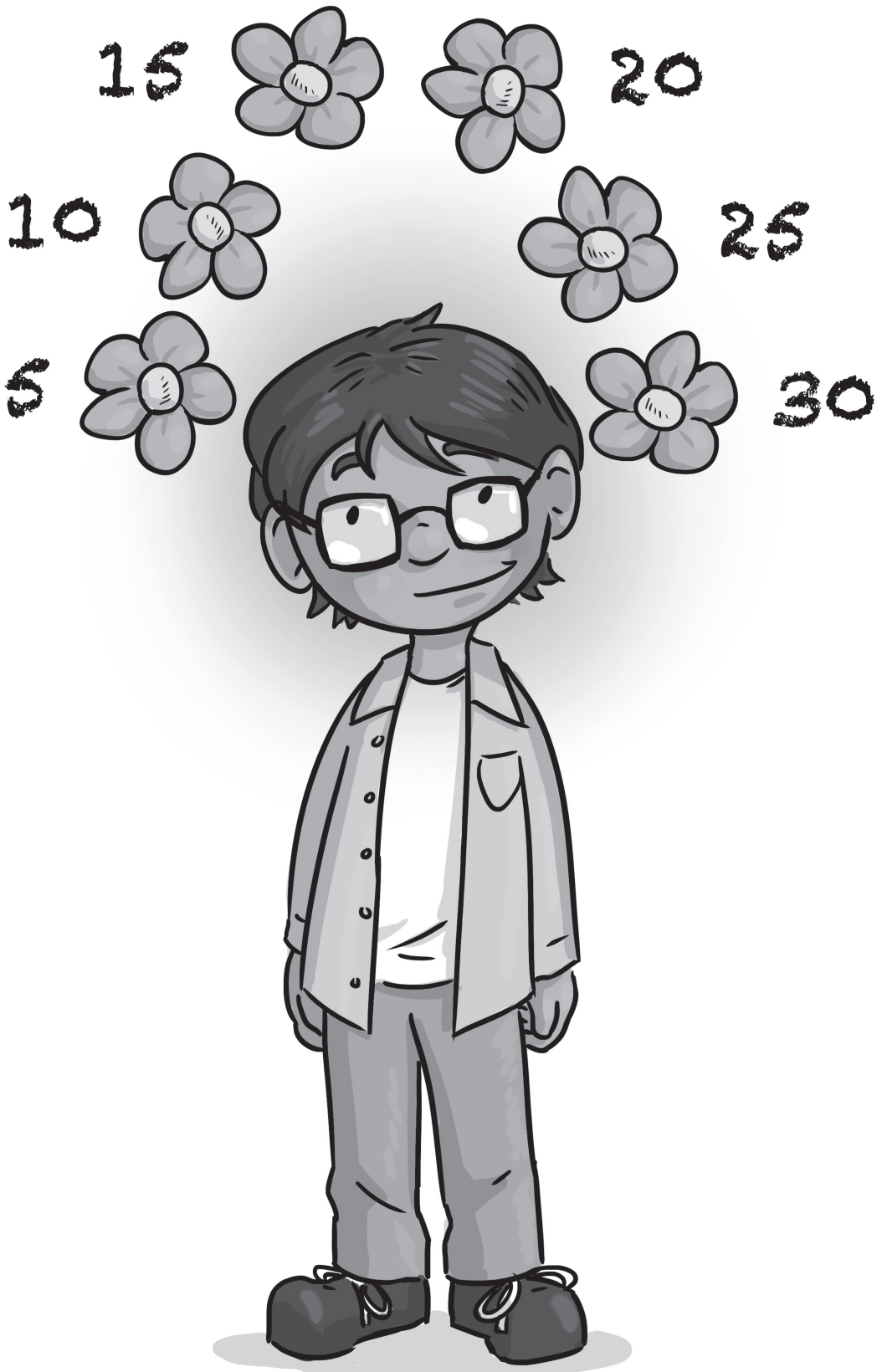
Awesum Alex
Math Detective

The Multiplication Problem

Implementation Manual

Rachel R. McAnallen & Carol Ann Williams

Royal Fireworks Press
Unionville, New York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When you help children understand what math truly is, the options for effectively solving math problems multiply.

As a lover of math, Rachel, a co-author of this manual, experiences many math epiphanies when teaching students, presenting workshops for teachers, and conducting math nights for parents. One evening many years ago, Rachel was conducting a family math party, teaching a lesson on multiplying a two-digit number by a one-digit number using the expanded form. The example was forty-five times six. She broke down the forty-five into forty plus five. Six times forty equals two hundred forty, and six times five equals thirty. Add the two hundred forty to the thirty, and the result is two hundred seventy. This is what it looks like:

$$\begin{array}{r} 45 = 40 + 5 \\ \times\ 6 = \quad \times\ 6 \\ \hline 270 = 240 + 30 \end{array}$$

Written in vertical form using partial products, the problem looks like this:

$$\begin{array}{l} 45 \\ \times\ 6 \\ \hline 240 = 6 \times 40 \\ +\ 30 = 6 \times 5 \\ \hline 270 \end{array}$$

After the program was over, Rachel explains what happened: “A woman approached me with her fifth-grade son. She was crying. All I could think at the time was, ‘What did I say that might have offended her?’ To my surprise, she hugged me and whispered, ‘Thank you. I am severely dyslexic, and this is the first time I have ever understood math. Calling numbers by their place value names and using the correct mathematical vocabulary

has made everything so clear to me. Now it make sense! Dyslexics must depend on their ears, since their eyes lie to them.'

"When I went back to my hotel, I began to write down all of the ways in which a dyslexic might see the number 45 using rotations and reflections. Below are some examples of 45 with the digits 4 and 5 rotated and reflected. The possibilities grow when the 45 is seen as 54.

"Until that time, I had been adamant about calling numbers by their correct place value names, but after that evening, I became fanatical about it. It is a fundamental part of learning math to use the correct base ten place value vocabulary and never to move the decimal point."

Co-author Carol Williams remembers her first year of teaching; she had a young student in her class who was both severely hearing impaired and dyslexic. Fortunately, Carol had a special education teacher consultant who advised her to place an arrow above the first letter of each phrase or sentence she wrote on the board in order to help the student see where to begin to read. Now that Rachel and Carol have introduced a dyslexic character into the Awesum Alex series, they are using the arrow in the student book, but they are also using color coding in some places to designate place value names. The color coding is useful for all children, but it is particularly helpful to children who have reading or vision disorders.

Multiplication Facts, or Multiplication of Two One-Digit Numbers

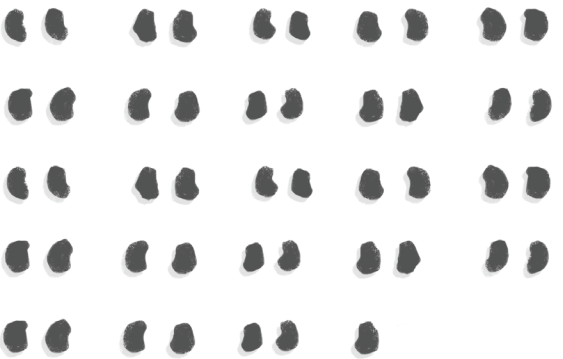
In order to understand the big idea of multiplication conceptually, learners must understand that multiplication is merely arranging items into groups to make it easier to find the total number of items. It is the adding of a number to itself a certain number of times.

In the United States, multiplication is traditionally introduced in the third grade, where students are told to memorize the multiplication facts, which they are expected to know by heart by the beginning of fourth grade. However, many fourth-, fifth-, and sixth-grade teachers lament that some students "still don't know their multiplication facts."

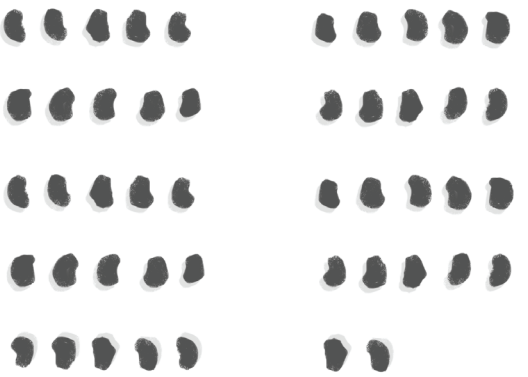
There are four main reasons why some students do not learn the multiplication facts. First, they don't understand the mathematical concepts behind multiplication. Second, they haven't had adequate time or opportunities to practice the facts. Third, if the facts are only memorized but the students forget them, they have no previous knowledge on which to recall those facts. And fourth, some children simply aren't interested in doing the memorization. Many times, these reluctant learners are gifted children who decide that it's a waste of their time to memorize a bunch of facts that don't mean anything to them conceptually.

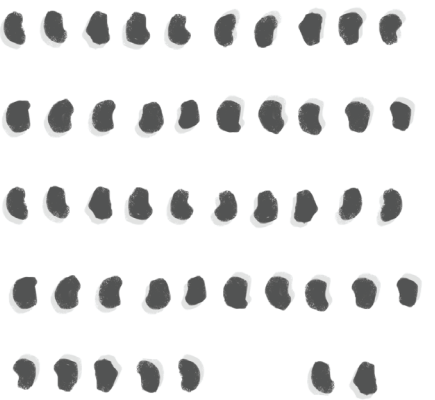
A good way to introduce multiplication to children is to give them a handful of objects. These can be dried beans, popcorn kernels, unifix cubes, or something similar, but each child should get forty-five to seventy-five of them. They should then be asked to count by ones to determine how many of the objects they have and then to record their findings.

When that task is finished, the children should be instructed to put the objects in groups of two, count them, and record the total number.



The children should then put the objects in groups of five, count them, and record them. Next is groups of ten, following the same procedure.

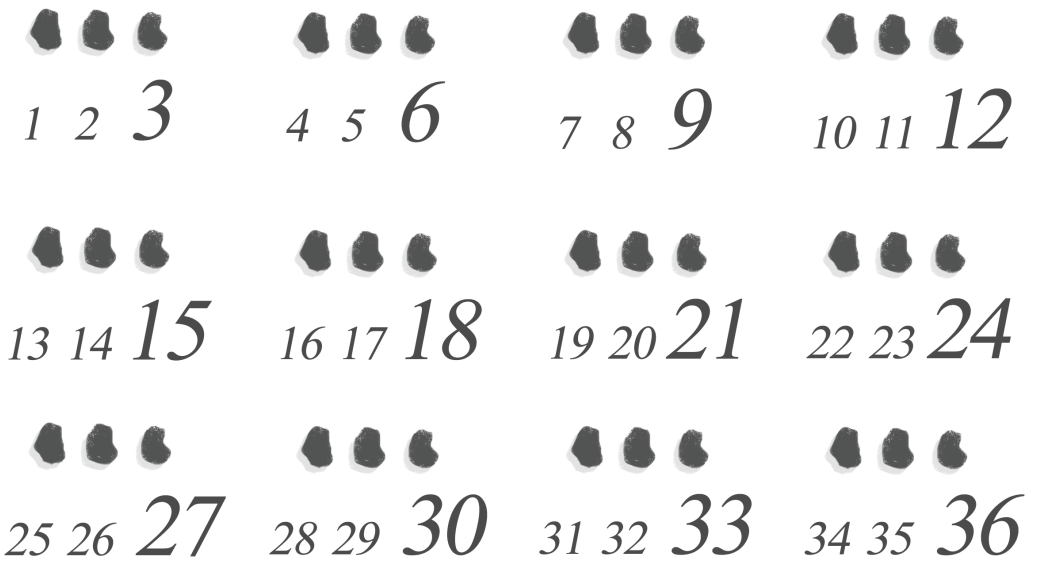




At this point, the instructor should initiate a discussion about which method of counting was the most efficient and which was the least efficient to find the total number of objects. The discussion should continue about which method led to the correct total and which method was the easiest to use to check the answer. This activity should be repeated several times using different amounts of the objects.

Counting Out Loud

Children benefit from hearing patterns of counting by numbers other than the number *1* before they pursue more advanced counting, such as by twos, threes, fours, and fives. This can be accomplished by using a whisper-talk activity. When counting objects such as beans by twos using the whisper-talk method, children will touch the first bean in a pair and whisper *one*, then say out loud **two**. They will continue touching and counting the pairs of beans in consecutive order: *three*-**four**, *five*-**six**, *seven*-**eight**, *nine*-**ten**…. To count beans by threes, they will touch the first bean in a group of three and say, "*One*-*two*-**three**," whispering the first two words in each group and saying the third aloud. That means they'll continue with "*four*-*five*-**six**, *seven*-*eight*-**nine**," and so on, counting all of the beans but putting emphasis on the multiples of three.



When the children have mastered groups of two and three, they can continue using the whisper-talk method to count groups of four, five, six, and more.