

# *Manipulative Mathematics*

**Using Manipulatives to Promote Understanding of Math Concepts**

## **Coin Lab**

### **Manipulatives used:**

Plastic coins

**Resources Needed:**

Each group of students needs a bag containing a handful of several different kinds of plastic coins (pennies, nickels, dimes, etc.).

**Background Information:**

Students often have trouble with coin word problems. They get confused with all the information given in the problem and don't know how to even begin solving it. Part of the difficulty stems from the fact that they don't distinguish between the *number* of coins and the *value* of the coins. By using a concrete example familiar to them from everyday life, students develop a strategy for calculating the value of a handful of coins. The strategy directly leads them to an organized method for solving coin word problems. This exercise may seem almost trivial to teachers, but it can make a tremendous difference in students' ability to solve coin word problems.

**Directions:**

- This activity is best done with students in groups of 2 to 4.
- Give each group the worksheet and a bag of coins. It is not necessary for all the bags to contain the same number of coins.
- On the worksheet, students are asked to determine the value of all the 'money' in their bag. Students need to devise a method for counting the money.
- After finding the total value of their 'money', they must describe completely, in words, the method they used. They must write their method step-by-step.

Many students find this hard to do—you might want to tell them to start with "dump the coins from the bag to the desk" and then list each step carefully. Walk around and notice if they are stuck on vocabulary. Often they will say "sort coins in piles." Help them realize that they sorted the piles by *type of coin* or by the *value of the coin*. Often they next say "add them all up." They need to distinguish counting the number of coins and the total value of coins.

Most students eventually devise a method similar to this:

- 1) Dump the coins from the bag.
- 2) Sort the coins into piles based on the type of coin—quarters, dimes, nickels, etc.
- 3) Count the number of coins in each pile.
- 4) Find the value of each pile by multiplying the number of coins times the value of that type of coin.
- 5) Add together the value of all the piles to get the total value of all the coins.

It is steps 3, 4, and 5 that will lead them to an organized strategy for solving coin word problems.

- Finally, students must show the calculations for their bag of coins. For example:
  - 3 quarters -  $3 \times 0.25 = 0.75$
  - 9 dimes -  $9 \times 0.10 = 0.90$
  - 13 nickels -  $13 \times 0.05 = 0.65$

○ 27 pennies -  $27 \times 0.01 = \underline{0.27}$

\$2.57

- While the groups are working, you might want to 'gather data' to create a few coin word problems using your students' names and some of the coins on their desks. Just choose 2 or 3 types of coins. For example, if Melissa has 8 nickels and 6 dimes (ignoring the rest of her coins), you could write on the board:

Melissa has nickels and dimes worth a total of \$1.00. The number of nickels is two more than the number of dimes. How many nickels and how many dimes does Melissa have?

If you do this, try to cover all the different types of coins with your problems. You might build up the complexity of the problems by starting with two types of coins that you relate to each other using 'more than', then 'less than', then 'twice as many', and finally using three or more types of coins.

- You may wish to have a few groups write on the board the methods and the calculations they used to find the total value of their coins. If a group used another method instead of sorting by type of coin, (for example, some students sort coins into piles that add up to \$1) have them explain their method, and then ask the class to find the total value by the 'number x value' method.
- This can be a good time to introduce a chart, such as the one shown below, to help students organize all the information. The chart will be especially helpful when doing coin word problems, and can easily be adapted for other mixture problems.

Type of coin	Number	Value	Total value

Students can get more practice finding the value of a handful of coins by choosing 'Count' in the NCTM Illuminations Coin Box activity. In this activity, several coins appear scattered around the workspace. Students can group like coins by dragging them together. There is even an option to display the value of each coin; this might be especially helpful for students who are not completely familiar with U.S. coins. Finally, students enter the total value of the coins and click to check their answer. This website for this interactive activity is <http://illuminations.nctm.org/ActivityDetail.aspx?id=217>.

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### **Coin Lab**

**Name** \_\_\_\_\_

Team

Members: \_\_\_\_\_

- 1) How much 'money' is in your bag?
- 2) Describe, in words, **the method** you used to determine how much 'money' is in your bag. List everything you did, step-by-step, so that someone not in your group could follow your directions.
- 3) Show the **calculations** you used to determine the total value of the money in your bag.

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## Coin Lab - Practice

Name \_\_\_\_\_

Fill in the charts to calculate the total value of each set of coins.

1)

Type of coin	Number	Value (\$)	Total value (\$)
Quarters	3	0.25	
Nickels	4	0.05	
The total value of all the coins goes here.			\$0.95

2)

Type of coin	Number	Value (\$)	Total value (\$)
Dimes	5	0.10	
Pennies	1	0.01	

3)

Type of coin	Number	Value (\$)	Total value (\$)
Dimes	8		
Nickels	11		

4)

Type of coin	Number	Value (\$)	Total value (\$)
Quarters	6		
Pennies	9		

5)

Type of coin	Number	Value (\$)	Total value (\$)
Pennies	7		
Quarters	9		
Dimes	4		

6)

Type of coin	Number	Value (\$)	Total value (\$)
Nickels	15		
Pennies	3		
Dimes	8		

7)

Type of coin	Number	Value (\$)	Total value (\$)
Pennies	19		
Quarters	13		
Nickels	22		

8)

Type of coin	Number	Value (\$)	Total value (\$)
Dimes	12		
Nickels	19		
Quarters	16		

9)

Type of coin	Number	Value (\$)	Total value (\$)
Pennies	24		
Nickels	17		
Dimes	31		
Quarters	15		

10)

Type of coin	Number	Value (\$)	Total value (\$)
Pennies	29		
Nickels	14		
Dimes	23		
Quarters	35		

For more practice finding the value of a 'handful' of coins go to the website <http://illuminations.nctm.org/ActivityDetail.aspx?id=217> and choose 'Count'. If you are not completely familiar with U.S. coins, you may find it helpful to have the program display the value of each coin next to its picture.