of representatives from five of the six public baccalaureate institutions<sup>1</sup> and is managed by the Academic Placement Testing Program (AFTP)<sup>2</sup> at the University of Washington (UW). The purpose of the program has been to place incoming students into mathematics courses at participating institutions. Although the two program tests have functioned well in serving this restricted purpose, the recent development of the Washington State College Readiness Mathematics Standards (CRMS)<sup>3</sup> and the recommendations of the Washington Learns committees<sup>4</sup> have suggested ways in which the MPT program might be modified to improve the articulation between secondary and post-secondary mathematics education in the State.

Over the past several months, the Transition Mathematics Project (TMP)<sup>5</sup> has initiated a series of conversations among mathematics educators from the State's K-12 schools, community colleges, and public baccalaureate institutions. These conversations suggest that closer alignment of the MPT with the CRMS would facilitate student preparation for post-secondary mathematics courses. Additionally, pressing needs have been identified for 1) early testing of high school students regarding their readiness for college-level-mathematics courses, and 2) improved placement of community college students into non-college level mathematics courses. Several testing alternatives were discussed to meet these needs, and the outline of a comprehensive testing program was suggested.

Following are brief descriptions of the current Mathematics Placement Tests and a proposed testing program to assist high school students in preparing for, and placing into, mathematics courses (both college- and non-college-level) in post-secondary institutions in Washington State. A specific proposal to improve the alignment of the Mathematics Placement Tests with the CRMS, and to develop an 11<sup>th</sup>-grade college readiness mathematics test is also presented.

### CURRENT MATH PLACEMENT TESTS

The Mathematics Placement Tests are taken by students who have been accepted into one or more of the participating baccalaureate institutions. The tests are administered throughout the state to high school seniors in May and June, as well as on college campuses throughout the year. The Advanced Math Placement Test (MPT-A) is intended to place students into college-level calculus, and is directed toward students who have taken at least three or four years of high school math with average grades of B or better. The Intermediate Math Placement Test (MPT-I) is intended for students with less preparation or lower grades. The tests are made up of 30 and 35 items, respectively, and each test has a time limit of 60 minutes. While the tests differ somewhat in content (see Table 1) and difficulty level, there is sufficient overlap to allow both tests to place students into pre-calculus courses. Placement below this level is provided by the Intermediate test. Specific placement cutoff scores vary by institution.

Table 1. Content areas covered by Mathematics Placement Tests (number of items)

Content Area	Intermediate Test	Advanced Test
Basic manipulation	7	
Distance	2	
Exponents and roots	3	
Factoring	2	
Inequalities	1	
Proportions	3	2
Linear graphs and functions	6	3
Functional notation	3	2
Graph interpretation	4	4
Quadratic graphs and functions	4	2
Equations		4
Exponents and logs		4
Absolute value		2
Simplifying		3
Trigonometry		4
Total	35	30

The recent development of the College Readiness Mathematics Standards (CRMS) provided an opportunity to examine the degree to which the content and difficulty of the existing Mathematics Placement Tests accorded with expectations for college readiness. Given that the tests were developed with the restricted purpose of placing admitted students into specific post-secondary mathematics courses, it was possible that there could exist a large discrepancy between the tests and the expectations. To examine this question, an outside agency, Achieve, Inc., was asked to include the MPT in an ongoing study of the alignment of Washington State placement tests. The study concluded that the MPT showed a fairly good balance across content standards (with some over-emphasis on functions and algebra), but that the tests provided little assessment of process standards.<sup>6</sup> Because the methodology of the Achieve study did not recognize that items may relate to more than one standard, the analysis was repeated by the UW Office of Educational Assessment (OEA), providing more specific information about areas in which the tests could be brought into closer alignment with the standards.<sup>7</sup>

## PROPOSED TESTING PROGRAM

The TMP conversations have suggested the need for four types of tests with different purposes and directed to different student populations. These are shown in Table 2.

Table 2. Proposed Test Types, Purposes and Populations Served

Test Type	Purpose	Population
Calculus placement (CP)	to identify students who are ready for college-level calculus	students admitted to baccalaureate institutions or intending to enroll in community colleges
College readiness 2 (CR-2)	to identify students who are ready for college-level math as defined by the CRMS	students admitted to baccalaureate institutions or intending to enroll in community colleges
College readiness 1 (CR-1)	to identify students who are ready for college-level math as defined by the CRMS, and to provide diagnostic information for additional coursework	11 <sup>th</sup> grade high school students
Developmental placement (DP)	to provide diagnostic information for placement into developmental courses	students intending to enroll in community colleges

In the context of current state-wide discussions, the primary purpose of an improved testing program is to distinguish between students who are college ready and those who are not. The MPT-I has been functioning as a de facto college readiness test (CR-2, in Table 2) for students who have been admitted to baccalaureate institutions but no similar test (CR-1) exists for 11<sup>th</sup>-grade students.

The secondary purpose of the testing program is to provide diagnostic or placement information for specific groups of students. 11<sup>th</sup>-grade students need to know specific areas in which they need more preparation, and non-college-ready post-secondary students require placement into one or more developmental courses. At the other end of the spectrum, placement into calculus is needed by post-secondary students with especially strong math backgrounds. The function of the developmental placement (DP) tests listed in Table 2 is currently being met at community colleges by commercially available tests, while calculus placement (CP) testing at baccalaureate institutions is provided by the MPT-A.

## PROPOSED TEST DEVELOPMENT

We plan to undertake a formal redevelopment of the existing Math Placement Tests in light of emerging Washington State testing needs. The existing MPT-I will be revised to create college readiness tests appropriate to both 11<sup>th</sup>-grade and post-secondary testing needs (CR-1 and CR-2, respectively), while the existing MPT-A will be evaluated and possibly revised to maintain its alignment with the MPT-I. This work will be carried out over the course of two years, and will result in two parallel versions of each of the first three tests (CP, CR-2, CR-1) listed in Table 1, as well as an established system for ongoing test development and maintenance.

All tests will undergo sufficient psychometric validation to inform possible conversations about high school curricula. We will retain the current multiple-choice test format to allow the efficiency of machine scoring. We will also retain the 60-minute test length for the post-secondary college readiness test (CR-2) to meet the constraints of test administration. The 11<sup>th</sup>-grade college readiness test (CR-1) will be parallel to the CR-2 with respect to content, although the test length may be increased depending on the balance between diagnostic needs and time available for test administration. Diagnostic tests are typically longer than are placement tests due to the specificity of the information required, but this isn't always the case. It may be that we will be able to create a single CR test, rather than two different versions, to meet both 11<sup>th</sup>-grade and post-secondary testing needs.

The UW Office of Educational Assessment will take the lead role in designing and carrying out this development program, in collaboration with a working group comprised of mathematics instructors from the baccalaureate institutions, community colleges, and high schools, in approximately equal numbers, as well as assessment specialists from each constituency. Dr. Nana Lowell, OEA Director will be responsible for program direction, with the assistance of Dr. Gerald Gillmore, OEA Director Emeritus and developer of the existing MPT Program. Jon Peterson, OEA Research Scientist, will develop materials and carry out statistical analyses and reporting, in addition to providing general project coordination. The working group will assist in operationalizing college readiness standards, developing test specifications, writing and critiquing items, and planning for validity testing.

The proposed work plan is shown in Table 3.

Table 3. Work Plan to 1) Create CR item bank, 2) Finalize CR-2, and 3) Evaluate CR-1 and CP

<b>2007</b>	Mar	form CR working group	
	May 11	meet with sub-set of CR working group (1 day) <ul style="list-style-type: none"> <li>– analyze CRMS for relevance to specific college-level classes and measurability</li> <li>– identify/write sample test items for each Standard</li> <li>– develop preliminary test specification for CR-2 and, if different, CR-1</li> </ul>	
	May-Jun	develop CR items compile CR items and distribute to working group for review <ul style="list-style-type: none"> <li>– revise items based on feedback</li> </ul>	
	Jun 22	meet with CR working group (1 day) <ul style="list-style-type: none"> <li>– critique revised items</li> <li>– finalize test specifications for CR-2 and, if different, CR-1</li> <li>– confirm post-secondary pre-test sites</li> </ul>	
	Aug	assemble 36-item (one-hour) CR pre-tests	
	Sep	pre-test CR items with college-level classes	
	Oct-Nov	analyze CR pre-test results (item performance) and distribute to working group	
	Dec	phone conference with CR working group <ul style="list-style-type: none"> <li>– review item performance results</li> <li>– determine whether second pre-testing of items is necessary</li> </ul>	
	<b>2008</b>	Jan	analyze CR pre-test results (relationship to course retention/grades) and distribute to working group meet with CR working group (1 day) <ul style="list-style-type: none"> <li>– review overall pre-test results</li> <li>– finalize two parallel versions of 36-item CR-2, if possible</li> <li>– identify preliminary common CR-2 college-ready cut-score</li> <li>– determine whether 36-item length is sufficient for CR-1</li> <li>– confirm K-12 pre-test sites</li> </ul> pre-test CR items with college-level classes, if necessary
		Feb	analyze second CR pre-test results (item performance), if necessary create and print two parallel versions of CR-1 (36 or 54 items)
Mar		create and print two parallel versions of CR-2 (36 items) pre-test CR-1 items with selected 11th-grade classes meet with CP working group (1 day) <ul style="list-style-type: none"> <li>– develop test specifications</li> <li>– write test items</li> </ul>	
Apr-May		analyze CR-1 pre-test results and compare to earlier CR results (item performance) revise and expand CP items	
May-Jun		implement statewide CR-2 testing through APTP testing program	
Jul-Sep		document CR-2 test development and technical specifications and distribute to working group prepare for statewide 11th-grade CR-1 testing	
Oct		implement statewide CR-1 testing through school districts	
Nov-Dec		analyze CR-1 test results document CR-1 test development and technical specifications and distribute to working group	

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- <sup>1</sup> These are Central Washington University, Eastern Washington University, University of Washington, Washington State University, and Western Washington University. The Evergreen State College is not a participant.
  - <sup>2</sup> See [www.washington.edu/oea/services/testing\\_center/apt/index.html](http://www.washington.edu/oea/services/testing_center/apt/index.html).
  - <sup>3</sup> See [www.transitionmathproject.org/assets/docs/standards/crs\\_march23\\_2006.pdf](http://www.transitionmathproject.org/assets/docs/standards/crs_march23_2006.pdf).
  - <sup>4</sup> See [www.washingtonlearns.wa.gov/FinalReport.pdf](http://www.washingtonlearns.wa.gov/FinalReport.pdf).
  - <sup>5</sup> See [www.transitionmathproject.org/](http://www.transitionmathproject.org/).
  - <sup>6</sup> See [www.achieve.org/files/WA\\_Align\\_Analysis\\_Math\\_Std\\_06-2006.pdf](http://www.achieve.org/files/WA_Align_Analysis_Math_Std_06-2006.pdf).
  - <sup>7</sup> See [www.washington.edu/oea/pdfs/reports/OEARReport0606.pdf](http://www.washington.edu/oea/pdfs/reports/OEARReport0606.pdf).