Modifications

Consider whiting out the bubbles that contain the characters' ideas and adding your own examples of commonly held ideas you may have observed with your own students. An alternative way to generate distracters is to ask students to work in small groups to fill in the bubbles with ideas they think the characters may have and exchange them with other groups for discussion. Students can also create their own cartoons to depict mathematical ideas. A fun and engaging strategy shared on the www.conceptcartoons.com website is to digitally photograph several teachers in the school, paste them into a cartoon format, and include thought bubbles that depict different ideas seemingly coming from the teachers. You can also use digital photos from the Internet of famous people and add bubbles describing their mathematical ideas. One middle school teacher reported that she used digital photos of Bon Jovi, Bono, and Lady Gaga to create a concept cartoon and said she had never seen her students so engaged with a question!

Caveats

Make sure the cartoons are used to stimulate discussion about the various ideas and that students do not disparage the cartoon characters' ways of thinking, because there may be students in the class who have the same or similar ideas as the cartoon characters.

Use With Other Disciplines

This FACT can also be used in **science*, social studies, language arts, health, foreign language, and visual and performing arts.

My Notes

#11. CREATE THE PROBLEM

Description

Create the Problem is a reverse problem-solving FACT. Instead of performing the computation, students are given the solution and are asked to figure out what the real-world problem might be.

How This FACT Promotes Student Learning

Create the Problem helps students think about the purpose of performing certain computations and order of operations to solve problems. It moves students beyond performing rote computations to understanding the variety of problems the computation can be used to solve. It also helps students see the ways mathematics can be used in a variety of contexts.

How This FACT Informs Instruction

This FACT helps teachers see if students understand the purpose of a computational problem. Rather than always asking students to perform a computation, they are asked to tell in their own words what problem the computation might be used to solve. The examples students generate reveal whether they know why a computation is performed versus knowing the procedures used to perform a computation. The information may reveal the need to help students see the real-world applications of performing mathematical procedures, not just how they are used in math class.

Design and Administration

Create the Problem can be designed using basic computational problems or more complex problem-solving tasks. Choose a mathematical equation and have students work backwards from the end result to what they think the initial problem could be. For example, the teacher might give students the equation *2/3 of 15 = 10*. Students are asked to come up with problems that may have been solved with this equation, such as:

- John's mother gave him $15 to spend at the fair. She told him he could only spend 2/3 of it on rides. How much money could John spend on the rides?
- Felix had 15 homework problems. He was 2/3 finished before bedtime. How many problems did he finish before he went to bed?
- Sarah wondered how many pieces in a 15-slice box of pizza would be left if 2/3 of the pieces were not eaten.

Students share their examples and describe how their "story" matches the equation. The teacher asks the class for feedback on whether the "story" is a match to the equation. If not, how could it be changed to match?

General Implementation Attributes

Ease of Use: High
Time Demand: Medium
Cognitive Demand: Medium

Modifications

Use expressions instead of equations and in addition to creating the problem scenario, ask students to describe how they solved it. For example, instead of using the equation given above, give students the expression *2/3 of 15* and ask them to come up with situations where they might use this. Have them share the answer and describe how they found it. Ask students to create problem scenarios to show the need for using grouping symbols. For example, students write a problem for $3 \bullet (5 + 7)$ and another problem for $3 \bullet 5 + 7$. (*Note:* Elementary teachers often prefer to use the $\times$ symbol for multiplication.)

Caveats

Use simple expressions or equations when you first start using this FACT. Once students are comfortable with it, you can add more complex equations or expressions.

Use With Other Disciplines

This FACT can be used with science in contexts where mathematics is used to solve problems in science.

My Notes

#12. EVERY GRAPH TELLS A STORY

Description

Every Graph Tells a Story reveals how students make sense of graphic representations. Research indicates that students of all ages often interpret graphs of situations as literal pictures rather than as symbolic representations of the situations (Leinhardt, Zaslavsky, & Stein, 1990; McDermott, Rosenquist, & Van Zee, 1987). Students are given a graph and asked to choose the statement that best tells the story of the graph. Their answers reveal whether they interpreted the features of the graph literally (for example, an upward slope interpreted as climbing a hill) or consider the data points and the relationships they describe.