Addressing New Topics Through Direct-Instruction

With very few exceptions, the Singapore Math curriculum works like a ladder in which students shouldn't be moving on to a new rung (chapter) until they've mastered every previous rung (chapter). Any new topic in the Singapore Math series is built on a foundation of concepts that have already been learned. Therefore, new concepts can be introduced through a ladder of questions that start very easy and gradually progress in difficulty.

Effective lessons will lead students to answering questions on their own, using a series of call-response questions and/or commands, using as few words as possible. Call-response lessons are designed to help struggling and/or inattentive students. Studies show that if a teacher speaks for more than twenty seconds, the majority of students stop listening. Call-response lessons, in which teachers use as few words as possible, can go far to keeping all students engaged.

The first step in introducing a concept is to choose easy numbers to work with so students can focus on the concept rather than the computation. For example, when teaching 2-digit subtraction with renaming, choosing numbers that the students can subtract easily after unbundling tens can make teaching and practicing more efficient and productive.

The following is a sample script.

Teacher: Read the subtraction sentence on my signal. Get ready (click)

Students: Twenty-one minus two.

Teacher directs students to the place value chart.

Tens	Ones

Teacher: Raise your hand if you know how many tens are in twenty-one. (click)

Students: Two.

Teacher writes a 2 below the tens.

Teacher: Twenty-one is two tens and how many ones? (click)

Bill Davidson – bdavidson40@gmail.com

Students: One
Teacher writes a 1 below the ones.

Teacher: Raise your hand if you know how many ones are in two. (click)

Students: Two

Teacher writes a 2 beneath the one in the ones column.

After writing a 2 below the 1 in the ones column, the place value chart should read as follows:

Tens	Ones
2 -	1 2

Teacher: Can we take two ones from one one? (click)

Students: No.

Teacher: So we need to unbundle a ten. *Teacher crosses out the 2 in the tens column and writes a 1.* Raise your hand if you know how many ones are in a ten. (click)

Students: Ten.

Teacher: Raise your hand if you know how many ones one ten and one one is. (click)

Students: Eleven.

Teacher crosses out the 1 in the ones column and writes 11.

Bill Davidson – bdavidson40@gmail.com

Teacher: Can we take two ones from eleven ones? (click)

Students: Yes.

Teacher: Raise your hand if you know how many eleven take away two is. (click)

Students: Nine.

The place value chart should look as follows.

Tens	Ones
~~2~~ 1	~~1~~ 11
-	2
	9

Teacher: Raise your hand if you know how many tens are left. (click)

Students: One

Teacher: Raise your hand if you know how many ones are left. (click)

Students: Nine

Teacher: Raise your hand if you know how much one ten and nine ones are. (click)

Students: Nineteen.

Bill Davidson – bdavidson40@gmail.com

Teacher: Say the subtraction sentence. (click)

Students: Twenty-one minus two equals nineteen.

Teacher writes a 1 below the line in the tens column.

Tens	Ones
~~2~~ 1 -	~~1~~ 11 2
1	9

The ladder can also work well for word problems. This word problem from the Ratio chapter of the 6A book, synthesizes fractions, multiplication, division, adding, and perimeter. By sixth grade, students should have mastered all of these skills, but when they are blended together, it often confuses students. Breaking apart the problem, piece by piece, however, can make it easier.

The following is a script of how it can be taught. Side notes will be boldfaced and underlined.

Teacher: Read together on my signal. Get ready (click).

Students: "*The sides of a triangle are in the ratio 4:5:6. If the perimeter of the triangle is 60 cm, find the length of the shortest side.*

Bill Davidson – bdavidson40@gmail.com

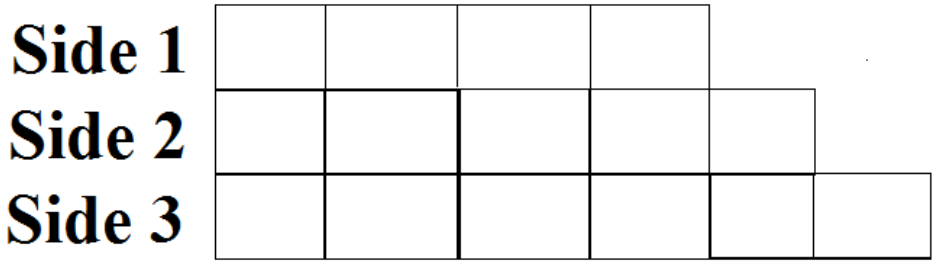
Teacher: Raise your hand if you know how many sides are in a triangle. **<u>This is a first grade question that any student can answer.</u>** Get ready (click).

Students: Three.

Teacher: Raise your hand if you know the ratio of sides of the triangle from smallest to biggest. **<u>A slightly harder question that any student can answer.</u>** (click).

Students: Four to five to six.

The teacher writes the following diagram on the board:



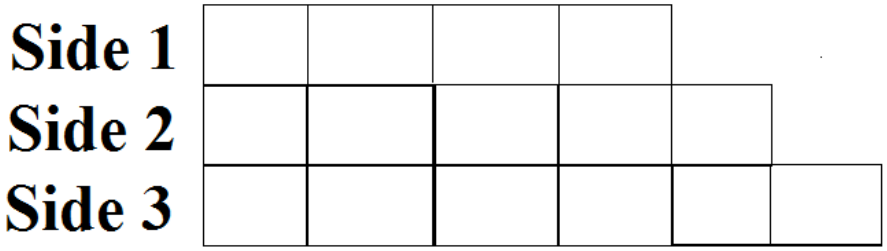
Teacher: Raise your hand if you can say the perimeter of the triangle in units as a three-step addition problem**<u>. This is a third grade problem. Students should know that the perimeter of the triangle is found by adding the three sides together.</u>** (click)

Students: Four plus five plus six.

Teacher: Say the perimeter of the triangle in units. **<u>Computing four plus five plus six mentally is a skill students are introduced to in second grade and should hone in third grade.</u>** (click)

Students: Fifteen.

Beneath the diagram, the teacher writes the following on the board:



15 units =

Teacher: Say the perimeter of the triangle in centimeters. (click)

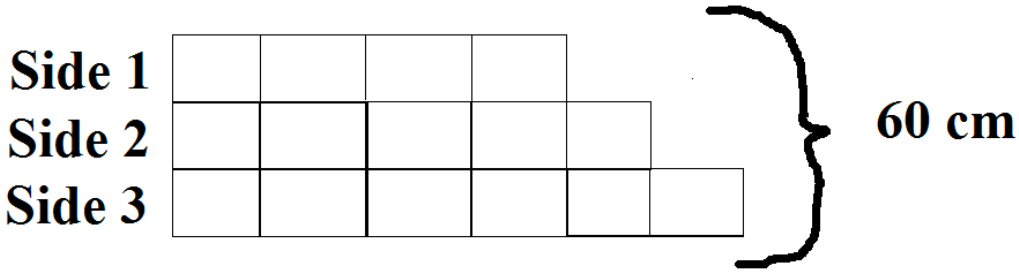
Students: Sixty centimeters.

Teacher: Raise your hand if you know how many units 60 centimeters equals. (click)

Students: Fifteen

The teacher writes the following underneath the diagram:

<u>This diagram should look very familiar to a student who has passed through each level of the Singapore Math curriculum.</u>



15 units = 60 cm

1 unit =

Teacher: Say what one unit equals as a division problem. (click)

Students: Sixty divided by fifteen.

Teacher: Raise your hand if you know what sixty divided by 15 equals. (click)

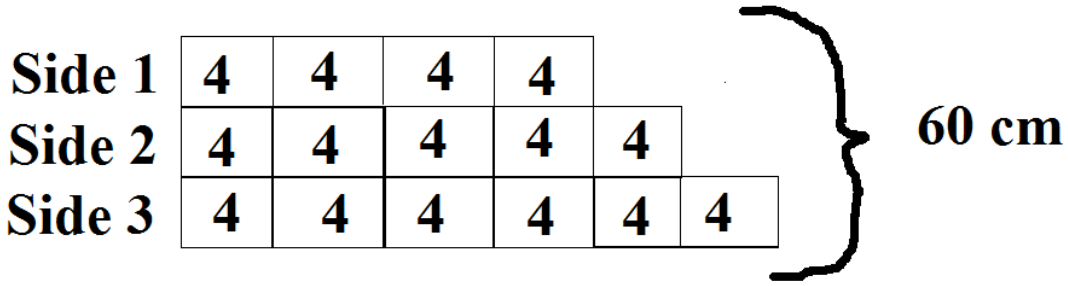
Students: Four.

Teacher: Raise your hand if you know what one unit equals. (click)

Bill Davidson – bdavidson40@gmail.com

Students: Four centimeters.

Teacher should write fours inside the boxes.



Teacher: Raise your hand if you know how many units the shortest side of the triangle is. (click)

Students: Four.

Teacher: Say the length of the shortest side as a four-step addition sentence. (click)

Students: Four plus four plus four plus four.

Teacher: Say it as a multiplication sentence. (click)

Students: Four times four.

Teacher: Raise your hand if you know the length of the shortest side of the triangle.

Students: Sixteen centimeters.

Things to consider when introducing new concepts and delivering direct-instruction:

1. **Start with an easy question that every student in the class can answer**. The simplest question I can think of is pointing at a number and asking the students "Raise your hand if you know what number I'm pointing to." Although extreme in its banality, simple questions like this can go far to keeping lower level students engaged and feeling successful.

2. **Call for responses with a sharp click.** Snapping, knocking, and striking chalk on a chalkboard all work well. The click maintains rhythm and cohesion in choral responses.

3. **Use simple numbers so that computation won't be difficult**. 21 – 2 is simple subtraction and works well for an introductory lesson. The 6A word problem was not. If introducing Ratio word problems, it might be better to make the ratio 1:2:3 with a total perimeter of 12 cm, so that the hardest computation a student would have to do is 12 cm divided by 6. Dividing and/or multiplying by twos, threes, fours, fives, and tens works best, because almost all students feel very comfortable with these multiples.

4. **Use the exact same wording whenever reviewing how to do problems OR helping a student with class work**. Succinct word precision is incredibly important in being effective at direct instruction. Asking a series of clear questions that lead students to answering difficult questions is very hard and requires a lot of practice. The lower the skill of the student, the more important the teacher becomes. When teachers are able to continually ask students the same series of questions using the exact same language, the lesson has a better chance of internalizing in the students' memory, leading them to being able to solve the problems on their own.

5. **During reviews, gradually eliminate the easiest problems, i.e. start working towards the answer at a higher point in the ladder.** The 21 – 2 script required ten student responses. The Ratio/Perimeter problem required 15 student responses. As more and more students master the easier foundational concepts, e.g. "How many tens and ones are in twenty?" the entry point for the instruction can start with harder questions.

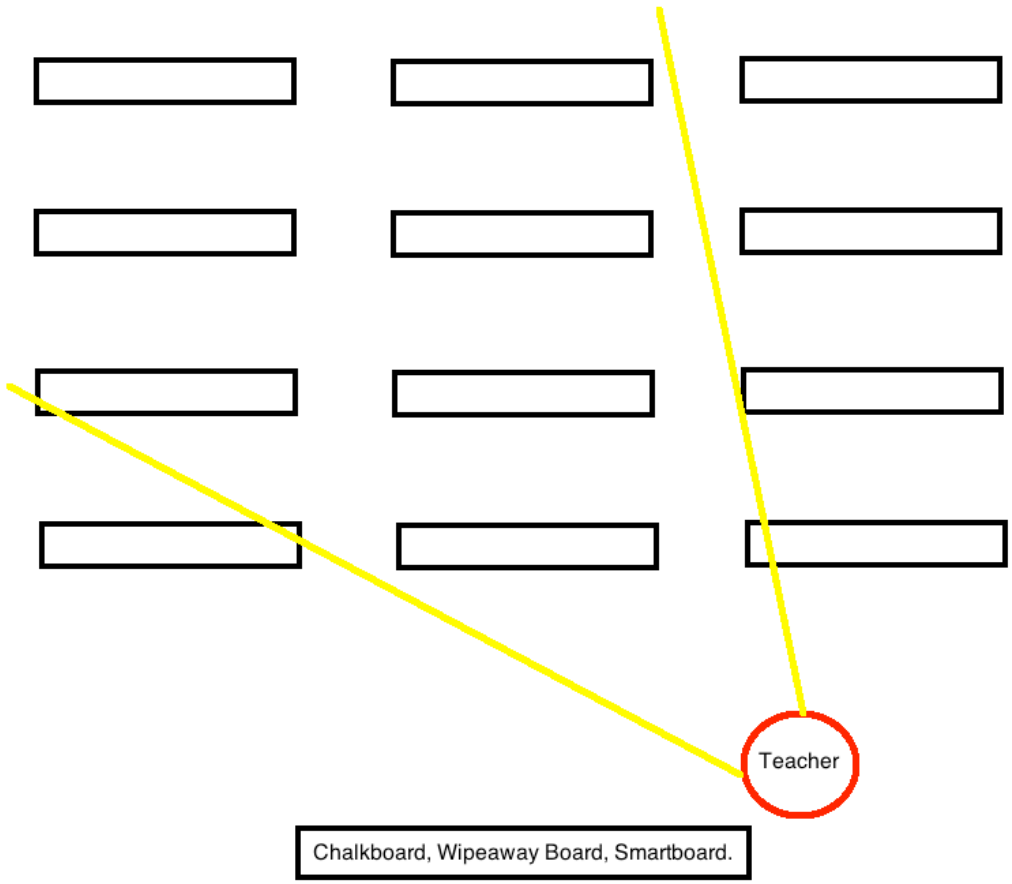
6. **When helping a student individually, start asking questions at the highest point in the ladder that the students will be able to quickly and comfortably answer.** An upper level student may only need to be asked the last two or three questions to solve the answer. If a student can't answer a question higher up on the ladder, then the teacher should backtrack by a question until the student can answer it. For instance:

   > If a student is struggling with the same Ratio/Perimeter word problem during class work, a teacher might begin by asking them what one unit equals. If the student isn't able to answer it correctly, then the teacher should back track one question, by asking "How many units equals sixty centimeters?" If the student knows that 15 units equals 60 cm, then the teacher should ask "What is one unit as a division problem?" If the student doesn't know that fifteen units equals 60 centimeters, then the teacher should back track one more question and ask "What is the perimeter of the triangle in units?", and so forth until the student is able to answer a question.

7. **In the early stages of learning to teach via call-response direct instruction, begin by trying for a short amount of time (4-7 minutes) and gradually build up endurance.**

8. **Writing "Teacher says, Student says" scripts are helpful when beginning. This forces the teacher to think critically about what questions are being asked, and anticipate student responses. If a teacher doesn't write a script they should still carefully consider the wording and sequence of their ladder of questions.**

Suggested Classroom Setup for Precision Teaching



Weakest, least attentive students should sit centered in the teacher's triangular vision. Most attentive students should sit outside the triangle.

Bill Davidson – bdavidson40@gmail.com