Problem-a-palooza!

You have 1 minute to solve the following problems.

1. A man buys a horse for $4000, then sells it a year later for $5000. He decides a few months after that to buy the horse back again for $5500. Two years later, he sells the horse again, this time for $6500. Did he make money, lose money, or break even?

2. There is a ping-pong ball in a hole. The hole is just a little bit bigger around than the ball. It's longer than your arm is. Or anyone else's arm. There are no long sticks around. What can you do to get the ball out of the hole? (*The Book of Think*, by M. Burns)

Collaboration with Project Based Learning: Recipe for an Engaged Classroom

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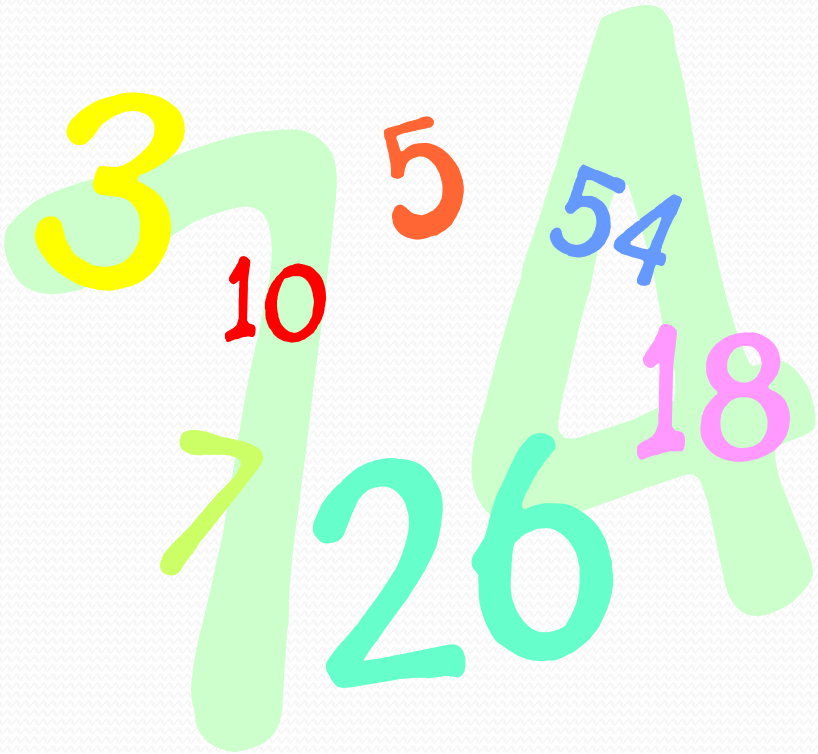
Problem-a-Palooza!

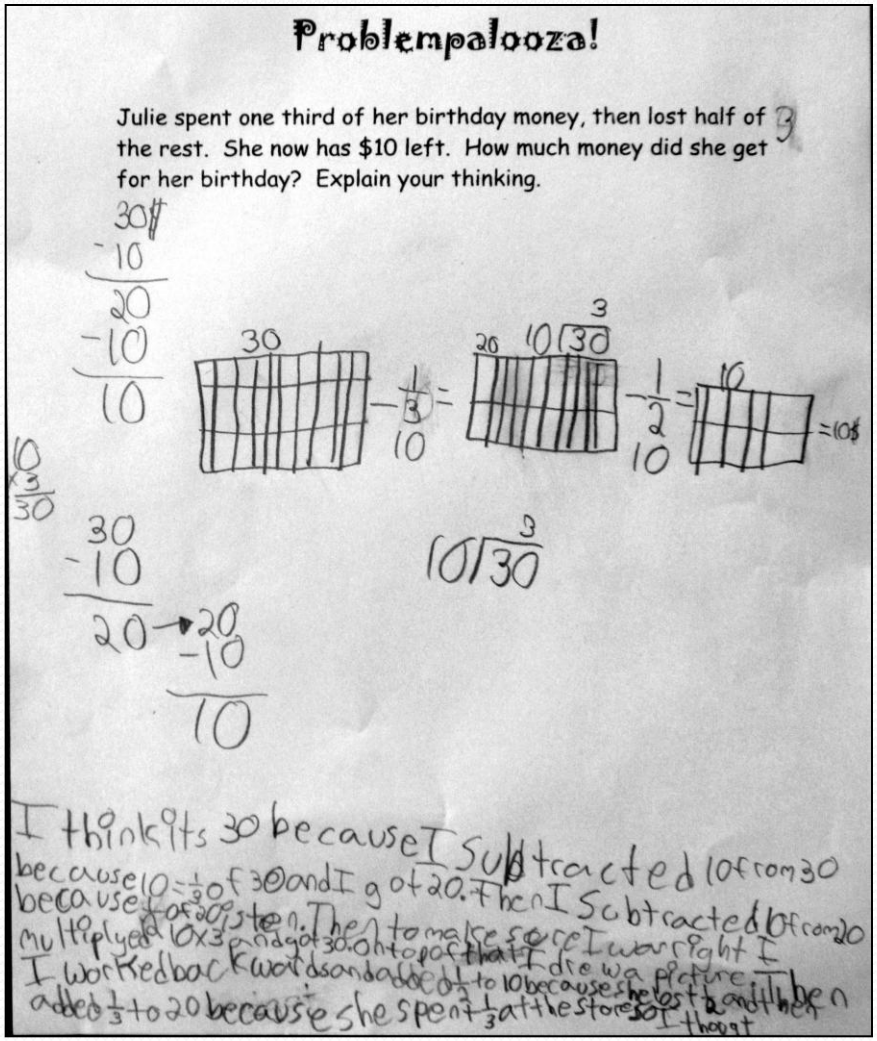
- Biweekly problem-solving party
- 4-5 problems
  - Logic problems
  - Curriculum based problems
  - Innovative thinking



Goals of Problem-a-Palooza!

- Have fun with problem solving
- Solve problems out of context
- Develop problem solving skills
  - Out-of-the-box thinking
  - Model with mathematics
- Develop communication skills
  - Write to clarify thinking
  - Write to communicate mathematics

Problem-a-Palooza! and the Common Core



- K-12 Mathematical Practices
  - Use what you know to solve what you don't.
  - Be clear and concise.
  - If you don't get it the first time, back up and try again.
- Students write up solutions
  - Use pictures, words, and numbers.
  - Explain all steps.

Problem-a-Palooza!

- Rubric for students to self-score responses

	1 Novice	2 Apprentice	3 Practitioner	4 Expert
Strategy	I do not know how to set up the problem, or My work does not show my strategy, or My strategy didn't work.	I did not apply my strategy to the whole problem. I did not check my work.	I picked an efficient strategy and used it throughout the whole problem. I solved the problem through skill, not luck.	I used at least two different strategies to solve and check my work. At least one of my strategies is efficient. I solved the problem through skill, not luck.
Explanation	I did not explain my answer. My explanation is difficult to read and/or follow.	I explained my answer in one of the three ways: pictures, words and numbers. I explained my answer, but it's not very clear and/or readable.	I explained my answer in two of the three ways: pictures, words and numbers. I explained most of my steps. I used accurate mathematical vocabulary. I labeled my answer appropriately.	I explained my answer in all three ways: pictures, words and numbers. My answer is very readable and my steps are easy to understand. I used accurate mathematical vocabulary. I labeled my answer appropriately.
Reflection	There is no reflection.	My reflection lacks detail. My reflection is not connected to anything else.	My reflection is detailed and connected to other problems I've solved or to what I already know. I explained why I made the problem solving decisions I made.	My reflection is very detailed and connects the problem to other problems I've solved as well as to what I already know. I explained why I made the problem solving choices I made and provided evidence of how I did it.

Developed using Primary Problem of the Week Scoring Rubric for Students, Drexel University.

Problem-a-Palooza!

- How the magic happens—
  - Behind the curtain: fellow and teachers collaborate to develop problem set
  - Prize showcase
  - Reminders: write up solution, any specific problem instructions
  - Problem solving madness
    - Check solutions, award tickets
    - Provide hints as necessary
  - Ongoing prize drawing

Outcomes

- Increased problem solving ability
- Better math communication
- Students expect to look at problems from different perspectives
- Students expect to spend time and persevere to solve problems
- Students bring problems home to challenge family members

Project Based Learning

- Student-driven inquiry-based learning
- Integrating the curriculum
  - Science, math, reading, writing
  - Visual and performing arts
  - STEAM (STEM plus Arts)
- Addresses real-world problems or situations

Strengths of Project Based Learning

- Teacher/Fellow:
  - Provides an effective framework for collaboration
  - Allows educators and scientists to use their particular expertise in creative ways
- Students:
  - Higher level of engagement
  - High order thinking skills
  - Provides authentic learning experiences

Original Soda Flavors

- Math, science, persuasive writing, visual and performing arts
  - Fractions and proportional reasoning
  - Mixtures and solutions
  - Creating scripts and jingles for 30 second commercials to sell a product
  - Package design

Phase I: Brainstorming

- Students assigned to teams of 3
- Students came up with list of flavors they want to use
- Strawberry-kiwi, watermelon, lemon, chocolate, chipotle, lime, caramel-apple, cherry, coconut, pickle juice, and bacon.

Phase II: Practice Makes Perfect

- Practice measurement using tools and materials
  - Dry and liquid ingredients
  - Math: Proportions of flavor to the whole
  - Good scientific note taking skills: recording tries, writing down amounts used (mL)

Phase III: Test Kitchen

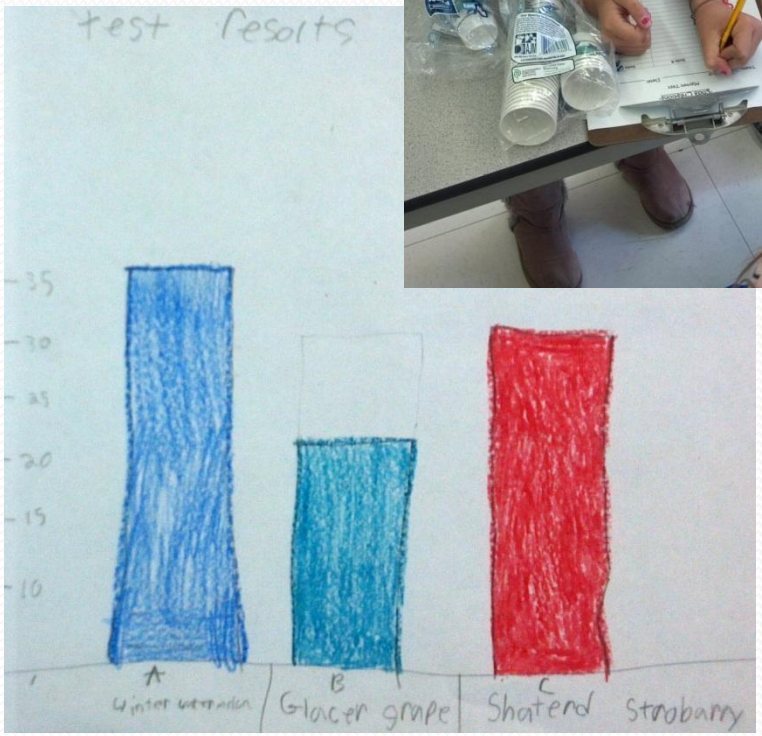
- Teams brainstorm a recipe using up to 4 flavorings and 250 mL of liquid
- Student recipes
  - Pickle juice-vanilla
  - Vanilla-chocolate
  - Bacon-caramel apple (tastes strangely like coffee)
- Teams informally test sodas on other students
- **Lesson:** Proprietary information
  - One team accuses another team of stealing their recipe; we explain that the proportions of ingredients make up the formula just as much as the list of ingredients

Phase IV: Market Testing

- Students double recipes to make 500 mL of soda for testing
- **Lesson:** Sugar was measured not measured in mL, but in cups or tablespoons, and they are not the same!

Phase IV: Market Testing

- Students make up all three recipes, then test their soda flavors on third, fourth, and fifth graders during lunch.
- Based on the data, students select the winning recipe.
- **Lesson:** Dealing with real-world data to make decisions



Phase V: Mass Marketing

- Packaging, commercials, jingles

Outcomes

- 100% engagement
- Students working productively in teams
- Students see real-world application of math and science
- Students see authentic application and connection between the arts, math and science
- Literacy connections
- Integrated teaching, rather than distinct strands

Resources

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Sarah: sarah.clements@tusd1.org

Problem-a-Palooza! sets and Problem Solving Rubric available at:

http://ime.math.arizona.edu/g-teams/Profiles/M_Hine_Profile.html