Place Value vs Face Value

Recognizing "200" and putting "2" in its place!

This important unit was created by Math Maniac, Rachel McAnallen. The lesson serves as the foundation for a series of articles on the operations including this issue's "Algebraic Addition."

Topics Involved: Recognizing the difference between a number and digit, calling numbers by their correct place value names.

Materials: Enlarged copies of $100, $50, $20, $10, $5, $2, and $1 bills (just the face of the bill). Make 3 or 4 copies of each denomination—enough for each student to have just a single bill. We recommend using an overhead projector with a stack of clank transparencies. Students should have pencil and paper for taking notes

Type of Activity: Group

Relation to NCTM Standards: understanding numbers, ways of representing numbers.

Place Value Pre Test

To begin "Place Value vs. Face Value" Rachel gives each student a single bill from Ms. Math's stack of bright green "money" in one of the following denominations: $100, $50, $20, $10, $5, $2, or $1. She informs the class that she is going to give them a pre test so she will know which lesson she needs to teach them. "In the hundreds of classes I've done this in, I've never had a group of students pass the pre test," she warns with a smile.

"If you have a hundred dollar bill, raise it up in the air," Rachel directs. She asks the holders of each denomination, from $100 to $1 to raise their bills in turn. With this quick monetary roll call, anyone observing the class can see that there are only three or four of each type of bill in the classroom.

On the overhead projector, Rachel writes down all the three-digit combinations possible among the bills at hand. "I'm going to go through and point to different numbers," she explains to the class. "If you are holding the bill that the number I'm point to represents, raise it in the air."

"I use the word number, not digit," stresses Rachel. "They are not holding digits in their hands, they are holding says Rachel. "But the one that always gets them is 111. For the most part,

symbolic of a specific value. They are holding $2 bill, not a 2."

Silently, Rachel points to the one hundred in 152 (Fig. 3.1). Several bills go up in the air.

"Only the $100 bills should go up in the air," Rachel notes, "but $100 bills will go up in the air and $1 bills will go up in the air. I never say a word," she emphasizes. "I do not make any sounds or indicate that I see mistakes, because this is a pretest."

As she continues to point to various numbers on the overhead projector, there are often more bills in the air than there should be.

"If I point to the 50 in 152, $50 bills go into the air, $5 bills go up, and so on," says Rachel. But the one that always gets them is 111. For the most part, every student that has a $1 bill will hold it up for all three numbers".

Fig. 3.1

Q: *What amount does this number represent?*

A: *One hundred dollars.*

$$\$100+50+2$$
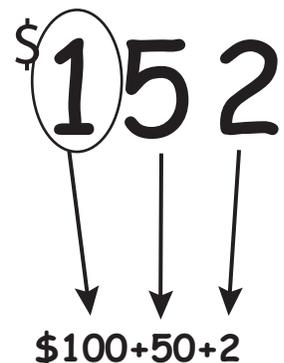
"Put your bills at the top of your desk," instructs Rachel. "I have to tell you, loads of you failed the pretest, so now we have to have a lesson." Students ask who among them has failed, but Ms. Math remains firm. "I'm not telling. But as we do this lesson you will begin to understand," she hints.

Numbers are Adjectives

During this lesson, students are expected to take notes. "I have discovered that 4th, 5th, and 6th graders don't know how to take notes in math," says Rachel. "So I have them get out a pen and paper and I model what they are to write using the overhead projector."

Place Value   vs   Face Value

(Number)   (Digit)

"When used in mathematics, numbers are adjectives, not nouns."

At the top of their paper, she has them write: It is important that students are able to distinguish these parts of speech. Rachel asks the class to give definitions for both noun and adjective, and then give examples of each. Although she has already told them that numbers are adjectives, it is rare that a student will suggest a number as one of their examples.

Rachel plays a game with one student to illustrate the point. "I have forty-seven," she says mysteriously. "Forty-seven what?" asks the student. "Forty-seven red." "Forty-seven red what?" "Forty-seven red, shiny." "Forty-seven red shiny WHAT?" "Forty-seven red, shiny convertibles."

"I want them to understand that forty-seven is describing a noun," she says. "Forty-seven is the adjective in my sentence. The meaning of that number depends upon the noun I choose to use."

She has them practice this idea. "Tell me something that you have a number of, and describe it with a number and two other adjectives."

"I have two lovable furry cats." "I have 50 exciting mystery books." "I have one bossy older sister."

"They are getting the idea," says Rachel. "They are talking to me. They are speaking the language of mathematics."

She tells the class, "During this lesson we are going to work with one of my favorite nouns: dollars. From now on, when we write a number down, we will put a dollar sign in front of it."

Rachel stresses the importance of using the dollar sign to put the numbers in context. "One hundred twenty-three means nothing. But one hundred twenty-three *dollars* is something that students might like to have."

Writing Numbers in Different Forms

Rachel writes out the following:

"This is a number in written form," she explains.

One hundred twenty-three dollars

Next she writes:

She draws arrows from the written word that corresponds to each number. "This is the same number stretched out," she says.
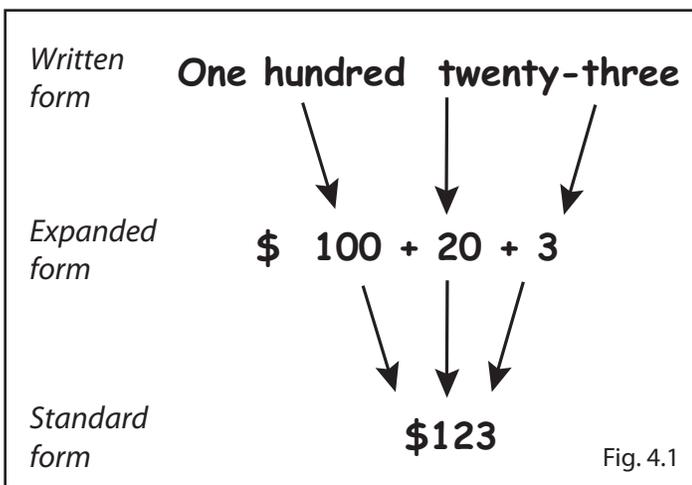
$100 + 20 + 3

Finally she writes:

"This is the number in normal form,"

$123

She tells students, as she draws arrows from the expanded form above to the corresponding numbers below. (See Fig. 4.1)

Rachel produces a rubber band from her pocket and holds it up for the class to see. "This is the rubber band in its normal form," she tells them. She then stretches the band between her fingers. "This is the rubber band stretched out," she says. "Mathematicians don't call numbers normal and stretched out—when we write $123, we call that standard form. When we stretch it out, we call that expanded notation. When we spell it out, that is the written or word form."

Written form	**One hundred twenty-three**
Expanded form	**$ 100 + 20 + 3**
Standard form	**$123**

Fig. 4.1

Rachel asks a student for a three-digit number, which she then has the class write in expanded and standard form:

She does this with five or six three-digit numbers taken from students, but cautions, "If a kid gives me a number in the teens, I have them add twenty or thirty to it because I don't want to put the teens in there yet."

Descending Order

"Think about how the person who suggested $489 said that number," Rachel urges the class. "Four hundred

$400 + 80 + 9 (E.F.)

$489   (S.F.)

eighty-nine dollars. Why did they say four hundred first, then eighty, then nine?" she asks. "Why didn't they say four hundred nine eighty? Or nine eighty four hundred? All of you said the largest number first. Why?"

"Because that's the way we do it," reasons one student.

Rachel expands on this explanation. "In the world of place value we say things in descending order. Descending order means we start high and end low." She writes this definition on the overhead.

"Can you tell me a number that is not spoken in descending order?" Rachel asks.

The class cannot think of an example.

Rachel writes 17 on the transparency. "Say that number," she tells them with a smile.

"Seventeen."

"Look what came out of your mouth first!" she exclaims. "Seven*teen*! *Teen* means ten. Seventeen means seven plus ten. So that number is not said in descending order, it is said in ascending order. It starts low and ends high."
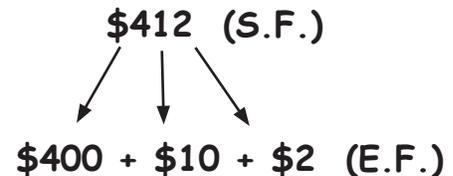
The class lists all of the English numbers that are not said in descending order: nineteen, eighteen, seventeen, sixteen, fifteen, fourteen, and thirteen.

"And eleven and twelve don't even make sense!" observes Rachel. She notes that students often have difficulty when they attempt to write out these numbers in expanded form. For example, instead of expanding eleven into 10 + 1, they will write 1 + 1.

A fun way to demystify these numbers is to teach students how to say them in descending order. "Let's say seventeen in descending order," says Rachel. "Ten plus seven...Ten seven! Or, if twenty plus seven is twenty-seven, we could say ten plus seven is tenny-seven." Tenny is the popular choice and the class counts. "Tenny-one, tenny-two, tenny-three, tenny-four, tenny-five, tenny-six, tenny-seven, tenny-eight, tenny-nine."

Rachel writes:

"What does this number say?" she asks.

$412 (S.F.)

$400 + $10 + $2 (E.F.)

"Four hundred tenny-two," is the enthusiastic reply. "Kids just love using tenny," says Rachel. "It makes sense to them."

Position Power
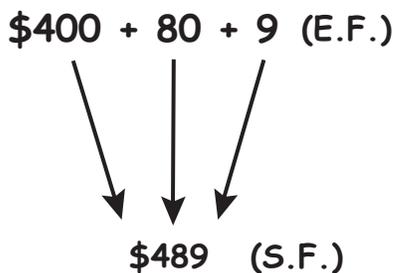
"Place Value is position power," Rachel writes.** "Let's think about the word 'position' in terms of power," she tells the class. "When I say position, I don't mean vertical position or horizontal

9

position. I mean a position like a job. For instance, we could look at the different positions in the school: teacher, principal, custodian, student."

"Who is the person in your school who has the most power?" she asks them.

"The principal," someone volunteers.

"Name another person with power in the school," says Rachel.

"The teacher," suggests another student.

"Okay, now name someone with no power."

"US!" the class replies in unison.

"Absolutely right!" laughs Rachel.

Using chairs is a fun way to illustrate position power within the school, especially if you can get your principal to cooperate. "The chairs we sit on denote power," Rachel tells the students. "Look at the chairs you are sitting in—cheap plastic chairs. You have no power, so you get the chap chairs!" she teases. She walks over to the teacher's chair and pulls it out so everyone can see it. "Wow, look at this chair!" She sits and demonstrates the features of the chair. "It's got rollers on it, and it swivels! It's got a cushion! The teachers have more power, so we get a better chair!"

Rachel's next question, "Who has been in the principal's office?" gets a laugh from the class. Fortunately, no one has to confess, since Rachel has arranged for the principal to roll her chair down to the classroom. In addition to having cushions and rollers, the principal's chair has arms, and a high back that

tilts. "You see?" says Rachel. "The more position power you have the better the chair you have!"

Place Value Party

By using examples like the chairs, students begin to get a clear idea of what position power is. Now Rachel ties the concept back around to her original statement. "Place value is position power," she repeats. "The word place means position. The word value means power."

"There is a party going on," she tells the class. "And there are four chairs in the room where the party is being held—the $1000 chair, the $100 chair, the $10 chair and the $1 chair (Figure 5.1). Only four partygoers are allowed into this particular party. Outside the door in a line are all the digits, zero through nine. The door opens and digit 2 runs in and says, 'Which chair should I take?'"

"The $1000 chair," the class responds.

"Okay, the digit 2 takes the big chair," says Rachel, writing 2 under the $1000 chair. "Now the digit 5 takes the $100 chair." She writes 5 under the $100 chair. "Then 7 comes in and sits in the $10 chair, and then last of all comes poor 9 and sits in the $1 chair." (See Fig. 5.1)

Rachel is very deliberate with numbers in her examples. "I put the smallest digit in the greatest place value position and the largest digit in the lowest place value position," she explains. "I want them to see that."

"Which place has the most value? Which position has the most power?" she asks

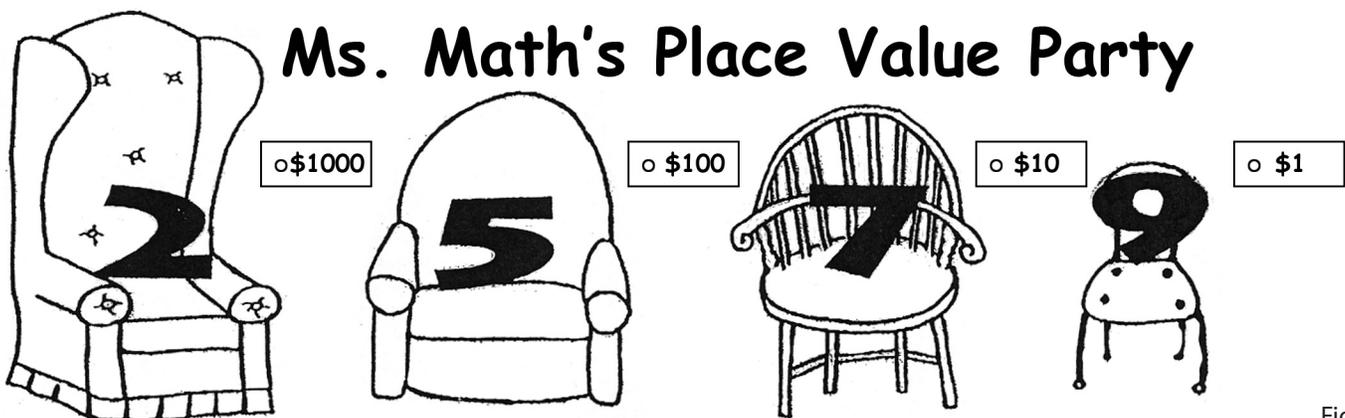# Ms. Math's Place Value Party

o$1000 o $100 o $10 o $1

Fig. 6.1

the class. "What does this number say?"

"Two thousand five hundred seventy-nine dollars," answers a student.

This is a light bulb moment for many of the learners in the class. When Rachel asks, "How many of you realize you may have made a mistake on the pretest?" Several of the student raise their hands.

Number versus Digit

Returning to the $2579 on the overhead, Rachel points to the 2000. "When you were in kindergarten and you didn't know about place value, you thought this was a plain old what?" she asks.

"Two," the students reply.

"That's right," says Rachel. "You now know that it is a what?" "Two thousand," they chime. "And you thought this was a what?" she asks, pointing to the 500. "Five." "And you thought this was what?" she continues pointing to the 70. "Seven." You were looking at face value," explains Rachel. "Face value is when you only look at someone's face. When I walked into the classroom, you just looked at my face, so all I had to you was face value."

Rachel encourages students to ask questions that might increase or decrease her value to them. They discover she lives in two different places and spends much of her time traveling. "Do you have animals?" one student asks her. "I have 53 cats," jokes Rachel. Judging from students' reactions, this information has quickly lowered her value! "Where have you traveled?" another student asks. "I've been all over the United States," says Rachel. "I have taught in South Africa and the Virgin Islands several times. When I was younger, I traveled to London and Paris and went skiing in Austria." The class agrees that this information increases Rachel's value. "Now you can see that I have place value because I've been to places," she quips.

After her interview, Rachel moves back to the overhead projector. "Now, let's look at the value of 123. She writes:

Number

123

100 + 20 + 3

"This is the number 100, this is the number 20, and this is the number 3," she says, pointing to each number respectively. "When you add these numbers together, you get a total of one hundred twenty three. That is place value."

Next she writes:

Digit

123

1 + 2 + 3 = 6

"This is the digit 1, the digit 2, and the digit 3," she says as she points to each digit. "When you add the digits 1 + 2 + 3 together, you get a total of 6. That is face value."

Rachel gives students the opportunity to ask her questions if anyone is unsure about the lesson. She then writes a few four-digit numbers on the overhead. She advises that any time teachers add a number, they also write the place value above the digit with a dollar sign:

$1000 $100 $10 $1

2 5 7 9

"I'm going to point and ask you to give me the number or the digit," Rachel explains. For example, when she points to the 5 in 2579 and asks "Digit?" The students reply "Five." If she asks "Number?" The students reply, "Five hundred."

3792

Rachel: "Digit?"—Students: "Nine."

Rachel: "Number?"—Students: "Ninety."

2579

Rachel:"Digit?"—Students: "Two."

Rachel: "Number?"—Students:"Two thousand."

6666

Rachel: "Digit?"—Students: "Six."

6666

Rachel: "Digit?"—Students: "Six."

6666

Rachel: "Number?"—Students: "Six thousand."

6666

Rachel: "Number?"—Students: "Six hundred."

3792

Rachel: "Number?"—Students: "Two."

Rachel: "Digit?"—Students: "Two."

"They have to think," says Rachel. "Sometimes I will have a contest between teachers and students. Next to one-to-one correspondence, this is the most important thing for students to understand."

Post-Test

For the post-test, Rachel returns to the original numbers she used in the pretest. "Take your bill and raise it in the air if it represents the number I point to," she reminds them. Now when she points to a 100, only the three $100 bills are in the air.

Before she closes the lesson, Rachel asks students and teachers for a final promise. "Raise your hand and repeat after me," she tells them. "I promise to always call numbers by their correct place value names. I will never disrespect a one hundred by calling it a puny little one—I will have the same respect for numbers that I have for the 26 letters of the alphabet."