

Watch your labels!

Teacher's notes, early algebra class.

In an earlier class, students were introduced to our ability to place objects and events into different categories without changing the object or event. As we change categories, the labels change. This exercise will reinforce the earlier experience, and emphasize the need for proper labeling when working with mathematics.

Hold up the enclosed truck graphic. Tell the class, "You probably saw these pictures previously, and you filled in the blanks. We have two fire engines, one dump truck and two pick up trucks. When we park them all together we see we can call the result five trucks. You can see how we did that graphically, but how do we do that with our language?" (pause) "We find a category in which all can be classified. We could have called them five vehicles, or five wheeled conveyances, or with a little thought, found some other label which would have permitted us to group and total them together."

Write on the board, two apples plus three oranges. Ask "What is an answer—and it is not fruit salad?" (pause) Hopefully, some students will find a category (i.e., pieces of fruit) that will permit us to add these objects together. "I am sure you have heard that you cannot add apples and oranges—and that remains true if we don't change the labels. But you and I are free to categorize objects in any way we see fit. When we view an object or event, we abstract from it. Then we abstract from our abstractions. At each level we create a new term for the object or event. It does not change the object or event, just the label. Am I making sense?"

Now ask the students to take out a piece of paper and be prepared to write down a sentence when instructed. Say, "I have here a news release from the Chicago Cubs. It states that this year's paid attendance was 2,255,000. Our local newspaper receives the news release, and the headline writer comes up with this headline. I want you to write it down. 'Over two million fans see Cubs play.' I want you to look at that headline, and I would like you to think about it and comment on it."

Depending on the definition of 'fan', the headline may be false to fact*. Does a fan represent an individual, or an action? Are all people who attend fans? If the individual had season tickets and attended 72 games, would you classify him/her as one fan or 72 fans? Fans generally attend multiple games during a season if we use the usual definition of fan, that is, a person extremely interested in a team or individual. After pointing out these bits of information, ask the class to again visit the headline, and as editor, what might they say to the headline writer? Point out this careless bit of category switching, could, in other areas, become problematic.

"Look around the room. Look at yourself. How many categories do you fit into?" Have students try to find many categories such as sex, size, age, last name, location of residence, hair color, etc. as they can.

*False to fact: Not true, a lie

PART B

The other day we spoke of changing categories to permit us to work with various types of objects. Although we are free to change categories, we must ensure that the categories chosen are what we are really counting. We want to be sure the labels we use for our objects all belong in the category we have selected. For example, if we want to find our average speed over a trip, we divide the distance by the time. If we want MPH, our distance must be in miles and labeled as such. If our distance was 75 miles and we covered it in 90 minutes, we do not divide 75 by 90. Our time must be hours, and again, properly labeled. Thus 90 minutes must be changed to 1.5 hours. If you take the time to label your numbers, your labels help confirm your results.

“Now let me show you another way to confuse our abstractions. Will someone count the number of students in the class?” Write that number on the board. Now have the boys stand up and count them. List that number on the board and label it. Do the same for the girls, and put that number under the boys. Now select two other categories such as hair color, height, bus student, etc. Have the students in these two categories stand, have them counted, and add the number below the other two. “Now, since all these individuals can be categorized as students, let’s add the column. It shows we have only XX number of students in the class, but we counted YY. How come?”

We counted students in subsets of categories we had already counted. We were not counting students in this exercise, we were counting the number of times students stood up.

Remember, improper labeling leads to errors.