Soybean Math: Fun by the Bushel!
[Math]

Objectives:

1. Students will develop an understanding of what a bushel is and its associated volume.

2. Students will analyze and complete math story problems involving soybeans, bushels, trucks, trains, and grain bins.

3. Students will formulate and complete a variety of addition, subtraction, multiplication, and/or division number sentences in order to complete the math story problems.

Common Core Standard(s):

4.OA.1   Use the four operations with whole numbers to solve problems. Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

4.OA.2   Use the four operations with whole numbers to solve problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.

Materials Needed:

- computer and projector to show Pod to Plate Video Episode IV – "Elevators & Trains" (available online at www.podtoplate.org)
- pencils
- scratch paper for working problems
- *Soybean Math Facts by the Bushel!* handout
- *Solving Soybean Scenarios* worksheet
- bushel basket (authentic, plastic one from big box store, borrow one from local farmer or county agriculture literacy coordinator, or use a similar sized container with similarly volume, i.e., cardboard box or laundry basket)
- sheets of paper, old newspapers, packing material ("peanuts"), craft cotton balls, skeins of yarn, small to medium sized playground balls, <u>or</u> misc. student-selected items from the classroom (gather enough of each type of item to fill the bushel basket)
- bathroom scale

Background:

This lesson, *Soybean Math Fun by the Bushel,* will work best after implementation of the related vocabulary lesson, *Billions of Beans*. After implementing the vocabulary lesson, students should be shown the video "Elevators and Trains" (Episode IV) and/or "Trucking" (Episode V) found at www.podtoplate.org/videos. Once students are familiar with the vocabulary and content of the video(s), this math lesson will build more effectively on students' understanding.

Procedure:

1. In a whole group setting, teachers will provide a bushel basket for students to use in this hands-on activity. Students will sit in a large circle around the basket.

2. Use paper, newspapers, packing material ("peanuts"), craft cotton balls, skeins of yarn, small to medium-sized playground balls, or misc. student-selected items from the classroom to complete this hands-on activity. Students should be invited to choose an item with which to fill the basket, then offer predictions on how many of the chosen item it will take to fill the basket and how much the basket will weigh when full. Students then can be invited to come forward and gradually fill the basket. After the basket is full, it should be weighed on the bathroom scale. Once it has been weighed and the weight and number of items recorded, the basket can be emptied. A new type of item should be chosen, predictions made, basket filled and weighed, and so on until at least three different types of items have been tried. The difference in weights and number of items should help to illustrate the concept that a bushel of one item may be very different than a bushel of another item even though the items fill the same amount of space (volume).

3. Teacher will distribute *Soybean Math Facts by the Bushel!* handout. Class will read and discuss information on the fact sheet.

Evaluation:

- Distribute the *Solving Soybean Scenarios* worksheet to students (you may choose to have them work in pairs). Using the previously discussed and distributed *Soybean Math Facts by the Bushel* fact sheet and scratch paper if needed, students should solve the soybean math scenarios given.

Soybean Math Facts by the Bushel!
Information Sheet

What is a bushel?

pictured:
2 ½ bushels
of soybeans

- A bushel is a unit of weight used to measure grain (or any dry good/material).
- 1 bushel = 4 pecks, 8 gallons, or 64 pints,
- One bushel of soybeans weighs approximately 60 pounds
- One train car holds about 4,000 bushels
- One semi-truck trailer holds about 1,000 bushels.
- Grain bins come in different sizes. Different sized grain bins have different volumes and hold various amounts in bushels.

Solving Soybean Scenarios

1. If you had 2 ½ bushels of soybeans, about how much would they weigh in total?

2. How much would the soybeans weigh in one typical semi-truck trailer?

3. How much would one train car weigh if it were filled with soybeans?

4. How many semi-truck trailers, filled with soybeans, could dump their load onto one train car?

5. In the video, "Elevators and Trains", it is stated that the elevator operation fills 20 train cars at a time. At this rate, how many groups of 20 train cars will be filled in a 100-car train?

6. Video #4, "Elevators and Trains", shares that a 100-car train takes approximately 16 hours to load with soybeans at that facility. Given this information, how many hours would it take to load three 100-car trains?

7. A typical train car can hold 4,000 bushels of product. Given this fact, how many bushels can a 100-car train hold?

8. Grain bins vary in size. If the grain elevator had a 50,000 bushel grain bin, how many semi-truck trailers full of soybeans would it take to fill it?

9. How many train cars would be filled using the soybeans from the full 50,000-bushel grain bin?

10. In Video #5, "Trucking", semi-trucks are used to haul soybeans into the grain elevator. If the elevator has a grain bin that holds 500,000 bushels, how many train cars would it fill?

11. If a semi-truck completely loaded with soybeans was weighed on the elevator's scale, what would the net weight of the soybeans likely be?

12. If a semi-truck exactly half full of soybeans was weighed on the elevator's scale, what would the net weight of the soybeans likely be?

Answer Key (one possible method to solve each provided):

1. $60 + 60 + 30 = 150$ pounds (or lbs.)

2. $1{,}000 \times 60 = 60{,}000$ pounds

3. $4{,}000 \times 60 = 240{,}000$ pounds

4. $4{,}000/1{,}000 = 4$ semi-truck trailers full

5. $100/20 = 5$ groups of train cars

6. $16 \times 3 = 48$ hours

7. $4{,}000 \times 100 = 400{,}000$ bushels

8. $50{,}000/1{,}000 = 500$ semi-truck trailers

9. $50{,}000/4{,}000 = 12 \frac{1}{2}$ train cars

10. $500{,}000/4{,}000 = 125$ train cars

11. $1{,}000 \times 60 = 60{,}000$ pounds

12. $60{,}000/2 = 30{,}000$ pounds