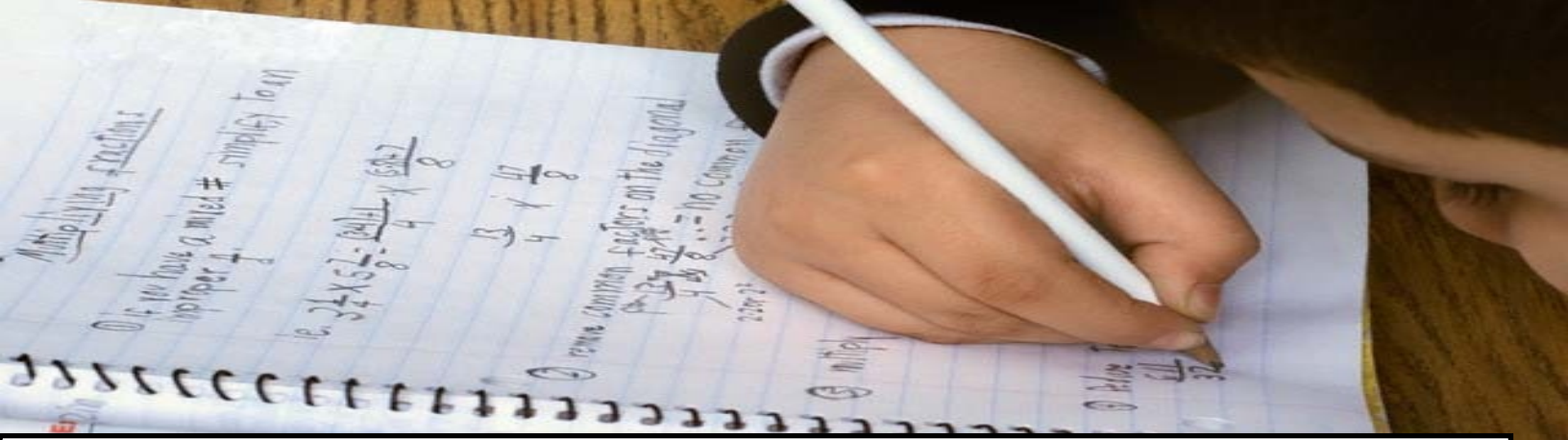


Turn Around Math Textbook Problems and Exercises To Enhance Classroom Assessment

by Catherine P. Vistro-Yu

Solving problems and exercises is a staple activity in a mathematics class. It is part of formative assessment that is often conducted using the blackboard. An investigative study of how secondary school mathematics teachers cope with a new teaching task revealed that teachers feel that assessment is necessary to measure students' learning before a class session ends (Vistro-Yu 2005). Interestingly, however, their notion of assessment is often limited to summative tests like a short quiz or a seatwork to be graded.

While summative assessment is useful, it does not present an accurate picture of the quality and quantity of learning that takes place in an individual student. Furthermore, summative assessment is often threatening and elicits a negative response such as fear in students. Thus, teachers should find ways to make assessments more student-friendly that would result in better and more faithful picture of how students improve their learning of the lessons.

Formative Assessment

Formative assessment is a way of determining students' progress in their understanding of the lessons without the danger of getting failing grades. This includes solving problems and exercises in the classroom, recitation, question-and-answer exchanges, homework, and seatwork, all of which are non-graded.

Often, however, the problems and exercises given to students that are found in most textbooks are standard, plain, and unexciting. Using textbook exercises becomes more problematic when teachers just rely on the textbooks and do not go beyond them.

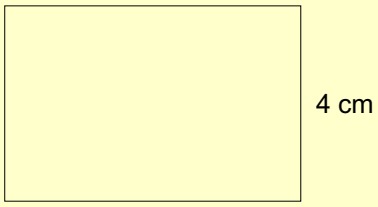
Formative assessments in mathematics classes need not be routine, boring, or unexciting. Turn around the standard textbook problems and exercises to encourage students to think and experiment with how to attack problems. Doing so will transform the usual answers into questions that will allow for more discussions among students. Nonroutine problems would raise the cognitive understanding of students and would lead to insightful ways in assessing who among the students possess strong and deep understanding of the concepts.

Creating New and Exciting Problems

Here are some tips to create new and exciting problems or exercises:

Consider the following standard problem in an elementary mathematics text:

What is the perimeter of the following rectangle? Find its area.



The answer is easy to get. Perimeter is twice the sum of the length and the width. Thus, perimeter $P = 2x (L + W) = 2x (5 + 4) = 18cm.$ Area A, on the other hand is the product of the length and the width. Thus, $A = 5 \times 4 = 20$ sq. cm. But, this problem is so standard and so unexciting.

Try this instead: *Which of the following rectangles have a perimeter of 18 cm? Which of them have an area of 20 sq. cm? Is there one rectangle that satisfies both conditions? Explain your answers.*

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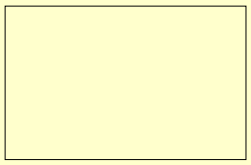
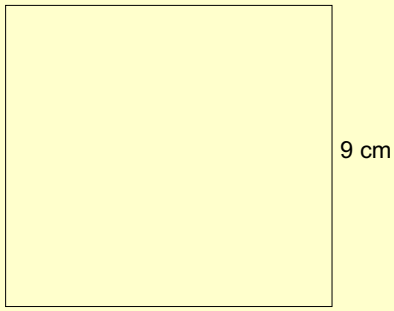
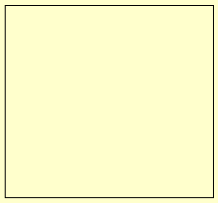
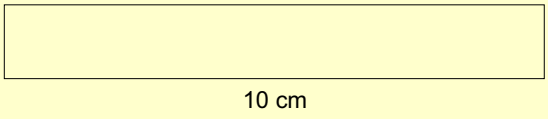
b) 

c) 

d) 

e) 

To answer the questions, a student will have to find the area and perimeter of each rectangle and check which ones satisfy what is being asked for. Rectangles *a*, *b*, and *d* all have a perimeter of 18. Rectangles *b* and *e* have an area of 20. Therefore, rectangle *b* satisfies both conditions. Note that rectangle *a* has the same numerical value for both its perimeter and area—a very interesting result. With this task, students who do not have a good grasp of the concepts and procedures for finding perimeter and area could confuse them and eventually give incorrect answers. The excitement also lies in the fact that there are now several rectangles to consider and many other "little things" to do.

Consider another standard problem in an elementary mathematics textbook:

Find the common factors and identify the greatest common factor of 32, 60, 100.

By listing, a student can easily obtain the factors of each.
The factors of 32 are 1, 2, 4, 8, 16, 32.
The factors of 60 are 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60.
The factors of 100 are 1, 2, 4, 5, 10, 20, 25, 50, 100.

It is easy to see that the common factors are 1, 2, 4 and the greatest common factor of the three numbers is 4.

How can you make the problem more interesting and still get to the heart of the task which is to determine if students understand what the greatest common factor is and if they do know how to find the greatest common factor of a set of numbers?

Try this problem:
Name three numbers that have 4 as their greatest common factor.

To answer, generate three numbers by multiplying 4 by each of three relatively prime numbers, i.e., numbers whose greatest common factor is 1. This is to ensure that the three numbers generated will not have an additional factor resulting in a greatest common factor that is not 4. For example, 4x5 = 20, 4x7 = 28, 4x9 = 36. Thus, the numbers needed are 20, 28, and 36 and their greatest common factor is 4. The numbers 5, 7, and 9 are relatively prime. But, if you take 4x12, 4x3, and 4x9, the numbers generated are 48, 12, and 36, respectively, and the greatest common factor is 4x3=12! This is because the numbers 12, 3, and 9 have a common factor of 3.

Reference

Vistro-Yu, C. P. "On Pedagogical Knowledge in Mathematics: How Secondary School Mathematics Teachers Face the Challenge of Teaching a New Class. "*International Journal for Mathematics Teaching and Learning, October 25, 2005.*

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