

Multiplicative Thinking K-3



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September 25, 2015

What is Multiplicative Thinking?

- A capacity to work flexibly and efficiently with the concepts, strategies, and representations for multiplication.
- As students develop multiplicative thinking, focus should be on
 - groups of equal size
 - the number of groups, and
 - the total amount.
- Multiplicative thinking leads to an understanding of fractions, decimals, percents, ratio, and algebra.

Different Ways to Count

More and more, we saw students counting sets without understanding that ones, twos, fives, and tens represent groups.



Red Flags at STRIDES

- Student brought to STRIDES team because she couldn't recognize and name numbers to 10.
- Couldn't count a set up to 10.
- Couldn't tell more or less within 10.
- Parent commented that student successfully counts to 100 by fives and tens everyday.
- Prompted case study in kindergarten.

Kindergarten SOL K.4

The student will...

- a) count forward to 100 and backward from 10;**
- b) identify one more than a number and one less than a number; and**
- c) count by fives and tens to 100.**

Understanding the Standard

- The patterns developed as a result of skip counting are precursors for recognizing numeric patterns, functional relationships, and concepts underlying money, time telling, and multiplication. Powerful models for developing these concepts include, but are not limited to, counters, hundred chart, and calculators.

Understanding the Standard continued...

- Skip counting by fives lays the foundation for reading a clock effectively and telling time to the nearest five minutes, counting money, and developing the multiplication facts for five.
- Skip counting by tens is a precursor for use of place value, addition, counting money, and multiplying by multiples of 10.

3rd Grade Needs Assessment

- Solve practical problems that apply knowledge of multiplication.
- Tell time to the nearest minute.
- Make change.
- Elapsed time.
- Read a thermometer.
- Solve a problem using a pictograph.
- Analyze and interpret information on a graph.

Remarks by President Clinton on the Education Standards 1997

“In no other country in the world did performance in math drop from above average in 4th grade to below average in 8th grade... We are doing a very good job in the early grades, but we’ve got a lot more work to do in the later ones.”

Remarks by President Clinton on Education Standards, The White House,
June 10, 1997

Pause to Ponder...

Where does the
mathematical decline
really begin?



The Value of Experience

While the everyday experience of most 5 year-olds supports intuitive ideas of getting/having more (addition), losing/having something less (subtraction), fair shares/sharing (division), and doubling, it generally does not support a notion of counting in equal groups or repeated addition. (Siemon, Breed, Virgona)

Clark and Kamii, 1996

- Research has shown that multiplicative thinking develops slowly in children, over long periods of time.
- Students need practice with tasks that help develop multiplicative thinking.

Count Collections

- Choose a bag from the center of the table
- Count your items
- Represent your count on your recording sheet

Counting Collections

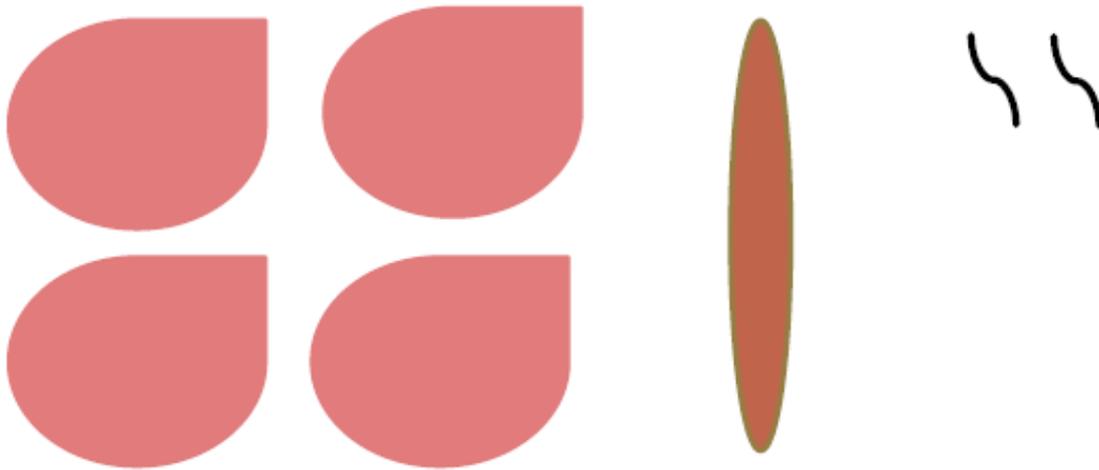
- <https://www.teachingchannel.org/videos/skip-counting-with-kindergarteners>

Talk at Your Table

- How might this type of activity develop multiplicative thinking in 5, 6, and 7 year olds?
- In what grade levels would this activity be useful?
- How might you change the activity?
- What mathematical concepts does this type of activity support?

Butterfly House

Some children visited the butterfly house at the zoo. They learned that a butterfly is made up of 4 wings, 1 body and 2 feelers.



Butterfly House

How many complete butterflies can be made with:

29 wings

8 bodies

13 feelers

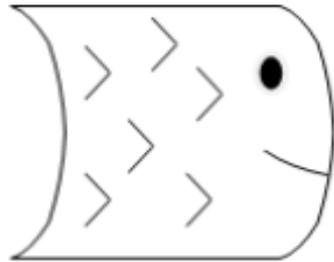
Consider your mental math while you attempt to solve this problem....where is your multiplicative thinking?

Butterfly House

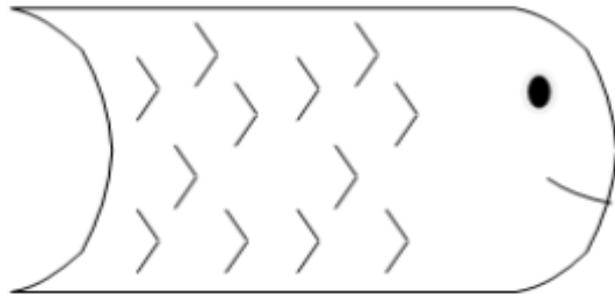
- What type of thinking or skills do you need in order to solve problems like this efficiently?
- Where is the multiplicative thinking?
- Where does the thinking fall apart for students who haven't transitioned to multiplicative thinking?

(Siemon)

Feeding Fish



Fish A



Fish B



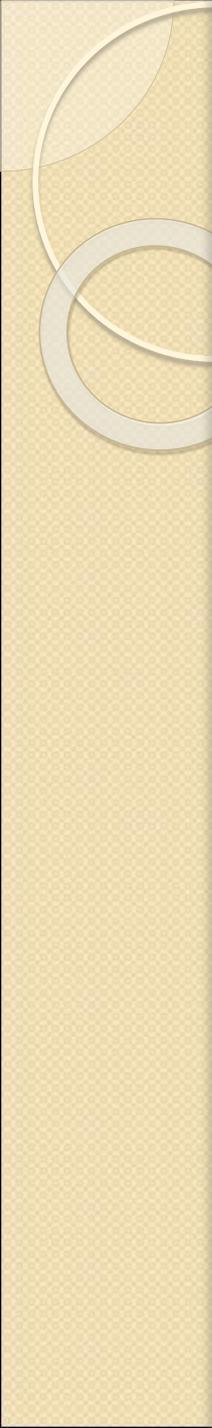
Fish C

Folding Paper

If you fold an $8 \frac{1}{2} \times 11$ sheet of paper in half 6 times, how many sections would you create?

Adventure Camp Problem

- Work together at your table to solve



Questions and Comments

References

- *From Additive to Multiplicative Thinking—The Big Challenge of the Middle Years*
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- *The Power of Paper-Folding Tasks: Supporting Multiplicative Thinking and Rich Mathematical Discussion*
Erin E. Turner, Debra L. Junk, Susan B. Empson
- *Educating Teachers to Teach Multiplicative Structures in the Middle Grades*
Judith Sowder, Barbara Armstrong, Susan Lamon, Martin Simon, Larry Sowder, Alba Thompson
- *Identification of Multiplicative Thinking in Children in Grades 1-5*
Faye B. Clark, Constance Kamii