



Algebra Readiness Programs and MDTP

Inside This Issue:

Algebra Readiness Programs and MDTP.....	1
Reuse of MDTP Test Booklets	2
AR and MR Status.....	2
Problem Corner	3
Older GR and SR Being Phased Out.....	3
Available Diagnostic Tests	4
Regional Sites.....	5
Users Conferences.....	6
MDTP at CMC.....	6
Edusoft and MDTP	6

CSU
 California State University

UC
 University of California

CAPP
 California Academic Partnership Program

New recommendations for programs for students in grade eight or higher who are not prepared to take a course in algebra were introduced in the 2005 California Mathematics Framework. Those students "will require instructional materials that give extensive attention to fundamentals in the seventh grade standards and thereby improve the likelihood of students' success in algebra." (p. 226) These instructional materials are more fully described in Appendix E under "Algebra Readiness Instructional Materials". The California Department of Education will be adopting instructional materials for Algebra Readiness Programs this year.

Appendix E of the Framework describes qualities of an algebra readiness instructional program. Such a program should (selected bullets):

- Include a balance of computational and procedural skills, conceptual understanding and problem solving.
- Provide clear goals and extensive diagnostic tools to assess students' mathematical knowledge. The entry level assessments should identify which students need the program and their strengths and weaknesses.
- Provide valid and reliable and periodic assessments that can give ongoing information on the causes of student errors and misconceptions and advice for the types of interventions that can be used for each area of difficulty.
- Provide tasks that require students to show their mathematical reasoning and problem-solving strategies so that the teacher can identify sources of students' incomplete or erroneous understanding of the underlying mathematics. (p. 338)

MDTP recommends that teachers and curriculum designers consider the use of the

MDTP Algebra Readiness Test (AR) near the beginning of an Algebra Readiness Program in the sense of Appendix E of the Framework. MDTP's test results reports can help teachers identify specific topics that require emphasis for individual students as well as for classes as a whole and for groups of students. In addition, MDTP can provide aggregated test result reports for a school to help identify school wide needs.

Algebra Readiness Programs address the needs of students who have completed coursework designed in part to prepare them for an Algebra course but who are not yet adequately prepared for Algebra I. The MDTP AR test can help identify the specific areas where students need additional study to be fully prepared for Algebra I. When the results indicate that a class of students is very weak in almost all areas, it may be helpful to give that class MDTP's Prealgebra Readiness Test (PR) in order to identify prerequisite strengths and weaknesses to build on and address respectively.

MDTP also recommends that teachers consider administering its AR test somewhere near the middle of their Algebra Readiness Program, both to see an indication of growth and to identify areas that need further emphasis.

Finally, of course, MDTP recommends that its AR test be given near the end of an Algebra Readiness Program. The test results for that administration can serve at least three important functions. The individual test results can help students focus their studies for the rest of the course and over the summer to be fully prepared for Algebra the next year. If there is time remaining during the course, the class results can help the teacher identify areas to further develop and reinforce before the end of the year. In addition these results can help teachers identify strengths and weaknesses of the courses they have just

Algebra Readiness Programs and MDTP

continued from p.1

taught; by comparing notes with one another they can share successful approaches. For districts that have the ability to do so, the final AR test student responses can be resorted and rescored so that the Algebra teachers receiving these students the following year can see profiles of the strengths and weaknesses of their students both individually and collectively.

While MDTP's diagnostic tests do probe for conceptual understanding, they cannot provide as complete indications of students' reasoning and problem solving as written work. Another MDTP resource to consider is the Written Response Materials notebook that has been developed to assess and improve students' ability to think and communicate effectively about mathematics. The notebook contains seven AR problems with detailed rubrics that require students to demonstrate their mathematical reasoning and problem-solving strategies and enable teachers to identify students' incomplete or erroneous mathematical understandings. These problems also provide exemplars of the kinds of assessment items and scoring rubrics that teachers might develop based on their own curricula.

For more information about using MDTP tests or the Written Response Materials in support of an Algebra Readiness Program, please contact your regional MDTP Site. To place an order for test booklets and other test materials, please use the link on MDTP's home page: <http://mdtp.ucsd.edu>. All MDTP test booklets and other test materials and scoring services are provided at no charge to mathematics teachers in California precollegiate schools.

Reuse of MDTP Test Booklets

The California Academic Partnership Program (CAPP) grant to MDTP allows the project to provide materials and services at no expense to precollegiate teachers, schools, and districts in California. CAPP has been established by the California legislature and is funded by it. Since all state funds are limited, MDTP urges teachers and schools to help it respond positively to all requests by reusing test booklets whenever possible and by only ordering materials that will be used. In 2006-2007, there were many instances of great cooperation by schools and teachers in respecting that request. For example, some 900 schools were sent no test booklets even though MDTP scored almost 250,000 tests for their teachers and students. At another 400 schools, the number of

Reuse of MDTP Test Booklets

continued from col.1

test booklets ordered was less than half the number of tests scored. Almost 300,000 tests were scored for those 400 schools. MDTP would like to take advantage of this opportunity to thank the teachers at those schools for helping us in this way.

This report must also note that some 280 schools for which MDTP did no scoring last year requested and received almost 50,000 test booklets and almost 100,000 answer sheets from MDTP. A rough estimate of the cost of these materials is \$20,000 for the tests and \$2,800 for the answer sheets; the expenses of shipping are not included. More generally, MDTP sent approximately 37% more answer sheets than it scored. A rough estimate of the cost of these materials is \$6,750 plus shipping. MDTP reiterates its request to teachers and others ordering its materials to only order materials that will be used.

AR and MR Status

This summer, the MDTP workgroup continued the development of a new Mathematics Analysis Readiness Test. A field test is being conducted this year. It is very likely that the data gathered from that field test will provide the workgroup with enough information to prepare one new test for release in Fall 2008. MDTP is designing the new test to be taken without a calculator. We will probably make the current calculator optional version of the Mathematical Analysis Readiness Test (MR45A92) available throughout 2008-2009 but then stop printing that test. We will continue to provide the current (scientific) calculator required test (MR45X94) as long as there is sufficient demand for it.

This summer, the MDTP workgroup also began the process of developing a new version of its calculator prohibited Algebra Readiness Test. Many new questions were written to refresh the current test and to reflect current ways of teaching and assessing mathematics. One noteworthy change is the inclusion of more conceptual and less formulaic data analysis questions concerning the interpretation and representation of data. This year, MDTP is asking teachers to help by administering one of two new field tests; new questions comprise about 40% of each of these tests, and there are a total of 33 new items on the two tests. These field tests will help us determine how well the new questions work and show us how to refine some of them. The other questions on the tests both help measure the difficulty of the new questions and contribute to the reliability of the overall score on the field tests. We greatly appreciate the cooperation of teachers who administer field tests for us.

Problem Corner The Chameleon Cube Solution

The Chameleon Cube problem was presented in the Spring 2007 MDTP Newsletter, which is available on the MDTP web site. In this issue, we will discuss some solutions to that problem and one teacher's experience with it.

Dick Stanley, who proposed the problem, provided this geometric solution:

Construct the unpainted $3 \times 3 \times 3$ cube, and paint its outside red. Take a 3×3 slab one cube deep from the left side and move it to the right side, with the red side in. Make the same sort of transfer of $3 \times 3 \times 1$ slabs from the front to the back, and then from the top to the bottom. The cube is now unpainted on the outside. Paint it green and repeat the above process. Finally, paint it yellow. This shows that there are 3 colorings of a $3 \times 3 \times 3$ cube.

We know of two other solutions. Both begin by using counting to see that every face of a small cube must appear on a face of one of the large cubes. Using that and assuming symmetry of colorings of the small cubes, a second solution develops a system of linear equations for the numbers of each type of coloring of a small cube and then solves the resulting system not only for constructing 3 colorings of $3 \times 3 \times 3$ cubes but also, more generally, for constructing n colorings of $n \times n \times n$ cubes. The third solution examined the constraints as colorings were constructed and determined that there were exactly seven ways to color the 27 small cubes so that the three large cubes could be formed from them.

Sam Weinstein teaches mathematics at the Zoo Magnet program of North Hollywood High School. He developed the second solution described above. He also described his class's experience with the problem:

I gave this problem to my students to see what they would come up with. I was impressed by the variety of techniques they used to find a solution. Some students found the solution by building 3-d models, other students drew 2-d representations of the 27 $1 \times 1 \times 1$ cubes, and others used no geometric models at all. For me, this clarifies just how difficult teaching is. How do we connect with students when their thought processes are so diverse?

Things got more interesting when one student asked if a $4 \times 4 \times 4$ cube could be painted with 4 colors. I told the class to give it a try. Several students came up with different solutions.

The class continued to explore the problem for $n = 5$ and $n = 6$ using "various brute force methods that required

extensive bookkeeping." Mr. Weinstein's collaboration with his students led him to consider the general case in the context of linear algebra. At last report, he was looking forward to sharing all aspects of the problem with his students this year.

MDTP congratulates Mr. Weinstein and his students for their good work and interesting insights on this challenging problem. We also thank Dick Stanley for providing us with such rich problems as invitations to mathematical thinking.

Older GR and SR Being Phased Out

Last fall, MDTP released new versions of its Geometry Readiness (GR45A06) and Second-Year Algebra Readiness (SR45A06) tests in both English and Spanish. Calculators are not recommended for either of the new versions. We continue to make the former versions (GR45A93 and SR45A93) available on request. Copies of the former versions are available but will only be available until MDTP's inventory is exhausted; MDTP will not print additional copies. If you need to continue using the former versions for a special project, please place an order before they are gone



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CSU/UC
MDTP
Mathematics Diagnostic Testing Project

Visit the MDTP web site at
<http://mdtp.ucsd.edu>

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AVAILABLE MDTP DIAGNOSTIC TESTS

Test Name	Description	Calculator Prohibited	Calculator Optional	Calculator Required
PR Prealgebra Readiness	Assesses some concepts needed for success in a course immediately preceding a first-year algebra course and subsequent success in that first-year algebra course. This test is often given near the beginning of a course immediately preceding a first-year algebra course. Spanish version available.	PR40A04 0814004		
AR Algebra Readiness	Assesses some concepts needed for success in a first course in algebra. Calculator prohibited and calculator required versions available. 45 question and 50 question versions available. Spanish versions available.	AR50/90 0715090 AR45A00 0714500		AR50X92 0775092
EA Elementary Algebra Diagnostic	Assesses some concepts needed for success in a second course in algebra. Appropriate when the second course follows immediately after a first-year algebra course and students have not studied a year of geometry. Spanish versions available.		EA50A90 0315090	<i>Scientific</i> EA45X91 0374591
GR Geometry Readiness	Assesses some concepts needed for success in geometry after completing Algebra I or II. Includes some informal geometry students should have encountered prior to and during algebra. Spanish versions available.		GR45A93 0414593 GR45A06 0414506	GR45X94 0474594
SR Second Year Algebra Readiness	Assesses some concepts needed from first-year algebra and geometry for success in intermediate algebra following a course in geometry. Spanish versions available.		SR45A93 0314593 SR45A06 0314506	<i>Scientific</i> SR45X94 0374594
IS Integrated Second Year Readiness	Assesses some concepts needed for success in the second year of an integrated mathematics curriculum. This test was based on the common content of two of the integrated curricula in use in California.		IS45A00 0414500	
IT Integrated Third Year Readiness	Assesses some concepts needed for success in the third year of an integrated mathematics curriculum. This test was based on the common content of two of the integrated curricula in use in California.		IT45A00 0314500	
MR Mathematical Analysis Readiness	Assesses some concepts needed for success in a course following two algebra courses and a geometry course. This course is often called trigonometry, precalculus, or mathematical analysis.		MR45A92 0214592	<i>Scientific</i> MR45X94 0274594
CR Calculus Readiness	Assesses some concepts needed for success in a first calculus course. 40 question and 55 question versions available, with suggested times of approximately 60 and 90 minutes respectively.		CR40A97 0114097 CR55A97 0115597	<i>Scientific</i> CR40X96 0174096 CR55X96 0175596
BC Beginning Calculus Readiness	Assesses some concepts and facility with graphing calculators needed for success in a first calculus course requiring graphing calculators. Some questions require the use of a graphing calculator.			<i>Graphing</i> BC30X97 0173097

MDTP tests were developed to provide students and teachers with diagnostic information. This information can help students identify specific areas where additional study or review is needed, and help teachers identify topics and skills that need more attention in courses. MDTP tests are diagnostic, not comprehensive, and so should not be used as final exams or as the single measure for placement. MDTP provides written response materials to supplement most of its diagnostic tests. Order forms are available at <http://mdtp.ucsd.edu> or through your MDTP regional site (see p.5).

MDTP REGIONAL SITE INFORMATION

<p>Berkeley Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Sonoma, and Stanislaus counties.</p>	<p>UC Berkeley Director: Emiliano Gomez (510) 642-0752 Asst.: (510) 642-0846 Fax: (510) 642-8204 mdtp@math.berkeley.edu</p>
<p>Chico Butte, Colusa, Del Norte, Glenn, Humboldt, Lake, Lassen, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Tehama, Trinity, and Yuba counties.</p>	<p>CSU Chico Director: Jack Ladwig (530) 898-6367 Asst.: (530) 898-4103 Fax: (530) 898-4363 mdtp@csuchico.edu</p>
<p>Davis Alpine, Amador, Calaveras, El Dorado, Placer, Sacramento, San Joaquin, Solano, Sutter, and Yolo counties.</p>	<p>UC Davis Director: Phil Knox (530) 752-2021 Asst.: Trish Ramos (530) 752-2015 Fax: (530) 752-7706 plramos@ucdavis.edu</p>
<p>Fresno Fresno, Inyo, Kern, Kings, Madera, Mariposa, Merced, Mono, southern San Benito, Tulare, and Tuolumne counties.</p>	<p>CSU Fresno Director: Peter Tannenbaum (559) 278-4029 Asst.: (559) 278-2992 Fax: (559) 278-2872 petert@csufresno.edu</p>
<p>Fullerton Orange county, and parts of Los Angeles and Riverside counties.</p>	<p>CSU Fullerton Director: David Pagni (714) 278-2671 Asst.: Christine Brackett (714) 278-8320 Fax : (714) 278-3972 mdtp@fullerton.edu</p>
<p>Los Angeles Los Angeles and Ventura counties except for schools near Fullerton.</p>	<p>UC Los Angeles Director: Heather Calahan (310) 825-1702 Asst.: Julia Carafelli (310) 206-8360 Fax: (310) 825-8914 mdtp@ucla.edu</p> <p>Shipping & Scoring Annex: Office Manager: John Hoover (310) 825-2495 Fax: (310) 206-7261</p>
<p>San Bernardino Inyo, Mono, and San Bernardino counties and part of Riverside county.</p>	<p>CSU San Bernardino Director: John Sarli (909) 537-5374 Asst.: Leeanne Richardson (909) 537-7670 Fax : (909) 537-7119 mdtp@csusb.edu</p>
<p>San Diego Imperial and San Diego counties and part of Riverside county.</p>	<p>UC San Diego Director: Bruce Arnold (858) 534-3298 Asst.: Monnie Barker (858) 534-3373 Fax : (858) 534-1011 mdtpsandiego@ucsd.edu</p>
<p>San Luis Obispo San Luis Obispo, Santa Barbara, and southern Monterey counties.</p>	<p>Cal Poly San Luis Obispo Director: Steve Agronsky (805) 756-1683 Asst.: Dale Wilbur (805) 756-2206 Fax: (805) 756-6537 dwilbur@calpoly.edu</p>
<p>Santa Cruz Northern Monterey, northern San Benito, Santa Clara, and Santa Cruz counties.</p>	<p>UC Santa Cruz Director: Bruce Cooperstein (831) 459-2150 Asst.: Judy Hobor (831) 459-2400 Fax: (831) 459-3260 jahobor@ucsc.edu</p>

Regional User Conferences

Six of the MDTP regional sites are planning conferences for teachers this year. For additional information, please contact the host site (p5). Links to conference flyers and registration forms will be posted on MDTP's News and Events web page.

UC Davis:

Wednesday 14 November 2007
Fractions, Long Division, and
Student Thinking

CSU Fullerton:

Wednesday 16 January 2008
Title To Be Announced

CSU San Bernardino:

Friday 22 February 2008
Middle School Mathematics

UC Los Angeles:

Saturday 15 March 2008
Mathematics and Teaching
Conference, 2008; Math/Ed
Research and Recommendations,
Mathematics for Teaching, and
Instructional Strategies

UC San Diego:

During week of 24–29 March 2008
Fractions, Decimals, and Percents

UC Berkeley:

Wednesday 12 March 2008
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MDTP at CMC Conferences

This year, there will be four MDTP presentations at CMC conferences. At CMC-South (Palm Springs), they will be led by Heather Calahan, Alfred Manaster and John Sarli, and Bruce Arnold. Emiliano Gomez will lead the CMC-North (Asilomar) presentation.

Edusoft California Clients

If your district subscribes to the Edusoft Assessment Management System, you can score MDTP tests with that system. This will enable you to get customized answer sheets for your classes, reducing the time needed for students to fill in their identification and increasing the accuracy of that information. In addition, MDTP will continue to provide its standard printed test reports for your classes to you and—through you—to your students.

To receive these services, you must have MDTP test booklets that our regional site offices can provide to you and your schools at no charge. You should verify that the Benchmark Assessment Exams include the MDTP tests you are giving. If they are not in the list, then contact Donna Ames [dames@ucsd.edu], your district's Edusoft regional representative, or Edusoft's help desk [1-866-433-8763 and select option 2]. If the MDTP tests are no longer in the folders, then the Edusoft regional representative can reload them upon request.

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Prior to administering the test, log into Edusoft, select the Benchmark Exams module, then Assessments. Scroll through the Assessments Folders list until you find the "Mathematics Diagnostic Testing Project" folder containing the test form you are administering. There are two "Mathematics Diagnostic Testing Project" folders, the second one contains the GR45A06 and SR45A06 test forms.

After giving the test, use the Edusoft Scoring Software to scan the sheets and transmit the data to Edusoft. As soon as the data is scored, you can access results online. The data, grouped by class set, will be transmitted to MDTP in order to provide teachers with the standard printed reports. MDTP recommends that all answer sheets for a class be scanned at one time so that the MDTP printed results will be for complete class sets.