Developing Reflective & Persistent Problem Solvers

National Council of Teachers of Mathematics
Annual Conference 2018

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Reasoning Through Problem Solving
What does it mean to Do Mathematics?
Doing Mathematics

Mathematicians often work hours, days, or even years on a single problem. ≠ Students often equate excellence in mathematics with speed in solving problems.
Project Goals

1. To better understand:
   • Conceptualize
   • Classroom cultural norm
2. And to help students:
   • Productive dispositions
   • Connections to learning
3. By creating:
   • Authentic and equitable experiences
   • Accessible
   • Promote persistence
Outline of Project

Year-long Problem Solving Project Guidelines
Each one will be about 10-14 days long.
Spend at least 5 days working on this problem
For at least 15 minutes for each of the days
(Truncated) Project Steps

- Teachers created project goals and a bank of problems/tasks
- Students viewed “Developing Problem Solving Strategies” videos prior to starting process
- Students filled out video reflection forms and chose their top 3 videos
- Emphasized focus/objectives to students:
  - Students illustrated “what a mathematician looks like?” and explained “who is a mathematician?”
- Then problem/task was introduced and students began working on it
Teaching Problem Solving
Pólya’s Problem Solving Strategies

Understand the Problem

Devise a Plan

Carry Out the Plan

Check and Extend
Developing Problem Solving Strategies

https://www.maa.org/math-competitions/teachers/curriculum-inspirations
Developing Problem Solving Strategies

1. Engage in successful flailing
2. Do something
3. Engage in wishful thinking
4. Draw a picture
5. Solve a smaller version of the same problem
6. Eliminate incorrect choices
7. Perseverance is key
8. Second-guess the author
9. Avoid hard work
10. Go to extremes
Developing Problem Solving Strategies

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Which video do you like best and why?
How would these videos help students learn to be problem solvers?
Developing Problem Solving Strategies

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The Nature of the Problems
The Locker Problem

There are 1000 students and 1000 lockers, numbered 1 through 1000. Suppose the first student opens each locker. Then the second student closes every second locker. The third student changes the state of every third locker (if it is open, she closes it; if it is closed, she opens it).

This process continues until the 1000th student changes the state of the 1000th locker. Which lockers are open after all 1000 students have passed through?
A Mathematical Tug-of-War

from Marilyn Burns
adapted by

Four warrior princesses pull against five grandmas and the result is dead even.

Omar the camel gets pitted against two grandmas and one warrior princess. It’s a tie!

Omar and three of the grandmas on one side, the four warrior princesses on the other.

WHO WILL WIN???????
AUS SWAT TEAM to the rescue!
The Water Jug Problem

You only have 2 containers, a 3 liter jug and a 5 liter jug. There is an unlimited supply of water, but no other containers. You need precisely 4 liters of water in 1 jug.

Describe a way to use these jugs to measure exactly 4 liters of water. Explain your solution and illustrate using math models and or diagrams.
A Piece of Cake

What is the greatest number of pieces you can cut a round cake into by making four straight cuts with a knife?
I am a mathem-atician! (+ ÷ x =)

Me?
What We Learned
If $y = 3$, what is $6y$?

Hmmm... $63$?
Thankyou!

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