Summative Assessment of Math 30 Finals

Background: Math 30 is the capstone course for the DE Math Program for students intending to transfer. Fall 2004 is the first semester that a Teaching Community for Math 30 has met. This is the first summative assessment of Math 30 finals relative to the DE Program Outcomes. Eight instructors (5 full time and 3 part time) participated in the assessment session.

Sampling design: Six of 12 instructors voluntarily submitted class sets of final exams (5 full time and 1 part time). Students who were failing the course prior to the final were excluded from the pool. From seven of the 13 sections of Math 30*, we chose a random sample of 32 exams, 4 or 5 exams per section. * Includes one section of Math 906, an experimental accelerated course that combines Elementary and Intermediate Algebra.

Method: The Teaching Community wrote problems aligned with the DE Program Outcomes and Math 30 SLO's. These problems comprised at least 50% of each instructor's final exam. Each DE Program Outcome was assessed using from 3 to 9 separate items on the final exam.

Technique: Each final exam was assessed holistically relative to each outcome using a rubric written by the Teaching Community earlier in the semester. For each outcome we conducted a benchmarking exercise in which each instructor graded the same paper. We then discussed the scores and reached consensus. Next, for each outcome each final was assessed independently by two instructors. If the two scores differed by ± 1 on a scale of 5, the scores were averaged. If the two scores differed by more than one level, that student's work was assessed by a third instructor. The closest two scores were then averaged. Seven instructors participated in the grading and one facilitated.

Outcome	Criteria	Final Exam problems
Communication Outcome: Students will read, write,	Clear, organized, and logical work	Final exam # 1a,
listen to, and speak mathematics with understanding.	Clear explanations and reasoning	1c, 1d, 1e, 3b, 3c,
	Correct use of vocabulary or notation	4a, 4c, 4e
	Defines variables and interprets the meaning of slopes,	
	points, intercepts, and solutions in a context.	
Problem-Solving Outcome: Students will use	Understanding of problem	Final exam #2,
mathematical reasoning to solve problems and a	Estimation and checking answers	3c, 5
generalized problem solving process to work word	Using an appropriate technique	
problems.	Generating and using a model	
	Use of a general problem solving process	
Multiple Representation Outcome: Students will	Construction, use and interpretation of tables.	Final exam # 1b,
demonstrate the ability to use verbal, graphical,	Construction, use, and interpretation of coordinate	1c, 1d, 3a, 3b, 4b,
numerical, and symbolic representations of	graphs.	4d, 4e, 5
mathematical ideas.	Construction of EQ's from tables or graphs.	
	Interpret models' accuracy/validity	
	Use of technology	
"Skills" Outcome: Students will recognize and apply	Percent of procedural skills correct or with minor errors	5 procedural
math concepts in a variety of relevant settings and		problems on the
demonstrate the math skills and knowledge		Final exam
necessary to succeed in subsequent courses.		

Summary: See rubric for description of scores

21 5 represents an average score of 2.5 rounded to the tenths

Communication Outcome : stemplot of rubric scores

0	5													Mean 3.5 Standard deviation 1.0	n = 32
1	5														
2	0	5	5	5										Quartiles: 0.5 3 3.5 4.4 5	
3	0	0	0	3	3	5	5	5	5	5	5	8	8		
4	0	0	0	3	3	5	5	5	5	5	8	8		26/32 = 81% proficient or better	
5	0														

Problem-solving Outcome : stemplot of rubric scores

0	1												Mean 3.4 Standard deviation 1.1	n = 32
1	0	0	5	5										
2	0	0	3	3	5	8							Quartiles: 1 2.4 3.6 4.2 5	
3	0	5	5	5	5	5	8	8						
4	0	0	0	0	0	1	3	3	3	3	5	8	22/32 = 69% proficient or better	
5	0	0												
Multi	iple R	Repre	senta	tions	Outo	come	: sten	nplot	of rut	oric sc	ores			
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Profile of the "average" Math 30 student based on rubric criteria and mean scores for each outcome:

Communication: Most of the work is neat and organized with answers supported by work shown. Explanations are usually given, but may at times be incomplete. If prompted, defines variables accurately and with appropriate specificity in most cases. Interprets slopes, intercepts, and solutions accurately, though some interpretations lack units.

Problem-Solving: Usually interprets problems correctly with occasional difficulty in understanding. At least 70% of the problems are worked correctly. Strategies are effective, but may not be efficient. Usually able to generate a model, but model may have minor errors. Usually able to use a model to answer a question, though some errors may affect accuracy. Limited and incomplete use of a general problem-solving process; for example, at times estimates are unreasonable, reasoning may be illogical, and does not consistently check answers.

Multiple Representations: Correctly interprets and uses information from tables and graphs in an attempt to answer a question, find an equation, etc. Constructs tables and graphs but organization, scale, or some other difficulty may impede finding a solution. Tables are labeled accurately. Graphs are accurately scaled and labeled. Interprets validity and limitations of tables and graphs though some interpretations lack precision or complete reasoning. Able to use technology to answer questions, though answers may be incomplete.

Closing the assessment loop: improving learning

1. The Teaching Community produced over 30 classroom activities during FA 04. Over the winter break Math 30 activities were edited to address areas of student difficulty highlighted in the assessment results. Specifically, we put a greater emphasis on

a. steps in the general problem-solving process (e.g. identifying given and extraneous info, paraphrasing the task, estimating, checking, etc.) and

b. fostering the critical thinking involved in generating useful graphs and tables (e.g. setting windows appropriate to a problem scenario).

2. The Math 30 Teaching Community will analyze the assessment results this semester and develop specific action plans. Since the learning experiences (activities) have already been edited to address the assessment results, instructors may choose to follow action plans developed by previous TCs, e.g. work on how to use the activities in class to promote student achievement --- the coaching principle --- or develop more CATs to assess student understanding after an activity and as an opportunity to incorporate review.

3. Small changes were made to the rubric and to the final exam questions.