
FEATURE

The concept of zero: How to teach *nothing*

Your preschool class can count from one to nine, and they can match one object to a card printed with the numeral 1, two objects to the numeral 2, and so on. But what about zero? Do they recognize the numeral and what it means?

If some of your 4- and 5-year-olds don't understand the concept of zero right away, don't despair. It took centuries for mathematicians to invent it.

Teacher information

Several early civilizations developed counting systems to use in measurement and trade. The number system we use today originated in what is now the Middle East. The ancient Sumerians invented a counting system, but without a zero, 4,000 to 5,000 years ago (Szalay 2013). The Babylonians adopted the system around 300 A.D. and added a wedge symbol as a placeholder to differentiate numbers such as 10 and 100. The Mayans in America, on their own, came up with a placeholder in 350 A.D. for use in their calendar.

Zero as an abstract concept (the notion of *nothing*) first appeared around 458 A.D. in India where mathematicians represented it with a word such as *void* or *space*. Decades later, mathematicians

came up with a symbol for zero, first as a dot (used by a Hindu mathematician) and then a circle (used by a Persian mathematician).

This Hindu-Arabic system gradually replaced Roman numerals, which had no zero, in much of Europe beginning with the fall of the Roman Empire in 300 A.D. Italian mathematician Leonardo Fibonacci helped show the system's superiority over the abacus with the publication of his land-

mark book, *Liber Abaci*, in 1202 (Knott 2013). By the 1600s, the system and the zero had spread widely throughout Europe.

So the zero, both as a concept and as a numeric symbol, was a long time in coming.

Learning activities

Use the activities below with children who have learned the numbers 1-9. That is, they can count objects (not just say the numbers



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by rote) and identify the numerals out of order. Children who cannot will need individual coaching with activities to help them learn 1-9.

Children generally learn the symbol for zero before they learn that the symbol represents a mathematical concept.

Find the zero

Use this activity to introduce the symbol for zero.

Here's what you need:

- card displaying a zero
- other visuals with the symbol such as a computer keyboard and cell phone

1. Show children in a small group the card and use the word *zero*.
2. Point out the symbol on a computer keyboard and cell phone.
3. Invite children to go around the

classroom looking for the symbol. They may find it on a play phone in the home center and on a ruler or scale in the science center, for example. Some children may find the alphabet letter *O*.

4. Explain that zero is used in talking about numbers and that the letter is used in words. Note that the zero is usually more of an oval shape.

Goose egg

Offer this activity indoors at the sensory table or outdoors in the sandbox.

Here's what you need:

- pictures or cards displaying a zero and the alphabet letter *O*
- sensory materials such as play dough, wet sand, and mud

1. Invite children to use the materials to shape or write a zero and the letter. Note the difference between a zero, sometimes called a *goose egg*, and the letter *O* in the alphabet.

2. Children using play dough can make a rope or snake and pinch the ends together for the numeral and letter. Others may draw the numeral and letter with their finger in a flat bed of wet sand or mud. Or they may shape the numeral and letter on a sheet of plastic or vinyl.

Goose egg as art

Set up this activity in the art center to provide more practice in distinguishing between the numeral zero and the letter *O*.

Here's what you need:

- typing or construction paper
- markers or crayons
- glitter
- glue
- paper scraps such as gift wrapping paper
- old magazines or catalogs
- pictures or cards displaying a zero and the alphabet letter *O*

1. Place the picture cards in the art center. Invite children to use the materials to draw or write a zero and the alphabet letter.
2. Encourage children to decorate their drawings with glitter, paper scraps, or pictures torn from magazines.

Zero hop

A movement activity offers an opportunity for kinesthetic learning.

Here's what you need:

- 10 4x6 index cards
- marker

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1. On a card, write a numeral, such as 1 and the corresponding word, *one*. In the center, draw one circle.
2. Continue with the numbers 2 through 9, drawing the appropriate number of circles on each.
3. On the last card, write the numeral 0 and the word *zero*. Leave the space in the center blank. Set this card aside.
4. Review the cards in sequence with the children. Invite them to hop the appropriate number of times for each numeral.
5. Shuffle the cards 1-9. Hold up one card. Invite children as a group to hop the number of times shown by the circles and count aloud as they go.
6. After going through the nine cards, hold up the zero card. Ask: "How many times do we hop for this number?" Expect answers such as "None," "No times," or "Zero."

Variation: Instead of hopping, have children clap their hands.

Five Little Monkeys

Add a verse to this popular finger play, and use it in transitions between activities.

- Five little monkeys (Hold up five fingers.)
 Jumping on the bed. (Jump up and down.)
 One fell off and bumped his head. (Fold in the thumb and tap the head.)
 Mama called the doctor, and the doctor said, (Put thumb and pinky to ear like a telephone.)
 "No more monkeys jumping on the bed." (Wag the index finger.)

- Four little monkeys (Hold up four fingers.)

Jumping on the bed. (Jump up and down.)

One fell off and bumped his head. (Fold in the pinky and tap the head.)

Mama called the doctor, and the doctor said, (Put thumb and pinky to ear like a telephone.)

"No more monkeys jumping on the bed." (Wag the index finger.)

Three little monkeys (Hold up three fingers.)

Jumping on the bed. (Jump up and down.)

One fell off and bumped his head. (Fold in the ring finger and tap the head.)

Mama called the doctor, and the doctor said, (Put thumb and pinky to ear like a telephone.)

"No more monkeys jumping on the bed." (Wag the index finger.)

Two little monkeys (Hold up two fingers.)

Jumping on the bed. (Jump up and down.)

One fell off and bumped his head. (Fold in the middle finger and tap the head.)

Mama called the doctor, and the doctor said, (Put thumb and pinky to ear like a telephone.)

"No more monkeys jumping on the bed." (Wag the index finger.)

One little monkey (Hold up the index finger.)

Jumping on the bed. (Jump up and down.)

She fell off and bumped her head. (Fold fingers into a fist and tap the head.)

Mama called the doctor, and the doctor said, (Put thumb and pinky to ear like a telephone.)

"No more monkeys jumping on the



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bed.” (Wag the index finger.)

No little monkeys (Hold up closed fist.)

Jumping on the bed. (Shake the head.)

None were there to bump their heads.

Mama called the doctor, and then she said, (Put thumb and pinky to ear like a telephone.)

“No little monkeys jumping off the bed.”

How much is zero?

Set up this activity in the math or manipulatives center to help children learn the concept of zero as *nothing*.

Here’s what you need:

- 2 baskets or bowls
- 5 or 6 apples or other objects

1. Place two or three apples in each basket.
2. Talk with children about the quantity of apples in each basket: “How many apples are in this basket?” Count them one by one.
3. Take one or two apples out of one basket and put them in the other. Ask again how many apples are in each basket and count them.
4. Place all the apples in one basket, and leave the other empty. Have children count the apples in the full basket.
5. Compare the number of apples in the two baskets. Use words such as *empty* (Spanish *vacío*) and *nothing* (Spanish *nada*). Say, “Another name for *nothing* is *zero*, and in Spanish *cero*. We have five (*cinco*) apples in one basket, and zero apples in the other basket.”

6. Ask children if they know of other times when *nothing* is called *zero*. A final score in a soccer game, for example, might be five to zero. Sports announcers, known for colorful language, may say a score was “five to nothing,” “five to zip,” or “five to zilch.”

Zero in measurement

Extend the notion of *nothing* to weights and measures in the science center.

Here’s what you need:

- ruler, yardstick, or tape measure
- rain gauge
- food scale
- apple or other fruit

1. Invite children to measure something in the classroom, such as the edge of a table, a

pencil, or a piece of paper. On the ruler, show the left-hand side with the first inch, and explain that the edge or starting point is zero (which may or may not be marked).

2. Invite children to examine the rain gauge. Pour in a little water, and ask how much rain the amount would represent. Pour out the water and ask what the zero means.
3. Invite children to weigh an apple on the food scale and read the weight, such as 4 ounces. Ask “What is the weight if we take off the apple?” Expect answers such as “Nothing” and “No ounces.” Point out the starting point and use the word *zero*.

Extended activity: Encourage parents to help their children identify zero as measuring *nothing*



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around the home. Examples might include the car speedometer and a bathroom scale.

Apples on the bulletin board

Encourage children to do this activity when they arrive in the morning, during free play, or while waiting for parents to pick them up at the end of the day.

Here's what you need:

- red, green, and brown construction paper
- scissors
- glue
- thumb tacks
- labels or cards 3x2.5 inches (old business cards with one side blank)
- marker
- hole punch
- yarn
- basket or envelope

1. Cut out 10 apple trees using the green and brown construction paper.
2. Cut 45 circles out of red construction paper to represent apples. Glue nine apples on one tree, eight on another, and so on, leaving one tree with no apples.
3. Tack the trees to the bulletin board in any order within the children's reach.
4. Write the numerals 0-9 on the labels, one on each label. Punch two holes at the top, thread them with yarn, and knot the ends to make a loop. Place them in a basket or envelope at the side.
5. Invite children to hang the labels on the appropriate trees. When finished, they return the labels to the basket.

References

- Szalay, Jessie. June 28, 2013. Who Invented Zero? LiveScience.com, www.livescience.com/27853-who-invented-zero.html
- Knott, R. and the Plus team. Nov. 4, 2013. The Life and Numbers of Fibonacci, *Plus Magazine*, <https://plus.maths.org/content/life-and-numbers-fibonacci> ■