Chapter XII
Inverting the Remedial Mathematics Classroom with Alternative Assessment

Victor W. Brunsden
Pennsylvania State University-Altoona College, USA

ABSTRACT

The author present a case-study of a classroom technique that allows assessment and some remediation of several shortcomings of college student skills in mathematics, particularly problem solving. Students are required to write their own notes for class and hand them in at the end for credit. Instead of a traditional lecture format, the first part of class is used to do examples of problems, creating an opportunity to model problem solving strategies for the class. Students then are separated into groups to work on individualized homework sets delivered via WeBWorK and group projects. Although problem sets are individualized, the problem types are the same from student to student, and the groups work on problems from all students in the group. Several issues of implementation are identified. Also discussed are alternative implementations of parts of the strategy, and possible extensions of the strategy to other courses that aren't based on problem-solving.

INTRODUCTION

Like many instructors, I have wanted to find better ways to get my students to master the material. It is a common enough wish; students should gain an integrated understanding of the topics, develop the skills for applying the material and gain some ability to use mathematics outside the classroom. Ideally they might also see some of what is so fascinating about mathematics. Without insisting that all students become mathematicians they should master the material and get some idea of what the attraction of the subject might be.

It is frustrating that students have a hard time integrating and applying information from a lecture format class. Though they may appear to understand during class, their performance on quizzes, exams and assignments shows a general lack of root comprehension. While they might be able to mimic template problems from class, changing even small details can throw them completely. Integrating material from more than one topic is more problematic still.

Furthermore, many students seem to lack many fundamental skills, note taking and study skills being two of the most glaring deficiencies. Given this, the difficulties integrating and applying mathematics is no mystery. Add to that the passive nature of a traditional lecture course and it is evident that something needs to be changed for there to be any hope of remedying these lacks. Problems with passive learning are well documented; students have no responsibility for their own learning, nor are they actively involved in their own learning. In a traditional lecture format class it would appear (Silberman 1996) that students may recognize only about one word in three per minute (for an instructor speaking at roughly 150 words per minute).

Over and above this, there is the problem of skill acquisition in mathematics classes; there are certain habits of thought that students need to master and make habitual to effectively learn mathematics. This is similar to language acquisition. There seems to be no better way to do this than to practice, practice, and practice. In a typical mathematics course this is achieved by assigning homework. In a small school setting this becomes difficult to grade as there may not be any graders and the demands on faculty may be such that grading all student homework is impractical.

One approach to the problem of passive learning has been to develop active learning strategies (Silberman, 1996; Fujii, 1997) in which a major portion, if not the entire period is spent with students working on problem solving. As some have noted, this can lead to reduced coverage, a problem in courses that are part of a sequence or where the curriculum is not entirely at the instructor's discretion. The approach adopted here follows that of Jones-Wilson (2005) in that a portion of the class is devoted to a combination mini-lecture and problem solving modeling session, with the remainder consisting of the students working in groups either on group assignments or on individual homework. It is this inversion of the standard lecture format, wherein notes are taken in class and problems worked on outside the class, which leads to the phrase "inverting the classroom".

Assigning and grading homework is dealt with by utilizing the web-based assignment delivery and grading system "WeBWorK" (Gage, Pizer & Roth, 2002; Brunsden, 2005). This provides instant feedback to students as to the correctness of their efforts and relieves the instructor of grading each and every student's assigned homework. Another advantage of WeBWorK is the capability for the instructor to arbitrarily allow many attempts by students at a given problem, where the number can range from a single attempt, to three or four attempts or even infinitely many (which is the default setting for most problems). Other advantages include a vibrant and helpful user community, a large and growing database of problems for various standard undergraduate mathematics courses together with the ability for instructors to add, debug or modify problems at will. In fact there is evidence that WeBWorK does in fact help students achieve mastery (Weibel & Hirsch, 2002).

It should be noted at the outset that all students would benefit from the methods outlined here, nor would the benefits be evenly distributed among those students who might benefit. A best case scenario was that this would help most of those students in the middle, and with care might broaden the middle.