Teaching Mathematics

… an article about teaching mathematics,

Recently I've been reminded how poorly some resources present mathematical topics. Many textbooks, workbooks and Distance Education materials do a pretty awful job of trying to teach math to students. Teachers who use *one resource exclusively* will be doing their students a disservice if they don't supplement the material.

Education students learn this. They learn that the proper way to prepare a lesson plan is to start with the proscribed curriculum outcomes, and find *multiple resources* that suggest ways to teach them. While the textbook may be a good starting point, it should be supplemented with other materials as needed.

It's a basic principle of teaching math that you should always do three things: work from the concrete to the abstract, work from simple to complex, and use lots of examples.

Typical workbooks and textbooks I've seen, especially for Math 30 and Math 31, follow the first principle, but fall down terribly on the second and third ones. Concepts are illustrated with just a few examples … far too few … and the more difficult examples are randomly interspersed with the simpler ones.

A student trying to learn math from one of these resources gets far too little practice at the basic skills, and is constantly confounded by complex problems before they have learned the concepts well.

Some students find their teachers using a single workbook or textbook that does this. These teachers forget that the resources were written *for teachers,* and *as guidelines only*, not as complete, self-contained teaching lessons. Concepts must be introduced with lots of *extra* basic examples that illustrate the ideas, and give students a chance to learn and practice the skills. Only later should challenging problems be introduced, and only after students are *made aware* that these are more difficult ones, and that they will require more thought and effort.

Many times I have seen students spending a great deal of effort trying to complete difficult problems when they haven't yet mastered the basic ones, because the teacher did not make a distinction between types of problems. It causes a lot of frustration. It makes no sense for a student who is struggling to pass a test to spend a lot of time on difficult problems, when they can't do the easier ones … they won't pass the test.

This concept, of working from easy to difficult, with lots of practice, should be applied at all levels when teaching mathematics, from Math 30 all the way down to a student's first introduction to counting in kindergarten or grade one. While teacher education programs do a good job at teaching prospective teachers how to teach mathematics, and the new math curriculum does an impressively good job of helping students understand mathematical processes and think 'mathematically' … the new curriculum is once again deemphasizing drill and practice. I think this is a mistake. Learning is about practicing something until you get good at it, and it's internalized. You can, for example, understand musical theory really well, but you won't become an accomplished pianist without hundreds of hours of practice. Math is the same.