Locker Dilemma

You are about to enter your brand new school for the first time. The teachers, however, have gotten together and decided to perform a little ritual. The whole school of 150 students need to line up and enter the school one at a time. The 1st student entering will open all 150 lockers. The 2nd student will enter and close every 2nd locker. The 3rd student will change every 3rd locker. . . and so on. You are the last in line! But as you are waiting for your turn you realize you can figure out which lockers will be open after your turn. You amaze your teachers! Which lockers are open?

Grade Levels 6 - 8

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Context

This was one of three problems I posed to my sixth graders after our study of number theory (factors, multiples, rules for divisibility, perfect, abundant, deficient and square numbers).

What This Task Accomplishes

This task shows me what students can make connections between a situation and the factors they were studying in class. The problem is not very real world, but it does show how factors can be used in problems that set up situations.

What the Student Will Do

Most students started with paper and a pencil and many got frustrated. Most went with a simpler case (some did not take enough lockers to see a pattern). Many went for manipulatives (tiles that had a smooth and rough side, pennies, etc.) and found that pretty successful.

Time Required for Task

50 minutes

Teaching Tips

I hope someday to be able to have a choice of problems with most of my units. I let the students know which problem I considered of high difficulty, medium difficulty and low difficulty. I was pleasantly surprised that most students chose a problem that was a challenge for them. Some aimed too high and ended up doing two problems.

Suggested Materials

- Manipulatives (that can be used for lockers)

- Graph paper

Possible Solutions

All the square numbers (numbers with an odd number of factors) will be open: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144.

Benchmark Descriptors

Novice
Since I gave a choice of problems, I did not get a Novice level. However, you can expect to get Novice solutions. The Novice will be recognizable because s/he will not be able to start the problem or will make an attempt that will not lead to a solution.

Apprentice
The solution is not complete, indicating that parts of the problem were not understood. The student used a strategy that was partially useful and there is evidence of mathematical reasoning.

Practitioner
This student shows a broad understanding of the problem and was able to recognize that the numbers in his/her sample were square numbers. His/her strategy leads to a solution and his/her explanation is clear.

Expert
This student has a deep understanding of the problem including the ability to identify the appropriate mathematical concepts. S/he uses a very efficient (in the end) approach that leads directly to the solution. There is a clear explanation detailing why the solution is correct.