Teaching and Understanding Mathematical Word Problems

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PaTTAN’s Mission

The mission of the Pennsylvania Training and Technical Assistance Network (PaTTAN) is to support the efforts and initiatives of the Bureau of Special Education, and to build the capacity of local educational agencies to serve students who receive special education services.
Our goal for each child is to ensure Individualized Education Program (IEP) teams begin with the general education setting with the use of Supplementary Aids and Services before considering a more restrictive environment.
Agenda

- Big Ideas
- General Strategies
- Schema-Based Instruction
Big Ideas
What goes wrong?

1. I can’t read/comprehend the problem.

2. I don’t know how math is related to the problem.

3. I can’t do the math.

4. I can’t keep track of where I am at?
General Strategies
Self-Regulatory Strategies

• **Self-Instruction**
  – Students reads the problems and tells themselves what to do.

• **Self-Questioning**
  – Students ask themselves questions as they go about solving the problem.

• **Self-Checking**
  – Students check over their work to make sure it is complete, accurate, and makes sense

(Montague, 2007)
Polya’s (1945) four Problem Solving steps:

1. Understand the Problem
2. Devise a Plan
3. Carry Out the Plan
4. Look Back
Schema-Based Instruction
(Addition/Subtraction)
Schema-Based Instruction

• Keywords lead to misconceptions

• General Strategy Instruction (GSI) is an improved problem solving process
  • Polya - UPS

• Students still have a hard time understanding a problem
  • especially struggling math students

• Categorizing a word problem into a “type” before solving has shown to increase mathematics achievement

(Jitendra et al, 2007)
SBI – Additive Schema

1. Total
2. Difference
3. Change Increase/Decrease
There are 8 horses in the pasture and 9 sheep in the pen. How many animals does the farmer have on his farm?
There are 6 more students using the sliding board than playing on the monkey bars. If 4 students are playing on the monkey bars, how many are on the slide?
Jaylon brought $12.00 to school. He found $6.00 on the bus. How much money did Jaylon have when he got home from school?
Jaylon brought $12.00 to school. He found some money on the bus. How much money did Jaylon find if he had $21.00 when he got home?
Pop Quiz
Pop Quiz

1) Jim has $3. John has $8. How much money do they have to spend at the fair together?

2) Julie had $8 when she got on the bus. At home she realized she only had $2. How much money did she lose on the bus?

3) Jennie has $31. That is $13 more than Juan. How much money does Juan have?
4) Jack had $1. He won a bet with a friend. Now he has $3.50. How much did he win?

5) Linda had some money. Luke stole $3 from Linda at recess so he could get ice cream at lunch. Ice cream costs $2. If Luke split the cost 50/50 for one ice cream with a friend, how much money did Linda have originally if she only has $4 now?
6) Tim had two cookies. Julie gave him 3 more cookies at lunch. How many cookies does he have?

7) Andrea has 8 cookies. She got some more cookies from Joe. Now she has 12 cookies. How many cookies did Joe give her?
8) Ellie has some cookies. She ate 2 and then realized she only had 1 left. How many cookies did Ellie originally have?

9) Jill has 6 cookies. Greg has eight cookies. How many more cookies does Greg have?

10) John had 216 cookies. Laurie had 137 cookies. How many cookies did they have all together?
Your turn!
Students
Teaching

1) Teach one at a time.

2) Each skill...
   - Identify the schema
   - Fill in organizer (know and find the parts)
   - Write equation from organizer
   - Solve (hopefully already done)

3) Snowball problem types.
Ellie has some cookies. She ate 2 and then realized she only had 1 left. How many cookies did Ellie originally have?
Ellie has some cookies. She ate 2 and then realized she only had 1 left. How many cookies did Ellie originally have?
First Half Summary...

What have we discussed that will change your approach to instruction? Why?

What will you do differently with students as a result of today? Why?
Schema-Based Instruction
(Multiplication/Division)
SBI – Multiplicative Schema

1. Equal Groups
2. Comparison
3. Combination
4. Proportion
A note about **Combinations**

Set $\times$ Set $\Rightarrow$ Product

- Red shirt
- Teal shirt
- Purple shirt
- White pants
- Green pants

Total combinations: $3 \times 2 = 6$
Adara worked 2 hours a day for 6 days. How many hours did she work?
Sara collects dimes and keeps them in her piggy bank. She cashes them in at the bank and gets $51.20. How many dimes did she save?
Juan has 8 pencils, which is twice as many Julie. How many pencils does Julie have?
You have 3 shirts in your closet and 4 pairs of pants in your drawer. How many combinations of outfits can you make?
Katie’s goal is to read 6 books every 3 months. Based on this goal, how many months will it take Katie to read 24 books?
Pop Quiz
Pop Quiz

1) Jim has $13. John has half as much. How much money does John have?

2) Julie makes $9 working 2.5 hours. How much money will she make if she works 7 hours?

3) Jennie has six $5 bills? How much money does she have?
Pop Quiz

4) Jack gets $15 dollars for each A on his report card. If he gets $60 at the end of the marking period, how many A’s did he get?

5) An ice cream shop allows 1 topping for free when you buy 1 scoop. If they have 8 toppings and 12 flavors of ice cream, how many different desserts could you order?
6) Tim has two cookies. Julie has 16 cookies. How many times more cookies does Julie have than Tim?

7) Andy eats 8 cookies a day. How many cookies does he eat in one month?
8) Ellie bought a cookie kit that claims you can make 32 different treats. If there are 8 different types of chips, how many types of batter are there?

9) Jill bought 8 packs of cookies so she would have 400 to share with friends. How many does each package have?

10) John can eat 6 hot dogs in 2 minutes. If the competition lasts for 15 minutes, how many hot dogs can he expect to eat?
Your turn!
Students
2 out of 3 Dentists recommend Crest. If there are 12 dentists in your area, how many will tell you to use Crest?
Student Work

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\[
\frac{3}{2} = \frac{12}{x}
\]

\[3x = 24\]

\[x = 8\]
2 out of 3 Dentists recommend Crest. If there are 12 dentists in your area, how many will tell you to use Crest?

\[
\frac{3}{12} = \frac{2}{x}
\]

\[
3x = 24
\]

\[
x = 8
\]
Second Half Summary…

What have we discussed that will change your approach to instruction? Why?

What will you do differently with students as a result of today? Why?
When does it end?

What schema are found within this problem?

The admission fee at a small fair is $1.50 for children and $4.00 for adults. On a certain day, 2200 people enter the fair and $5050 is collected. How many children and how many adults attended?
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Matthew Stem, Deputy Secretary, Elementary and Secondary Education
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