

Playing the Predicting Game: An Eye Opening Experience for Mathematics Teachers

David Pagni, California State University, Fullerton

The MDTP test items are designed to provide students with answer choices featuring distractors that capture students' errors in thinking.

For example, consider the following simple question that was created as an example for this article:

The sum of $1/8 + 1/2$ is: a) $1/16$ b) $2/10$ c) $2/8$ d) $5/8$

Of the answer choices,

Choice (a) could be found by multiplying the two fractions;

Choice (b) could be found by adding the numerators and denominators;

Choice (c) could be found by recognizing 8 as the common denominator but forgetting to change $1/2$ to $4/8$ before adding; and

Choice (d) is the correct answer.

An interesting exercise for mathematics teachers or departments is to make informed predictions of what percent of students will select each of the distractors.

We have been trying this activity at a local high school with some interesting results. In this case, the faculty and I have been constructing pre-algebra items, designed to test some state math standards. For our test items, we focused on the following topics, since they were being taught in class:

- Reducing fractions with variables
- Factoring numbers, listing factors
- Divisibility rules
- Factoring numbers, prime factorization
- Factoring numbers, greatest common denominator

Using the Propel Your Students Math Reasoning Thorough Test Prep guidelines prepared by Frank Carrillo of Birmingham High School in Los Angeles, a group of seven high school teachers created a seven-item quiz addressing three topics. The general consensus was that it is not easy to construct test items with good distractors. The quiz was typed and given to all pre-algebra classes as a warm-

up activity before the winter vacation. The high school teachers who constructed the quiz predicted the percent of students who would select each of the responses.

For example, here is one question with the predicted percents in parentheses:

Reduce to lowest terms: $\frac{16xy^2}{20x^2y}$

a) $\frac{8xy^2}{10x^2y}$ (20%) b) $\frac{4x}{5y}$ (30%)

c) $\frac{8xy}{10}$ (20%) d) $\frac{4y}{5x}$ (30%)

We met again in January, tallied the results for each item, and computed the percents for each distractor. The high school teachers were pleasantly surprised to find that the students exceeded the predictions for the correct answers on each item. Of course, we also examined and discussed the percents for each of the distractors.

We also constructed a five-item warm-up for the last two topics. This was given in late January since we met again in February. This time the teachers' predictors were closer to the students' results. For example, here is a question with the predicted percentages and actual results in parentheses.

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Predicting Game

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Which of the following is the GCF for $2abc^2$ and $6a^2b$?

	Predicted	Actual
a) $2ab$	(20%)	(22%)
b) $6a^2b$	(70%)	(72%)
c) $2abc^2$	(5%)	(6%)
d) $6a^2bc^2$	(5%)	(1%)

In this and other items, it became clear that some of the students had forgotten the topics they had been taught in December.

The whole process was eye-opening for teachers in terms of constructing test items and assessing their students' knowledge of certain topics. All teachers had a gut feeling on how their classes would perform, a feeling acquired by being in the classroom. But, the feeling was not always on target when measured against what their students actually did. The process caused all of us to peer a little closer into student reasoning on these particular topics.

In Transition

Long-time San Diego site director **Dick Pilgrim** retired on January 1st. Dick was a math teacher with experience in grades 7-14 when he came to UCSD in the mid-eighties. Since then, he has served as a mathematics instructor at UC San Diego in addition to directing its mathematics placement office and providing MDTP materials and services to area teachers. His many friends and associates wish him well in retirement.

Bruce Arnold has accepted the job as Dick's replacement. Bruce is a secondary math teacher who has been active in teacher education and staff development projects for math teachers offered by UC San Diego. He also is one of a small group of people who have landed an airplane on an aircraft carrier.

After six years as the MDTP community college coordinator, **Dorothy Fitzgerald** has returned to full-time teaching at Golden West College. As a member of the MDTP workgroup, she represented an important set of schools with diverse student bodies. We all appreciated her organizational skills, valuable insights, and her quiet smile.

MaryAnne Anthony of Santa Ana College is the new MDTP community college coordinator. MaryAnne has made many contributions to MDTP as a long time workgroup member. We wish her continued success with this new responsibility.

MDTP Updates

As you are probably aware, MDTP is developing a Prealgebra Readiness Test. It will test readiness for a course immediately preceding a college-preparatory one-year algebra course, the seventh grade course for many students. Over 10,000 seventh graders from all over California are already taking part in field tests of this new test. If field test results show success, a form of the test will be released in the fall of 2004.

A Spanish version of the popular Algebra Readiness Test (AR45A00) is now available. MDTP appreciates the translations of Emiliano Gomez, site director at UC Berkeley, and workgroup member David Morin, whomade this version possible. Copies of this version of the test may be ordered from your regional site director.

Twelve new written response items were released recently. They were included in a supplement to the Written Response Materials notebook that was mailed to everyone who returned the first page in the notebook. If you have not received the supplement, please contact your site director to request a set. Notebooks being distributed now include the new items.

An additional six written response items are currently being field-tested. They are written for the GR, SR, and MR levels. If you are interested in taking part in this field-test, please contact Tom Walters, UCLA Site Director (twalters@math.ucla.edu).

A new Mathematical Analysis Readiness Test has been posted online. It is on the MDTP web site (<http://mdtp.ucsd.edu>). The test can be taken over the Internet and immediately scored. Results presented online include topic scores and a list of correct and incorrect responses. It is easy to review items while reading that list. The test will be of particular interest to students who have completed the minimum CSU/UC math requirement of Algebra 2. Although the new online Mathematical Analysis Readiness Test has more emphasis on Algebra 2 content than the CSU Entry Level Math (ELM) Test, the MR online test will be helpful to students who anticipate taking the CSU ELM Test.

Finally, please have a look at the newly redesigned MDTP web site mentioned above. It contains important information about MDTP services and contacts, recent MDTP newsletters, and many helpful links for math teachers.

MDTP Web site: <http://mdtp.ucsd.edu>

Coaching New Teachers with MDTP Tests

Given California's shortage of qualified math teachers it is important to encourage both new graduates and older recruits from other fields who are becoming math teachers. Since questions about what students know and how we assess it are central to teaching, it seems natural that written response items can be used by mentor/coaches in helping to improve teaching skills for those new to the profession.

All MDTP tests are designed to be used by classroom teachers in helping focus some of their instruction on topics that are critical for continued success in learning mathematics. They provide useful information to teachers and students and help create opportunities for all students to learn more mathematics.

Written Response items have additional virtues, among them the fact that they require students to apply those critical skills to more general problems and explain their thinking as they do so. A secondary use of written response items, suggested by several users, is as a staff development opportunity.

In several schools, entire departments have used MDTPs and their own written response prompts to test student understanding of key concepts. But it is also productive to use the scoring process in a mentoring or coaching situation.

It is critical for mentors and coaches to engage new or inexperienced math teachers in a non-threatening way, and joint scoring of student work, especially work where focused professional judgement is essential provides that opportunity. In an ideal situation both mentor and coach would be teaching similar classes so that an exchange of student papers would be easy. Rubric-based blind scoring by both individuals could lead to a discussion in which student work, not teacher performance, was the focus.

The development of these items by the MDTP Workgroup involved a great deal of thought and discussion. A professional conversation about why an item essence statement important, and how the essence statement drives the scoring rubric, is valuable. Because Written Response items are diagnosing student strength and weakness, MDTP had made it policy that students only receive scores of one or more for some minimal level of correct mathematics. Under what other circumstances might it be a good idea to reward students minimally for simply engaging a problem as opposed to leaving it blank? All of these questions are appropriate for discussion among peers as well as in a mentoring/coaching relationship.

THE ASSESSMENT PRINCIPLE

Assessment is a valuable tool for making instructional decisions.

To ensure deep, high-quality learning for all students, assessment and instruction must be integrated so that assessment becomes a routine part of the ongoing classroom activity rather than an interruption. Such assessment also provides the information teachers need to make appropriate instructional decisions. In addition to formal assessments, such as tests and quizzes, teachers should be continually gathering information about their students' progress through informal means, such as asking questions during the course of a lesson, conducting interviews with individual students, and giving writing prompts.

When teachers have useful information about what students are learning, they can support their students' progress toward significant mathematical goals. The instructional decisions made by teachers are based on inferences about what students know and what they need to learn. Assessment is a primary source of the evidence on which these inferences are based, and the decisions that teachers make will be only as good as that evidence.

—NCTM Principles and Standards

MDTP Scoring Added to Edusoft Platform

MDTP and Edusoft have recently forged an agreement to help teachers combine the power of Edusoft and MDTP in districts where both are used. Edusoft provides a web based assessment platform for districts and schools. This agreement enables Edusoft to incorporate MDTP test information into its platform so that MDTP test reports can be provided to teachers as soon as they submit their students' responses. Edusoft will immediately transmit student responses to MDTP; MDTP will then provide teachers with its traditional printed reports, including individual student letters. The Edusoft Platform also enables re-rostering of student scores, making it possible for teachers to see their students' previous MDTP test results.

Edusoft was founded in 2000 and already has approximately 100 California districts or county offices as clients. (You may see a list at <http://www.edusoft.com>.) As soon as a test is scored, not only student scores but also detailed item analyses and topic results for the class are available to the teacher. The test results are stored on an Edusoft computer and can be integrated into comprehensive reports. At this time, the test results will be available to teachers for their own students and to some school and district administrators. Edusoft is working to develop a more restricted delivery of MDTP test results limiting them to teachers.

In order to use the Edusoft Platform to administer an MDTP test, teachers must first obtain the test booklets from MDTP. They then use the Edusoft Platform to automatically generate and print customized answer sheets for their classes. Each answer sheet includes a list of names of students in the class, with a bubble by each name. Students identify themselves by filling in one bubble, thus reducing the time needed to record information. After the students take the test, 20 answer sheets are scanned per minute at

the school into files, which are transmitted over the web to the Edusoft Platform. Teachers can then obtain the test results on-line.

In schools or districts that administer MDTP tests to many classes, the Edusoft platform will, on request from authorized personnel, provide aggregated reports including item and topic data. Further, a teacher who knows that many of his or her students took the same MDTP test in an earlier class even from different teachers can obtain MDTP class results from that test for students in his or her current class. This can be very helpful at the beginning of fall courses if most students were tested the preceding spring. The new report can help the teacher identify areas of common strengths and weaknesses to focus classroom activities. The new report can also help teachers identify areas of special attention for individual students.

MDTP and Edusoft are very pleased to be able to offer these services. For more information about Edusoft, teachers may contact them at 866-4-EDUSOFT. We at MDTP are eager to learn of our teachers' experiences with this new tool. Please tell us how it is helpful and how we can help you help your students.

Brain Teaser Answers from November 2002 Issue:

-3, -1, 1; 50 farthings; $3^{32} \cdot 2^2$

(Clearly, 1 is out. Any 4 can be two 2s. Any $n > 4$ can be replaced by 2, and $n-2$ (since $2n-2 > n$ when $n > 4$. That means we have only 2s and 3s. Since two 3s and three 2s both add up to 6 but have products of 9 and 8 respectively, we have at most two 2s. That leaves thirty-two 3s.)



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2341 Math Sciences Bldg., Box 951555
Los Angeles, CA 90095-1555
Relations with Schools Coordinator: Tom Walters

See the MDTP Website: <http://mdtp.ucsd.edu>

Brain Teasers

The surface area and volume of a certain sphere are both 4 digit numbers times π . What is the radius of the sphere?

The numbers one through seven are drawn from a hat without replacement. What are the chances that all the odd numbers will be drawn first?

Using only mathematical signs and without changing the position of any of the figures, can you make this into an equation? $2\ 9\ 6\ 7 = 17$

Answers in next issue.

MDTP TESTS AVAILABLE

Test Level/ Test Name	Description	Calculator Prohibited	Calculator Optional	Calculator Required
AR Algebra Readiness	Tests readiness for algebra. The Calculator Prohibited version requires arithmetic facility.	AR50/90 AR50/90S 0715090 AR45A00 AR45A00S 0714500		AR50X92 AR50X92S 0775092
EA Elementary Algebra Diagnostic	Tests readiness for second year algebra. Appropriate when the course follows immediately after first-year algebra and students have not been exposed to a year of geometry.		EA50A90 EA50A90S 0315090	<i>Scientific</i> EA45X91 EA45X91S 0374591
GR Geometry Readiness	Tests readiness for geometry after a year of algebra. Includes some informal geometry students should have encountered prior to and during algebra. Appropriate near the end of Algebra I or near the beginning of geometry.		GR45A93 GR45A93S 0414593	GR45X94 GR45X94S 0474594
SR Second-Year Algebra Readiness	Tests readiness for second year algebra courses that follow geometry courses. Measures first-year algebra and geometry topics critical for success in second year algebra. Appropriate near the end of geometry or near the beginning of second year algebra.		SR45A93 SR45A93S 0314593	<i>Scientific</i> SR45X94 SR45X94S 0374594
MR Mathematical Analysis Readiness	This test assumes two years of algebra and a year of geometry. Appropriate near the last of these courses or near the beginning of a trigonometry, precalculus, or mathematical analysis course.		MR45A92 MR45A92S 0214592	<i>Scientific</i> MR45X94 0274594
CR Calculus Readiness	Tests readiness for calculus. Currently available in both 60 minute and 90 minute versions. The CR tests have substantially more geometry than the former Precalculus Diagnostic Tests.		CR40A97 0114097 CR55A97 0115597	<i>Scientific</i> CR40X96 0174098 CR55X96 0175596
BC Beginning Calculus	Designed for introductory calculus courses that require the use of a graphing calculator. Tests student facility with graphing calculators in the context of some calculus readiness concepts and skills. Not all items require calculator use. Administering early in the course can provide information about students' facility with graphing calculators.			<i>Graphing</i> BC30X97 0173097
IS Integrated Second Year Readiness	Tests readiness for 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	Tests readiness for 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	

S indicates Spanish version available.

Written Response Materials Notebook

Written response materials allow students to communicate their understanding of the important conceptual ideas in their mathematics courses. Each notebook includes a general rubric that defines scoring criteria for all MDTP written response items in addition to an essence statement and a specific rubric for each item. The content for the items is linked to the topics on the diagnostic tests.

MDTP Regional Sites



<p>Berkeley Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Sonoma, and Stanislaus counties.</p>	<p>Emiliano Gomez (510) 642-0752 Dave Mina (510) 642-0846 Fax: (510) 642-6726</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>Jack Ladwig (530) 898-6367</p>
<p>Davis Alpine, Amador, Calaveras, El Dorado, Placer, Sacramento, San Joaquin, Solano, Sutter, and Yolo counties.</p>	<p>Phil Knox (530) 752-2021 Trish Ramos (530) 752-2015 Fax: (530) 752-7706</p>
<p>Fresno Fresno, Inyo, Kern, Kings, Madera, Mariposa, Merced, Mono, southern San Benito, Tulare, and Tuolumne counties.</p>	<p>Peter Tannenbaum (559) 278-4029 Diana Carmichael (559) 278-2992 Jeanine Cunningham (559) 278-2992</p>
<p>Fullerton Orange County, and schools in Los Angeles and Riverside counties near Fullerton.</p>	<p>David Pagni (714) 278-2671 Christine Brackett (714) 278-8320 Rebekah Oldani (714) 278-2691 Fax: (714) 278-3972</p>
<p>Los Angeles Los Angeles and Ventura counties except for schools near Fullerton.</p>	<p>Tom Walters (310) 206-8360 Johnna Keh (310) 825-8030 Fax: (310) 825-8914</p> <p>Shipping and Scoring John Hoover (310) 825-2495 Fax: (310) 206-7261</p>
<p>San Bernardino Schools in and NW of the city of Riverside in Riverside County and San Bernardino County.</p>	<p>John Sarli (909) 880-7670 Eileen La May (909) 880-7670 Fax: (909) 880-7119</p>
<p>San Diego Imperial, San Diego, and Riverside counties, except for schools near Fullerton or in or NW of the city of Riverside in Riverside County.</p>	<p>Bruce Arnold (858) 534-3298 Jean Forsythe (858) 534-3373 Fax: (858) 534-1011</p>
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<p>Santa Cruz Northern Monterey, northern San Benito, Santa Clara, and Santa Cruz counties.</p>	<p>Teel Blackman (831) 459-2400 Fax: (831) 459-3260</p>