MY FAVORITE lesson

Sonali Raje, Gail Kaplan, and Michael Krach

The Chinese Number Pyramid Puzzle

Puzzles are excellent tools for promoting logical reasoning, observational skills, and critical thinking abilities among students. The Chinese Number Pyramid is one such puzzle that requires students to observe data, analyze them critically, and obtain a logical solution. We have used this puzzle as part of a series of STEM workshops for high school students. The mathematics portion was designed to develop interest in problem-solving and critical thinking skills in preparation for college. The following narrative shows actual observations during the activity. We find that the puzzle engages students in a challenging, thought-provoking experience that enables them to develop an interest in mathematical problem solving.

The Chinese Number Pyramid Puzzle states: Discover the pattern in the following series of numbers and complete the succeeding lines, keeping in mind that each line of the sequence is uniquely determined:

1
11
21
1211
111221

The Back Page provides a forum for readers to share a favorite lesson. Lessons to be considered for publication should be submitted to mt.msubmit.net. Lessons should not exceed 600 words and are subject to abridgment.

Edited by ***Jennifer Wexler,*** *wexlerj@newtrier.k12.il.us, New Trier High School, Winnetka, IL*

To promote mathematical discourse, students are encouraged to work in pairs. Typically they start by adding the numbers in each row. Several pairs hypothesize that the sum of the numbers in each row is the Fibonacci sequence: 1, 2, 3, 5, and 8, …, in which each number is the sum of the two previous numbers.

By this logic, the sum of the next row would be 13. One group of students suggests a random permutation of 1s and 2s that add to 13. Because there are numerous permutations of 1s and 2s that add up to 13, the next line is not uniquely determined, so this educated guess is incorrect. Students continue to discuss potential solutions with peers. At this point, a facilitator shares that the only skills required for solving the problem are learned in first grade: reading and counting. That remark helps motivate students.

After working on the problem for about twenty minutes, the students ask for more help. Instead of providing the solution, the teacher provides the next element of the sequence: 312211.

When students notice the number 3, they immediately exclaim: "You didn't tell us we could use other numbers." The facilitators respond that no one said they couldn't. After about ten more minutes, at least one group finds the solution. As students in each group find the answer, they are asked to add another line to the solution. Often those who have been successful provide more and more leading hints, illustrating student-centered problem solving at its best. After a reasonable time, one student is asked to share her solution.

This deceptively challenging puzzle requires students to observe, critically analyze the given information, and use logical reasoning. It serves as an ideal model for encouraging students to think creatively and critically in mathematics.

SOLUTION (SPOILER ALERT!)

From left to right, read each number in the preceding line and count the number of times that number is present, consecutively. For example, the line 312211 begins with one 3 (1 3), which is followed by one 1 (1 1), two 2s (2 2), and then two 1s (2 1). Translating this sentence into numbers provides the next line: 13112221.

Note: We have named this puzzle in honor of a group of visiting Chinese educators who first shared this puzzle at our campus during a workshop on critical thinking and problem solving.

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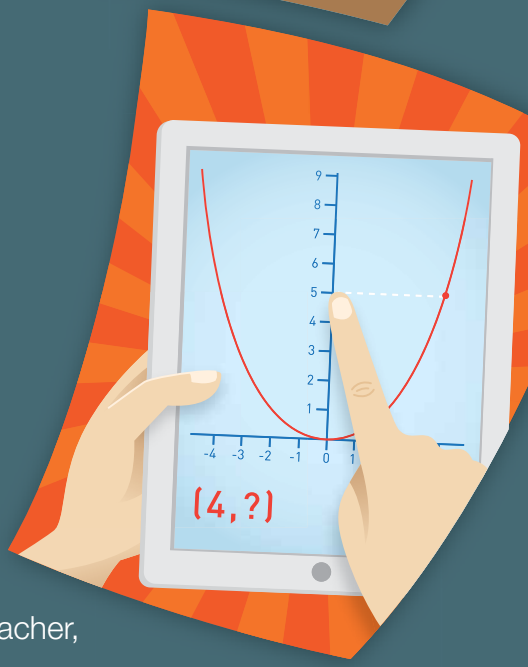

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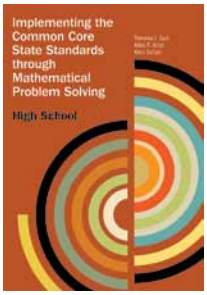

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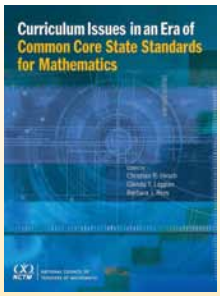

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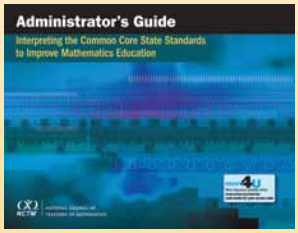

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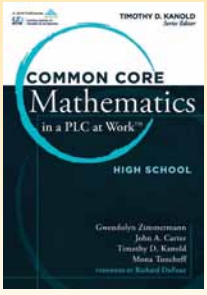

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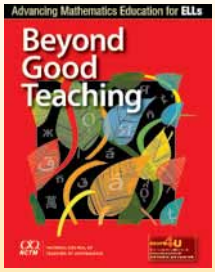

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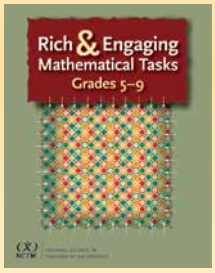

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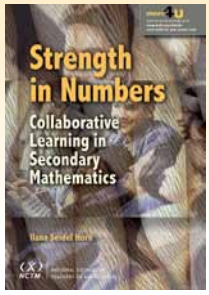

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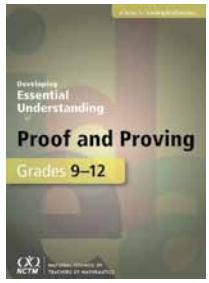

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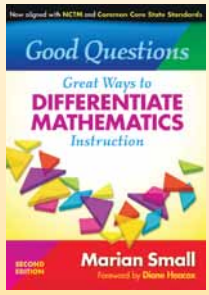

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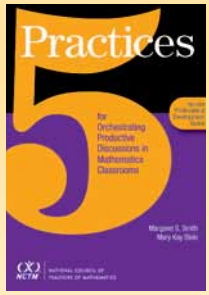

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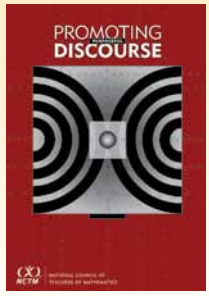

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