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Davida Fischman TSSA Winter 2011

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TSSA One-Page REPORT

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Conference attended: Joint Mathematics Meetings, January 5-9, 2011

Teaching Skill(s) Studied:

Getting Mathematics Majors to Think Outside the Box

In this mini-course, the team of instructors guided the participants through the process of modifying standard questions to make them more challenging and engaging. Through these types of questions they suggest that students would be led to discover some aspects of mathematics on their own and thus understand them better and have "ownership" of the material.

The point was made that in order to move toward thinking outside the box, it is not necessary to rewrite the whole course – one might take closed problems and make them more open-ended. For example the following problem in a discrete mathematics class: Lay out 5 coins in an pattern of stacks. Take the top coin from each stack and use these to create a new stack, reordering so stacks are always situated from highest to lowest. Keep going. What happens? An example of such a process could be:

2, 1, 1, 1 -> 4, 1 -> 2, 2, 1 -> 3, 2 -> 2, 2, 1 -> 3, 1, 1 -> 3, 2 -> 2, 2, 1 -> …

Notice that the pattern begins to repeat at some point – thus bringing to life the important concept of a *cycle.* Another interesting pattern is created by starting with a different set of stacks: 3, 2, 1 -> 3, 2, 1 -> … In this case, the pattern remains stable – i.e. is a *fixed point*. From here questions arise naturally: will cycles always appear? What patterns create fixed points? What kinds of patterns could be fixed points? What total number of coins could create a pattern with fixed points? And so on.

Compare this kind of process to the more usual one of definition, example(s), theorem, proof, and so on. Modifying instruction and problems to create this sort of activity provides students with an opportunity to discover and appreciate the way in which definitions arise naturally in mathematics, and are then put to use to learn more about the structures involved.

Impact on Current Teaching (How is this info being applied)?

I am currently teaching Math 632, Geometry from a Teaching and Problem Solving Perspective, which is a core course in the Master of Arts in Teaching Mathematics program. I am using this approach both in my teaching and in the discussions on how to teach geometry in the K-12 classroom. As an example, MAT candidates have noted in their most recent homework assignment that they intend to give students multiple samples of certain types of polygons, and then will have the students classify them in various ways, make lists of common properties, and seek out a minimal set of requirements which will then become the definition of a particular type of polygon.

This process is a significant change from the way the geometry is presented in their textbooks, and is correspondingly different from the way they have taught geometry in the past. This trip will have a ripple effect into the K-12 classroom! ☺

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