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**Linda Dacey**

# ***Just Right Problems***

2013 NCTM Annual Meeting & Exposition • Denver, Colorado

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**Just Right Problems**

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Dr. Linda Dacey

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**Why We Need Just Right Problems**

Students' lack of success:

- The need to *always* have a "model"
- Achievement gap
- Non-flexible thinkers who can't apply their knowledge to new situations

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**What We Need to Change**

- Introductory problem and direct applications after practicing skill
- Isolated teaching of problem solving strategies
- Little or no differentiation
- Differentiation that leads to lack of debriefing
- Lack of progressive explicit instruction on how to justify thinking

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### Standards for Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

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### #1 : Make sense and persevere

- Look for entry points
- Analyze givens, constraints, relationships, goals
- Think about a solution path
- Try special cases or simpler problems
- Understand the approaches of others



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### Just Right or Leveled Problems

- Allow for success for a range of learners, which motivates sense making and perseverance
- Provide a common setting and content for shared debriefing
- Give warm-up opportunities
- Have expansion potential

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### Ways to Level Problems and Tasks

- Amount and types of scaffolding
- Meaning and context
- Complexity of the language
- Way in which data are given
- Number of solutions to be found
- Number of conditions to be met
- Sizes or types of numbers
- Multiple intelligence or learning style

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### What Do You Know About Colorado?

1. Colorado borders \_\_\_\_\_ other states.
2. It has an area of \_\_\_\_\_ square miles.
3. It contains \_\_\_\_\_ of the land area of the U.S. with an altitude over 10,000 feet.
4. In \_\_\_\_\_, Colorado became the \_\_\_\_\_th state to join the nation.
5. It has \_\_\_\_\_ area codes.
6. In 2012, the estimated population of Colorado was \_\_\_\_\_.

Make sense  
Create viable  
arguments

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### Context: Use Interesting Data



270 1211 248 334

About how many muscles does a caterpillar have in its head?  
The number is less than  $1,000 + 200 + 10 + 1$ .  
The number has a 2 in the hundreds place.  
The number is not equal to  $3 \times 90$ .

Reason  
quantitatively

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### Format: Use Puzzle-like Problems

- Write the names and numbers to show who owns each cap.
- Carla's number is equal to  $5 + 9$ .
- The sum of Will's number and Mandy's number is 12.
- The sum of Mandy's number and Pablo's number is 11.



Reason quantitatively

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### How to Create Leveled Problems: Start in the Middle

Manny has 7 coins.  
He has 40¢.  
He has no nickels.  
What coins does Manny have?

Make sense  
Create viable arguments  
Be precise

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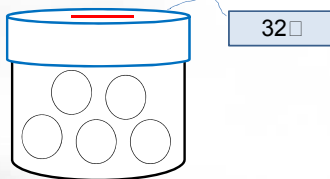
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### Simplify



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### Add More Challenge

Janelle has 30¢.  
She has at least 1 penny, 1 nickel, and  
1 dime. What coins could she have?  
Find three possible answers.

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### What Might You Do with this Problem?

My bedroom floor is rectangular. One  
side has a length of 9 feet. The floor  
has an area of 108 square feet. What is  
the perimeter of my  
bedroom floor?

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### Have Something to Talk About

Jamie held A animals at the pet store.  
She held mice, hamsters, and guinea pigs.  
She held B more guinea pigs than mice.  
Jamie held C guinea pigs and D mice.  
Jamie also held E hamsters.



Look for  
and use  
structure

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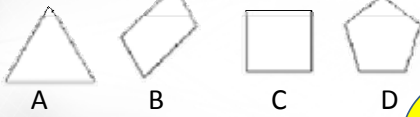
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### Have Something to Talk About

Which shape is different? Why?  
A different reason? A different shape?



Make sense  
Look for and  
make use of  
structure  
Be precise

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### What Do You Know?



Together Oni and Caitlyn have 22 nickels.  
Together Caitlyn and Xavier have 29 nickels.  
Caitlyn has one less nickel than Xavier.

What is the value of the nickels in each bank?

Make sense  
Reason  
quantitatively

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### Give Problems Before Strategies Learned

I have between 30 and 50 pennies. When I put them in piles of five, I have 1 penny left over. When I put them in groups of four, I have 1 penny left over. How many pennies do I have?

Look for and  
make use of  
structure  
Look for  
repeated  
reasoning

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### Encourage Alternative Strategies

There are bicycles and tricycles for sale. There are 18 bikes for sale in all. There are a total of 51 wheels. How many of each type of bike are there?

Try to find at least two ways to solve the problem.

Look for and make use of structure  
Look for repeated reasoning

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### Teach How to Explain Thinking

- Clarify student thinking
- Provide you access to student thinking
- Create documentation
- Support discourse

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### Equation Frames

To solve the problem, I first divided \$13.60 by 16 to find the price per ounce. After that, I multiplied the unit rate of \$0.85 by 6 to find the cost for 6 ounces and found it was \$5.10. Therefore, I know that 6 ounces of shampoo at that rate would cost \$5.10.

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### Procedural Language

- What words: *multiply to find...*
- Why words: *since, because...*
- Transitional words: *to start with, first, then, after that, second...*
- Concluding words: *Therefore I know*

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### Word Walls

- Include drawings, examples, and non-examples.
- Vary the arrangement
- Include abbreviations and mathematical symbols.
- Develop games and activities to use with the words that induce students to interact with the words.

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### References

- Collins, Anne. 2012. *50 Leveled Problems, Grades 5 and 6*. Shell Education.
- Dacey, Linda. 2012. *50 Leveled Problems, Grades 1, 2, 3, and 4*. Shell Education.
- Dacey, Linda and Lisa Donovan. 2013. *Strategies to Integrate the Arts in Mathematics*. Shell Education.
- Denman, Greg. 2013. *Think It Show It Mathematics: Strategies for Exploring Thinking*. Shell Education.

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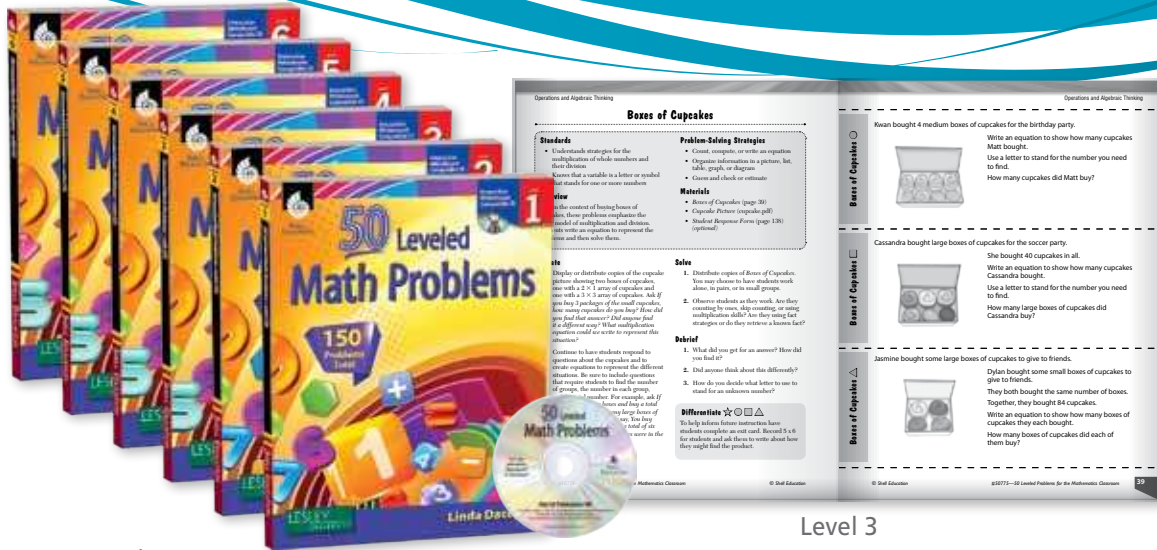
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# 50 Leveled Math Problems

## Grades 1–6



Level 3

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- ▶ Digital versions of activity sheets.



#### Author Focus **Linda Dacey**

Linda Dacey, Ed.D., is a professor of education and mathematics at Lesley University where she teaches courses for inservice and preservice teachers. A national and local leader, she is the co-author of numerous instructional materials designed to support the teaching and learning of mathematics. Dr. Dacey began her career in education as an elementary school teacher and still spends significant time in classrooms. Her current research focuses on ways to help teachers meet the needs of diverse students.



#### Author Focus **Anne M. Collins**

Anne M. Collins, Ph.D., is the Director of Mathematics Programs and the Director of Achievement Center for Mathematics at Lesley University. In her career she has taught at the elementary, secondary, and postsecondary levels. Dr. Collins has authored, edited, and reviewed numerous publications on mathematics instruction. Among her many leadership roles and honors, Dr. Collins is an elected member of the NCTM Board of Directors and was inducted into the Massachusetts Mathematics Educators Hall of Fame in 2005.

# 50 Leveled Math Problems

## Grades 1–6

### 50 Leveled Math Problems

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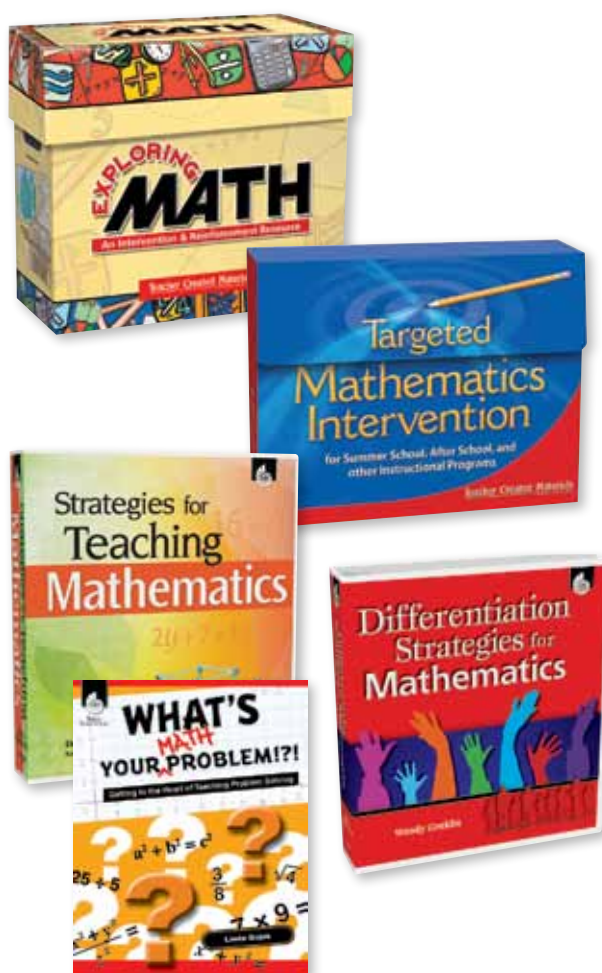
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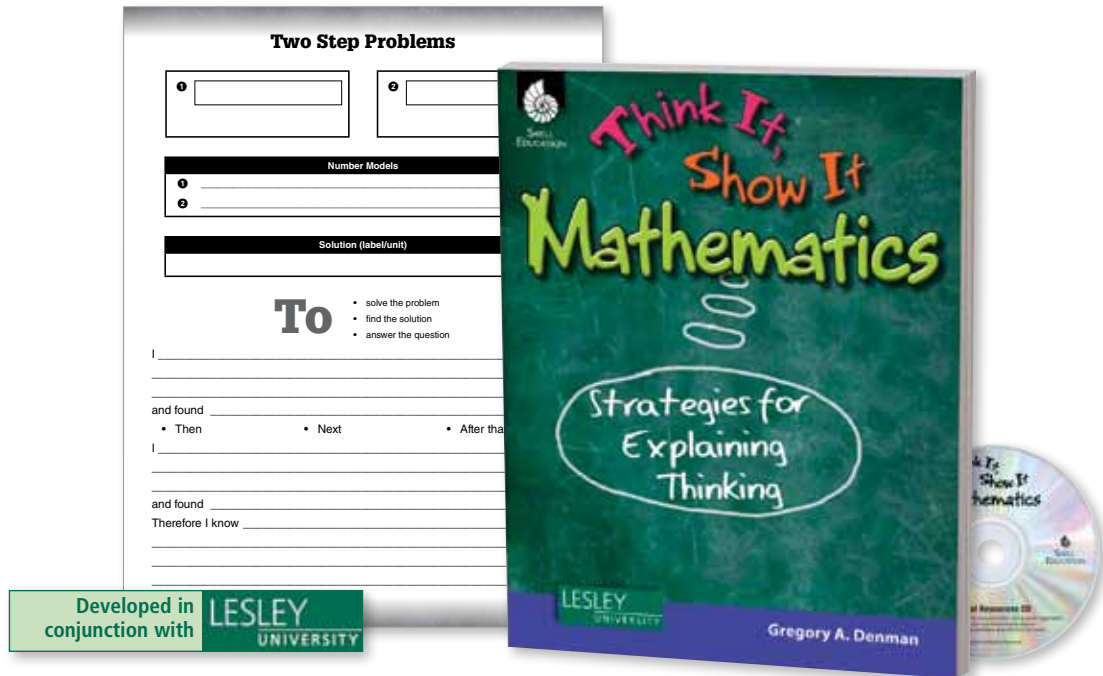


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