Alberta Health Services

February 2019

School Speech Language Services

The Language of Math

Language impaired children can struggle in the world of math. The language of math is often complex and decontextualized. To solve word problems successfully, students not only need to master basic numeracy facts and become experts in computation, but also need strong language skills. They must understand complex and often abstract vocabulary, concepts, and sentence structures in order to process, integrate and solve word problems.

The struggle however, goes beyond word problems. Math is full of 'sound alike' words.

Math word… sounds like **Everyday word**…

Altitude… attitude
Sphere… spear
Tenths… tents
Half… have
Cents… sense

Math also is full of multiple meaning words…

Word	Mathematical meaning	Everyday meaning
volume	Amount of space taken up by an object	Noise level of electronic equipment
product	Result of multiplying numbers	Items produced by a company
ruler	Tool for measuring length	Person in authority
mass	Amount of matter in an object	A church service

Consider how all the above words can cause confusion for students. Think about the other subjects you teach– there are words of confusion in every subject!

Executive functioning and math

The students in your classroom with executive functioning deficits may struggle with word problems for the following reasons:

Organizing the order of operations in a multiple step word problems

Holding information from one step while manipulating information from another step

Shifting from one piece of information to another piece of information

Attending to the *relevant* information within the word problem

Perseverating on *unimportant* information within the word problem

Controlling the impulse to solve the first identified operation without understanding all the steps involved

Students with Autism and Math

In addition to executive functioning difficulties, students with autism may lack theory of mind (ToM)– the ability to understand others' points of view or perspectives. Lacking ToM, students with ASD struggle to understand that others have their own ideas. They might have difficulty perceiving a situation from another person's perspective. And they are often unable to predict intent based on content.

Applying ToM to solving math problems, we can see how it might affect:

- Inhibiting comprehension
- Distracting the student from relevant information
- Bringing a social component to the problem that adds to its complexity

Self Talk

Research has shown that middle school students who are successful at solving math problems engage in self-talk during the problem-solving process. Students who have oral language difficulties are less likely and able to do so, and they benefit from teacher modelling.

Things to try in the classroom

Keep your vocabulary consistent...

Even when students are good language learners, inconsistency in math language can cause problems. Take the following math question:

$$\begin{array}{r} 84 \\ -19 \\ \hline \end{array}$$

The following words could be used when explaining how to proceed– regrouping, borrowing, stealing, trading…
For any child, but especially for ELL or language disordered students, there is going to be trouble if they are hearing multiple words for the same concept.

Look at the language of the problems…
Before the lesson take time to identify word problems that consist of complex sentence structures (e.g. passive voice, sentences with conjunctions) and abstract vocabulary. Emphasize and break down the complex structures.
Present the problem orally (e.g. *Jody had 6 cookies in her lunch bag in the morning but she ate 4 cookies at recess. How many cookies did she have left for lunch?*)

Paraphrase or simplify the complex sentence:
teacher: this sentence is a long sentence. I see the word *but.* The word *but* is a linking word which helps to stick two parts of sentences together to make a big sentence. Let's break the sentence into two parts. I will underline one part blue and the other part green. *Jody had 6 cookies in her lunch bag in the morning* is one part. (underline in blue) The other part is *but she ate 4 cookies at recess*. (underline in green)

Drawings or diagrams can help students understand not only the language but also the mathematical relationship. E.g. draw a lunch bag and ask how many cookies to draw in it. Ask if something else needs to be drawn– maybe 4 cookies get crossed out, maybe a bag with 2 cookies is drawn…

Being aware of the vocabulary and grammar used in math problems is the first step to simplifying it for struggling students!

Please feel free to copy the next page to send home to families.

Helping your child understand math problems

Sometimes trouble with math is more about the words and grammar used to write the questions. This is where you come in. Re-write the questions for your child keeping the following ideas in mind…

- Write the most important sentence first.
- Leave only the words and sentences that are important to solving the problem.
- Use simple sentence structure such as: Subject/Verb/Object.

Anna is having a birthday party with 8 friends. She is hanging balloons around for decorations. She has 4 bags of red balloons and 5 bags of yellow balloons but no blue balloons. If each bag has 10 balloons, how many balloons does she have to hang?

Rewrite as: *Anna has 4 bags of red balloons and 5 bags of yellow balloons. Each bag has 10 balloons. How many balloons are there in total?*

Vocabulary

Don't assume that your child knows what all the words in a math problem mean.

Help your child understand all the words in the problem before figuring out what math needs to be done.

E.g. if a problem states " John has a dozen donuts" and your child doesn't understand that a 'dozen' means 12, then they will not be able to solve the problem.