# Strategies to Facilitate Math Concepts and Homework

By: Regina G. Richards (2008)

One Tuesday afternoon, I received a frantic call at my educational therapy clinic. It was Sammy's mother. Sammy was one my clients and usually we worked on reading on Saturdays. Sammy's mother exclaimed, "I just picked Sammy up from school and he's pretty hysterical. It's hard to understand what he saying, but it seems he doesn't understand the words his teacher's using in math. He saying he's going to flunk math because of these words. Can you help?"

Sammy was in luck. I happened to have a canceled session in one hour. I suggested that Sammy's mother take them out for a snack to help him calm down and then bring him to my office in an hour. I felt it was important for Sammy to calm down before our session, because a student who is upset or anxious effectively "closes the door" on any learning that might otherwise take place.

Sammy arrived at the appointed time and although he was somewhat calm, I could tell that he still felt anxiety about these "words" that the teacher used in his math class. I decided to start our session by reading Sammy a story. When I explained this to him, his eyes lit up and he was delighted.

As I walked to my bookcase, I spoke with Sammy about Camelot and King Arthur and we talked about knights and their ladies. Sammy was delighted and enchanted with Camelot. I pulled out a book by Cindy Neuschwander called *Sir Cumference and the First Round Table*.

Sammy and I got comfortable and I began to read the story. In summary,

> King Arthur was King in Camelot. There was a problem so the King called his bravest knights for a meeting. Sir Cumference brought his wife, Lady Di, from Ameter, and their son, Radius.
>
> The knights had a meeting and they sat at a long rectangular table but everybody had to shout. The carpenter made a square table but then the people at the corners were very crowded and began to whisper. The carpenter tried a variety of different table shapes: diamond, parallelogram, triangular, and oval. However, there was a problem with each.
>
> The knights were discouraged, especially Sir Cumference. He decided to go for a ride in the forest with his family. Radius notices a fallen tree and proclaims, "See, Father! There's your table!" A picture in the book shows Lady Di, from Ameter, standing next to the fallen tree. She reaches from one end to the other, right in the middle. The carpenter cuts a cross-section of the trunk to make into a tabletop and Sir Cumference tells him, "Leave the bark on the outside edge. I like its rough feel."
>
> The carpenter makes a table, they use it for the next meeting with the knights and everyone is happy. King Arthur is delighted with his new table and thanks Sir Cumference, Lady Di, and their son, Radius.
>
> The King proclaims, "Because Lady Di of Ameter has a reach that is equal to the distance across the table, we will name this measurement for her. We will call it the diameter."
>
> "Radius may be small, but he has tall ideas. Let's call the small measurement from the center of

the circle to its edge the radius."

The King then reminds everyone that it was Sir Cumference's idea to leave the bark on the outside edge of the table. He names the outside edge of a circle after him and calls it, "the circumference."

When I finished the story, Sammy was all excited. He exclaimed, "Now I get it! I see what the words mean!" I noticed that he said, "I see" and pointed this out to him. I explained that sometimes words alone were not enough for him. He needs to remember this and not get upset but find a way to help himself "see" what the words mean. I told him, "You know, Sammy, you could even go to your teacher and tell her that you need to "see" what the words mean and ask her to show you or draw you a picture. Or, you could try to draw your own and then ask her if that's what the words mean."

We then reviewed the meaning of the words *circumference*, *diameter*, and *radius*. Sammy was excited that he understood.

I happened to have some round mint patties in my freezer and so, to reinforce the concepts, I pulled out a mint patty and some thin red licorice candy strips. I asked Sammy to take the licorice and, using the mint patty, show me the circumference of the circle. He outlined the circumference with the red licorice. He then cut another piece of licorice to show the diameter and another for the radius of the circle.


**Fig. 1 — Materials to demonstrate circumference, diameter, and radius**

We had only 10 minutes left in our session but Sammy was very comfortable with these three words that were so important to his math lesson. We then reviewed the formulas for circumference, diameter, and radius. I told him he had to memorize a term called "pi:" pi = 3.14. I promised him I would read him another story next time called *Sir Cumference and the Dragon of Pi*. We practiced a few calculations.

- Circumference: pi times diameter
  - The diameter of the circle is 3 cm. Find the circumference.
  - C = pi * d
  - C = 3.14 * (3)
  - C = 9.42 cm
- Diameter: 2 times the radius (Sammy reminded me that Lady Di was twice as tall as her son, Radius.)
  - The radius of the circle is 2 in. Find the diameter.
  - d = 2 * r
  - d = 2 * (2)

- d = 4 inches

- Radius: one half of the diameter
  - The diameter of the circle is 4 inches. Find the radius.
  - r = d/2
  - r = 4/2
  - r = 2 inches

## The teaching elements

*"Our brains are meaning-making machines, searching for matches to previous experiences."*

— From *Quantum Teaching: Orchestrating Student Success* by Bobbi DePorter, Mark Reardon, and Sarah Singer-Nourie

What were the key teaching elements that I used in my session with Sammy?

First, he needed to be more relaxed so that he could "open the doors" to new information. Part of achieving relative calmness is learning to accept our mistakes or the fact that we may initially have difficulty. We need to accept this without "crashing."

Second, I know that learners need to hook new information to existing and familiar information. I had to find a way to hook the vocabulary words to something that was familiar to Sammy. I knew that he could not begin to understand how to manipulate the formula until he had a deeper understanding of these words. Having a deeper understanding of the important words enabled him to create a concrete hook so that he had less of a tendency to confuse the words.

Third, I used the extremely critical teaching principle that applies to all new learning with students: experience before labels. I helped Sammy experience the meaning of these words and the related concepts.

### "Experience before labels"

As parents, we can use these principles to help our children feel more relaxed and competent with their homework, especially in math. As teachers, we can use these principles as we present concepts to broaden our reach to our students.

Following are a few additional activities we can use to help our students experience the meaning of concepts before they apply and use them. Readers interested in additional ideas may find them in the books listed in "other helpful resources" at the end of this article.

## The importance of words

As demonstrated in the above scenario, it is critical that students understand, at a deep level, the meaning of the words they will be using. You can assist your students by exploring the morphology, or meaning of

word parts, related to important conceptual terms.

Following are some word parts relevant for the area of math:

| Word part | Meaning |
|---|---|
| equi- | equal |
| multi- | many |
| poly- | many |
| quad(r)- | four |
| sub- | under; down |
| -gon | figure having certain number of angles |
| -lateral | side |

Here's a way, from my book *The Source for Learning and Memory*, to help students explore the meaning of math words:

- Select one or two word parts.
- Have your student brainstorm words containing those parts. Encourage use of words related to math. Examples using *multi-* are multiply, multiplication, and multiple. Examples using *sub-* include subtract and subcategory.
- Help your student figure out the meaning of each of the word parts and discuss how the word part relates to the concept of the total word.
- Example: "Multiply means to make a number many" or "Multiple means more than one, or many."
- Example: "Subtract means to pull a number down, or decrease" or "Subcategory means a division or part of a category, or under a category."

## Measuring

### Measuring mnemonics

Mnemonics are memory tools and students can use mnemonics to help them learn and recall many different ideas and concepts. Following are some examples from my book *LEARN: Playful Strategies for All Students* of mnemonics to help with measurement terms.

Meter — "A meter measures 3 ft. 3 / It's longer than a yard, you see"

Liter — "A liter of water's / a pint and three-quarters"

Kilogram — "2 1/4 pounds of jam / weighs about a kilogram"

Fahrenheit and Centigrade — to convert, take away 30 and halve it

Centigrade to Fahrenheit — double and add 30

Note: These are approximations. The technical method to translate Fahrenheit to centigrade is to subtract 32, multiply by five, and divide by nine.

### Body measuring

To help your student grasp the concept of various measurement sizes, have her compare the term to some part on her own body. Some examples from *The Source for Learning and Memory* follow:

- Have your student compare the size of his thumb (from the length of the first knuckle to the tip of the thumbnail) to an inch on a ruler. Compare your thumb to an inch on a ruler.
- Have your student compare the size of her foot to a foot on a ruler. Repeat with your foot.
- Explore other comparisons your student can do using his own body to help remember various sizes.

## Adding and subtracting

### Using 2 rulers

This technique helps students who have difficulty learning and remembering math facts for addition. For some students, it is more concrete than adding objects.

Use two rulers that have numbers written very clearly, or create your own using cardboard. What is important is an even sequence of numbers, rather than the exact measurement.

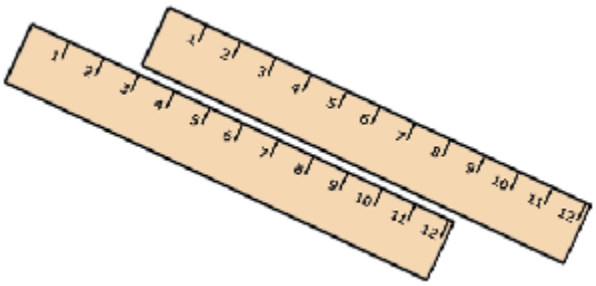

**Fig. 2 — Using the two rulers**

Using the two rulers to add 3 + 4, follow these steps:

- Locate the 3 on the bottom ruler.
- Place the left edge of the top ruler directly over the number 3.
- Locate the 4 on the top ruler.
- The number that is directly below the 4 on the bottom ruler is the sum or the answer to the problem: 3+4=7.

### Color coding columns

Color coding is useful if your student has difficulty keeping his numbers straight, i.e., lining up the ones-column and lining up the *tens*-column.

- Color the ones-column with green (explain that green means "go" or "start").
- Use a different color for the tens' column.

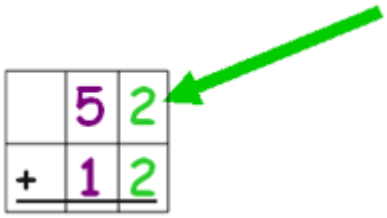


**Fig. 3 — Color coding columns**

To make it easier and more concrete, place a green arrow of the ones' column to indicate "start".

As your student progresses and increases her understanding of the use of columns, omit the color for the tens' column and only use the green for the ones' column. Eventually omit all of the color.

## Multiplying and dividing

### Patterns

Multiplication facts follow a specific pattern. It is useful to show your student some of the easier patterns, especially if you discuss with her why the pattern works. Provide experience by using manipulatives (counters such as beans) to practice and explain the pattern.

- Multiplying by 10s
  - Just add zero (0) to the number being multiplied
  - Examples:
    2 x 10= 20; 7 x 10 = 70; 55 x 10 = 550
- Multiplying by 11s (with a single digit number, 1 to 9)
  - Double the digits being multiplied.
  - Examples:
    3 x 11 = 33; 9 x 11 = 99
- Multiplying by 11s (with two digit numbers)
  - Write the number to be multiplied, leaving space between the two digits: to multiply 32 x 11, write 3 ___ 2.
  - Add the two digits: add 3 + 2

- Write the answer, 5, (3+2=5) in the space between the two digits: 3__5__2.
- The answer to the problem 32 x 11 is 352.
- Note: If the sum of the two digits is greater than 9, the process will be more complex because it will be necessary to carry.
  - 57 x 11
  - Write 5 _ _ 7
  - 5+7=12
  - Write >5__(12)__7
  - Carry the "1": 5+1=6
  - This makes >6__2__7
  - Answer: 627

## Using your fingers to multiply

Many students count on their fingers when adding and subtracting, especially at the beginning. Using their fingers to multiply is also very concrete and helpful for some learners. There are easy techniques for multiplying one digit by 9s, multiplying two digits by 9s, and multiplying 6s through 9s. The following explains how to use your fingers to multiply 9 by a one digit number.

- Hold your hands in front of you, with your palms flat on the desk or in the air.
- Label each finger from one to 10, beginning on the left. If your student has difficulty imagining the numbers, place a small sticker on each finger with the appropriate number.
- To multiply 9 x 5, the first step is to locate the "5 finger." It's the fifth finger counting right to left. Refer to the diagram below.

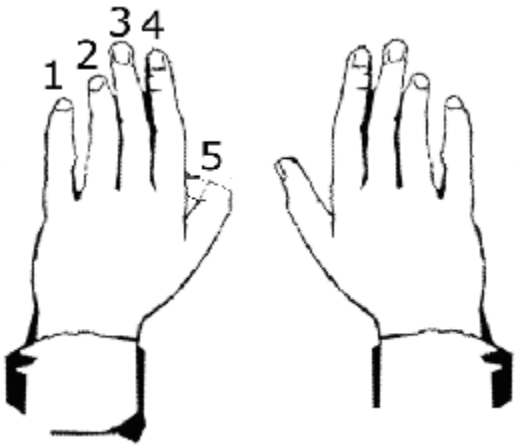


**Fig. 4 — Folding the "5 finger" underneath**

- Fold the "5 finger" underneath.
- Then count the number of fingers that are sticking up on the left side of the folded down finger: these fingers represent the tens digit. In this case, four fingers are sticking up.
- Next, count the total number of fingers are sticking up on the *right side* of the folded down finger: these fingers represent the ones digit. In this case, five fingers are sticking up.
- Refer to the diagram below. When multiplying 5x9, we have 4 fingers on the left side and 5 fingers on the right side. This makes 45 because there are 4 tens and 5 ones.
- The answer to 9x5 is 45.

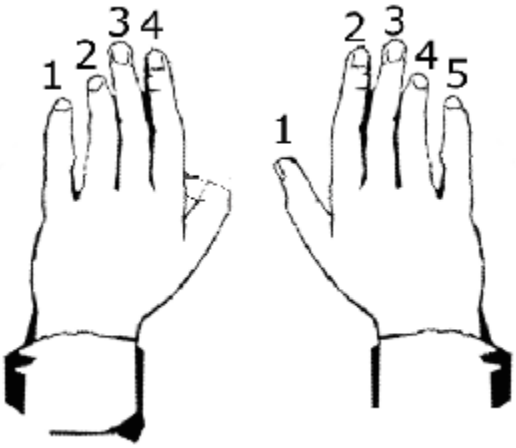


**Fig. 5 — Count 10s on the left hand**

Another example: If you wanted to know what 3x9 is, you would fold down the "3 finger." The number fingers to the left of that would be 2, and the number to the right would be 7. 2 tens plus 7 ones is 27. 3x9=27.

## Additional important strategies

### Multisensory strategies

Multisensory instruction is the linkage of visual, auditory, and kinesthetic-tactile modalities. Students simultaneously link what they see with what they hear with what they feel.

Students derive more benefit from activities in which they actively participate. Active learning enhances efficiency and the child understands and grasps concepts with greater depth.

Multisensory techniques increase active awareness. Students, especially those with learning challenges, benefit from being able to pull in memory hooks (mnemonics) along with multisensory techniques.

## Chunking

Chunking is a computer term that means "bundles of information." It means breaking information or a task into smaller manageable parts. There are many ways to use chunking in homework sessions.

Suppose your child is complaining about an assignment and makes a statement such as, "This assignment is way too long. It's not worth even trying."

- You may use chunking and acknowledge your child's feelings with a statement such as, "You're right. This is a long assignment. It may require a lot of energy, but think about how proud of yourself you'll be when you finish it."
- Then proceed to help your child divide the activity into manageable chunks. Perhaps even fold or cut up the paper so that each chunk looks smaller.
- Have your child complete only one chunk and then take a short movement or stretching break.
- Then have your child complete another chunk, followed by another very brief break.

Help your child appreciate these important aspects about the chunking process:

- You can store and organize information more efficiently in small chunks.
- Everything begins with one small step.
- The small steps add up to a bigger accomplishment.

## Artsy flash cards

This strategy calls on multisensory learning and works well with the most troublesome math facts. Remember the value of chunking and have your student select only two to five troublesome facts to work on. When he knows these facts, he can then work on additional facts.

Your student makes a flash card for each of the selected facts, making each card visually interesting and different from every other card.

- On one side, write the complete fact, using techniques to make it "artsy," colorful, and visually interesting.
- On the reverse side, place the question without the answer, using a single color marker.

To study a fact, have your student place the artsy side of the card about one or 2 ft. in front of him, perhaps taping it on a wall. Encourage your child to study the card using a variety of techniques:

- Repeat the fact.
- Close his eyes and picture the math fact and visual design using "a chalkboard in his mind."

- Create a clapping or rap rhythm while reading and looking at the card.
- Perform a motor movement (such as jumping up and down or on a trampoline).
- Cover or remove the card and imagining it still being there, read it.

Your child may use the single-color side to test himself.

## In summary

These tips for your math homework toolbox are just a few of many that are available. Hopefully, they will be useful to you and your student with your particular homework situation. Here are some valuable reminders:

- Remember to use chunking: go slowly and apply or use only one part at a time.
- Use multisensory strategies.
- Teach your child a strategy one step at a time.
- And above all, HAVE FUN!

## Other helpful resources


- Burns, Marilyn. **Spaghetti And Meatballs For All** (Marilyn Burns Brainy Day Books)
- Burns, Marilyn. **The I Hate Mathematics! Book**. 1975.
- Lavoie, Richard. **How Difficult Can This Be? — FAT City (video or DVD)**
- Levine, Melvin D. **Educational Care: A System for Understanding Children with Learning Differences at Home and at School**. 2001.
- Levine, Melvin D. **Keeping A Head in School: A Student's Book about Learning Abilities and Learning Disorders**. 1990.
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- Neuschwander, Cindy. **Amanda Bean's Amazing Dream: A Mathematical Story**. 1998.
- Neuschwander, Cindy. **Mummy Math: An Adventure in Geometry**. 2001.
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