

# Building Multiplication Fact Fluency (without timed tests)

The struggle is real! We want our students to accurately and automatically recall multiplication facts so that they can more efficiently solve more complex problems. Consequently, we turn to what we all have come to know as “timed tests” - giving and testing students on a list of assigned facts each week. One week students work on their “2 facts”, once they master these they work on “3 facts”, and so on until they reach their 10 facts. However, we are doing a disservice to many of our students by administering these weekly timed tests. Here are three reasons why timed tests are not effective for all students.

1. **Timed tests emphasize speed as being the one quality that makes a good mathematician.** *Students do not feel like successful mathematicians if they are not able to complete a certain number of facts correctly in a given time. Even though they may have brilliant strategies for multiplication computation, these strategies become devalued and often abandoned through the use of timed tests.*
2. **Timed tests focus on rote memorization.** *Since students are timed, they often focus on memorizing the fact, rather than learning a strategy for solving multiple facts. This can be very difficult for students with little working memory. Students often remember a set of facts in order to pass the test, but do not recall the memorized facts for longer periods of time - including the next grade level.*
3. **Timed tests build frustration within the student.** *Since students are not focused on learning strategies, they don't learn or seek new strategies. They continue to try to memorize facts. If they repeatedly are unable to master their assigned list of facts, they become frustrated with mathematics and feel like they are not good at math. These tests often cause math anxiety and negatively impact students' learning.*

If we continue to use timed tests as our only means of assessing fact fluency, we will continue to get the same results. Some students will memorize the

facts and *many* others will not. As we know from numerous research studies, most students need strategies to learn to decode words as they read. This is also true when learning math facts. Students need specific strategies for learning their multiplication facts.



## What is Fact Fluency?

As we think about fact fluency, we want to consider three important components:

1. Understanding
2. Accuracy
3. Efficiency

Note that understanding is the first component listed. This is a shift from our previous thinking in which accuracy and efficiency were our foci (hence our assessment with timed tests). It is now of utmost importance for students to understand why they arrive at the product they do.

## Order of Facts

Often students are introduced to facts in a numerical sequence 1-10. However, try introducing facts in an order based on children's current strengths and what they have previously been taught. Students have already worked with the base ten system (counting by multiples of 10) as well as doubling. Therefore, foundational facts for students to begin with include twos and tens. Other foundational facts include fives, ones, and zeroes. It is critical that students understand these foundational facts. They are essential for developing and learning the remainder of the multiplication facts. Once students have learned these facts, they've learned 85 of the 121 multiplication combinations. This sequence is recommended: twos, tens, fives, ones, zeroes, threes, fours, sixes, nines, sevens.

X	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

The task of learning multiplication facts seems daunting and often impossible for students. They believe they must learn 121 facts. But in reality, once students have learned  $6 \times 8$ , they have also learned  $8 \times 6$  based on the commutative property. It is important to provide opportunities for students to explore the commutative property and equivalent facts. Once students come to this understanding, the task does not seem quite so daunting.

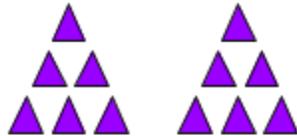
### Strategies for Teaching Multiplication Facts

There are multiple strategies and resources for teaching students their multiplication facts. For students to truly understand the process, they will need an instructional approach to move them from concrete to pictorial to abstract thinking. Students will need to be observed and assessed to see which place is the best to begin. See the following examples:

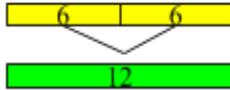
**x 2**

Students are familiar with the concept of doubling. So if students are presented with the fact  $6 \times 2$ :

*Concretely*, students may make and count two groups of six.



*Pictorially*, students may combine two groups of six.



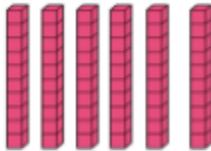
*Abstractly*, students may think:  
 $6 + 6 = 12$ , so  $6 \times 2 = 12$

There are also several strategies that students might use to find products for multiplication facts. Here are some you may want to highlight for students, but take note - students are very adept at developing their own strategies!

**x 10**

Students are familiar with skip counting by 10. So if students are presented with the fact  $6 \times 10$ :

- Concretely*, students may track on their fingers or skip count by tens using tens rods.



- Students may write the numbers as they count six groups of ten:  
**10, 20, 30, 40, 50, 60**
- Students may reason using place value. They know that  $6 \times 1 = 6$ , so 6 groups of ten equals 6 tens or 60.

**x 5**

*Doubling and Halving*

Students know that five is half of ten. So they may multiply by ten and then divide the answer in half.

$6 \times 10 = 60 \rightarrow 60/2 = 30$   
 so  $6 \times 5 = 30$  because 30 is half of 60

Students may skip count by fives:  
 5, 10, 15, 20, 25, 30

**x 4**

*Double, Double*

Students can double the number, then double that number again.

$4 \times 6 = (6 + 6) + (6 + 6)$   
 $6 + 6 = 12$ , doubling 12 equals 24

**x 8**

*Double, Double, Double*

$8 \times 6 = (6 + 6) + (6 + 6) + (6 + 6) + (6 + 6)$   
 $6 + 6 = 12$ , doubling 12 equals 24,  
 doubling 24 equals 48

## Implementing Instruction to Help Students Become Fluent Mathematicians

You may be asking yourself, “So if I don’t use timed tests, how do I know where my students are? How can I assess fact fluency?” You may use anecdotal notes or have individual conferences to observe what facts students are mastering and which strategies they are using. Observe students as they are solving math tasks or playing computation games and record notes on a checklist or observation form. Your notes will show you not only what facts students know, but also the areas where you should instruct them. You may give students an assessment, but be sure your assessments are short and not timed. Focus on a particular strategy and carefully select the problems for the assessment. Have students circle the facts they “just knew”, explain the strategy or “helper fact” they used for the others, and place a box around the facts they are not sure about. This provides you with helpful information about student needs.

Once you have determined where students are in relation to their fact knowledge, you will have a better idea for how to instruct them. You can include math fact instruction by incorporating daily number talks. In these math talks you can design expressions for students to solve and discuss with a specific strategy in mind. You may also want to differentiate the math fact instruction in small groups and with individual students. All students do not need instruction with ALL of the multiplication facts! Another way to give students opportunities to practice their multiplication fact strategies is to give them fluency games. There are several fluency practice games found in the resources below.

In summary, providing students with an array of strategies will help them become more fluent with their multiplication facts - helping them gain a deeper and longer lasting understanding of multiplication.

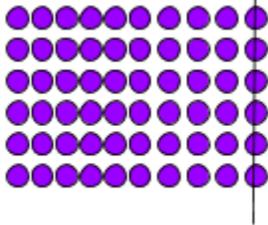
x 9

### *Compensation*

Students find easy numbers to multiply and then compensate to find the correct product. If given the fact  $6 \times 9$ , students may think:

“I know that  $6 \times 10 = 60$ . This is one group of 6 more than  $6 \times 9$ , so I have to subtract one group of 6.  $60 - 6 = 54$ .”

Pictorially, this may look like:



x 7

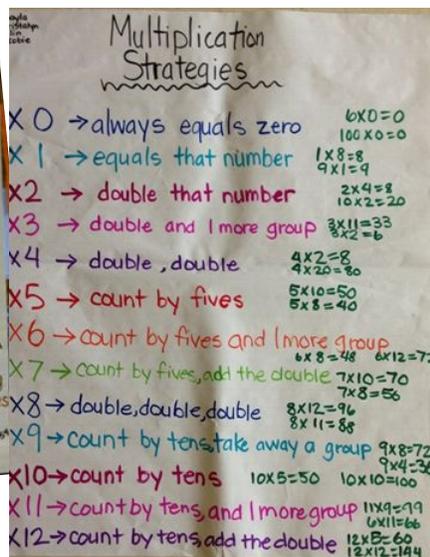
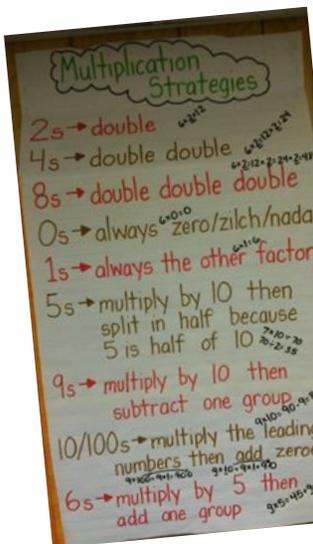
### *Decomposing a Factor*

Students often decompose to find “easy numbers to multiply.” So if students are given the fact  $8 \times 7$ , student may use the distributive property:

$$7 = 5 + 2, \text{ so } 8 \times 7 = 8 \times (5 + 2)$$

$$8 \times 5 + 8 \times 2 = 40 + 15$$

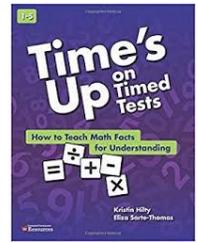
$$\text{So, } 8 \times 7 = 56.$$



## Teacher Resources

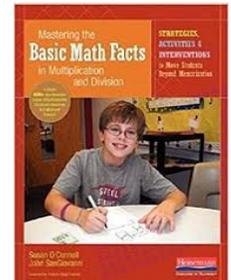
1. Time's Up on Timed Tests by Kristin Hilty and Eliza Sorte-Thomas

*This resource provides teachers with ways to teach addition and subtraction as well as multiplication and division facts for understanding. The book provides several games and activities for building fluency in both areas.*



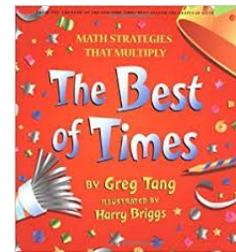
2. Mastering the Basic Math Facts in Multiplication and Division by Susan O'Connell and John SanGiovanni

*This resource focuses specifically on teaching strategies for multiplication and division facts. Each chapter is devoted to a specific multiplication fact and includes activities, games, and suggestions for instruction.*



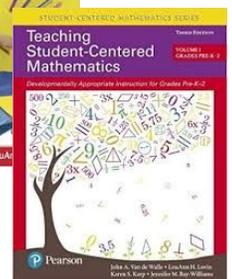
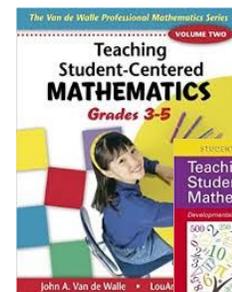
3. "Greg Tang Math Website" <http://gregtangmath.com/>

*Scroll to the bottom of this site to find links to all of the Greg Tang e-books for free. The Best of Times offers rhymes and poems about various strategies and ways to think about multiplying. This site also offers free online games that can provide practice for students when working on fluency.*



4. Teaching Student-Centered Mathematics by John Van de Walle, LouAnn Lovin, Karen Karp, and Jennifer Bay-Williams

*This book offers strategies for teaching multiplication/division facts and discusses the negative effects of using timed tests.*



5. About Teaching Mathematics: A K-8 Resource by Marilyn Burns

