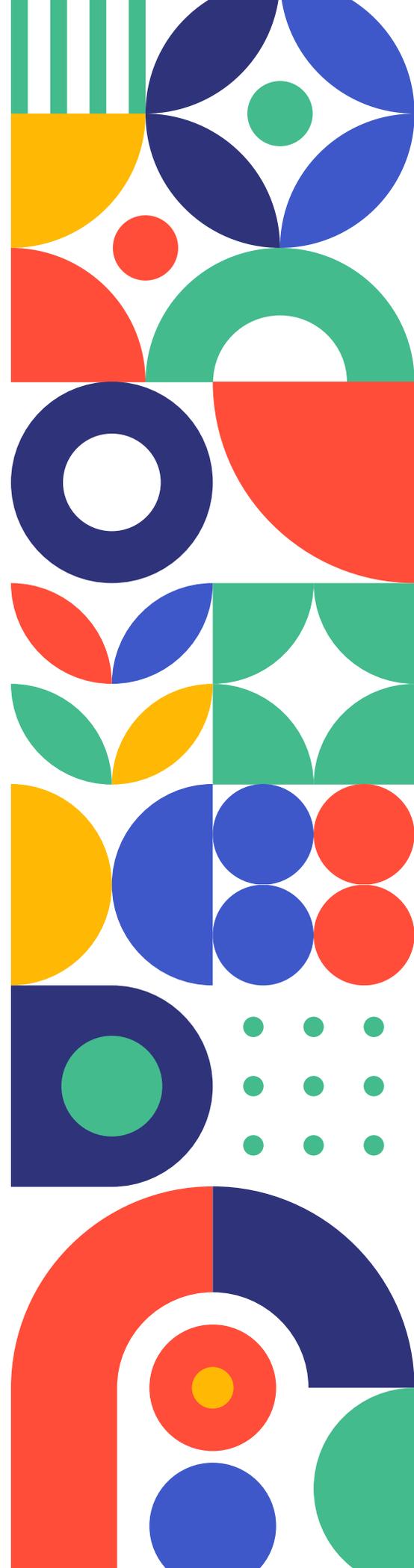


# A Math Teachers Guide:

## MATH AND DEVELOPMENTAL LANGUAGE DISORDER

Developmental Language Disorders II  
Final Project  
By: Sarah MacIsaac



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# WHAT IS A DEVELOPMENTAL LANGUAGE DISORDER?

## Introduction to DLD in the classroom:

Developmental Language Disorder (DLD) is a condition that makes it challenging for students to understand and use language effectively. This can affect their ability to follow instructions, express their thoughts, and engage in conversations.

DLD often impacts learning, as language is essential for understanding lessons, reading, and writing. More recently, research has been investigating the impacts of DLD and math abilities. Teachers should be aware that students with DLD may need additional support in the classroom. This manual will help guide math teachers how to best support all students in their classroom.



## Facts about DLD

- In every classroom, typically 2 students will be affected by DLD (1/14 kids)
- DLD is linked to an increased risk of developing dyslexia and other learning difficulties
- DLD is more common than autism, however it is less recognized.
- DLD can persist into adulthood

# EXECUTIVE FUNCTIONS



# DEVELOPMENTAL LANGUAGE DISORDER

## What are executive functions?

Executive functions are mental skills that help manage and regulate our thoughts, actions, and emotions to achieve goals. They help with planning, focusing, remembering instructions, and controlling impulses. There are 3 main branches of executive functions.



Working  
Memory

Holding and using information in your mind

*Example: when calculating  $5 + 7$ , the child must hold the information in their memory while processing new information (i.e. counting the new answer)*



Cognitive  
Flexibility

Ability to adjust between tasks and perspectives when thinking.

*Example: when calculating  $5 + 7$ , the child should be able to approach the problem in different ways (e.g. mental math vs. showing their work on paper)*



Inhibitory  
Control

The ability to block irrelevant information, stopping impulses and behaviours.

*Example: when calculating  $5 + 7$ , the child must avoid automatic responses such as assuming the answer is 13 without checking their answer. They would need to suppress their impulse and double check.*

## Executive Functions , DLD, and Math

Children with DLD struggle with executive functions. These executive functions affect a child's ability to comprehend and use language. These factors are exemplified in the classroom where language is constantly used. Furthermore, this effect is suspected to be exaggerated in math classes because the vocabulary is novel and one word may have multiple meanings. It is important for math teachers to teach vocabulary and reading strategies for all learners to succeed.

# MATHEMATICS & DLD

## The Relationship Between Mathematics and Language:

Math relies on language, symbols, and visuospatial working memory.

**Children with DLD** face challenges when tasks require language, symbols or a mix of both. Reading comprehension requires word recognition and language comprehension. In the simple view of reading model (figure 1), word recognition is broken down into the parts needing for decoding new words and reading familiar words. *Phonology* is the knowledge of sounds in a language. It is needed to decode *orthography* (i.e written language) if the word is novel. The student will use this pathway to sound out a word. *Semantics* is the knowledge of meaning in words and having words easily accessible from their vocabulary. When they recognize a word quickly and fluently, they are using the sight word pathway. A model very similar to this can be used to represent mathematics

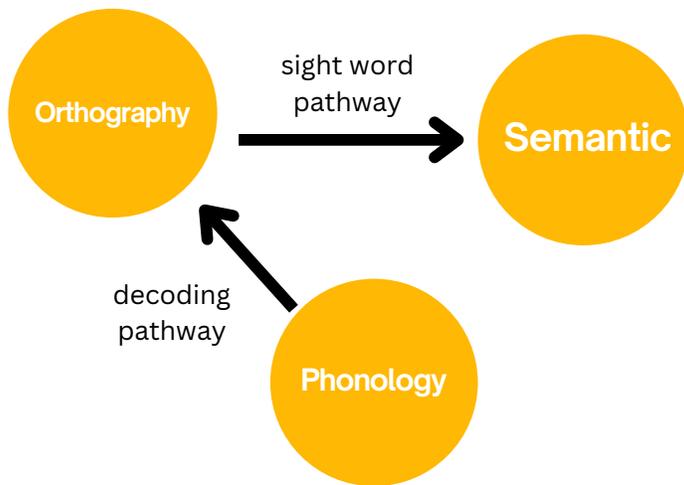


Figure 1: Simple view of reading

and how students used *symbols*, *number concepts* and *semantics* to calculate and retrieve facts. This is shown in figure 2. In the simple view of mathematics, the student must understand the concept of numbers and recognize symbols in order to perform a mathematical equation (e.g., +, -, x, ÷). When a child easily recognizes the symbols and numbers, they can easily solve an equation as it is a fact with their knowledge of semantics. For example, a student could quickly tell you that  $1 + 1 = 2$ .

## **How does language play a role in math and how does this affect children with DLD?**

Children with DLD may struggle with math because many tasks are heavily language based, such as verbal counting, naming numbers, or recalling number names. In addition, their difficulty with symbols, which are central to math (e.g., 4, +, %), contribute to the challenge. Another key factor, is poor working memory, as it affects their ability to count and recall number names. For example, a visuospatial working memory is necessary for holding information during mental math or visualizing a number line.

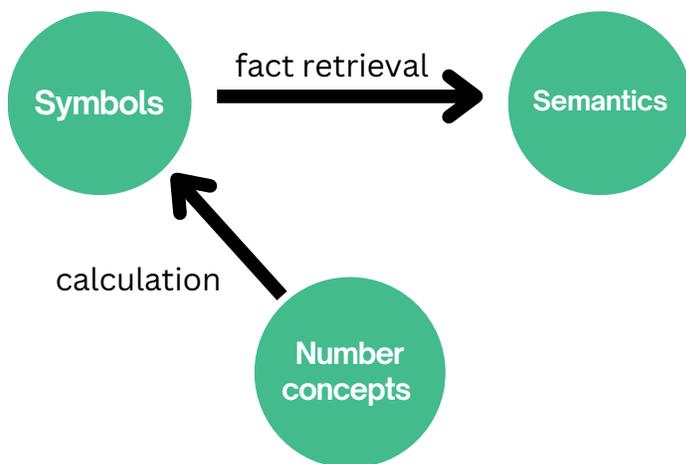


Figure 2: Simple view of mathematics

We will consider the key challenges in math and strategies to help students with DLD in the coming pages.

# MATH CHALLENGES FOR STUDENTS WITH DLD

Students with DLD will struggle with the following four math concepts and skills:

## Language-Heavy Math Tasks

Word problems and instructions require strong language comprehension. Students with DLD may struggle to understand the wording or retain multiple steps.

## Working Memory Strain

Many math tasks, such as multi-step calculations, depend on holding numbers in memory. This can be especially hard for students with DLD, as their working memory is often weaker.

## Math Vocabulary

Words that sound the same but have different meanings (e.g. sum vs. some) may confuse children with DLD. Additionally, words that are used outside everyday context may also cause confusion (e.g. difference, greater than, less than, etc).

## Abstract Concepts

Language difficulties may hinder the ability to grasp abstract mathematical ideas, such as fractions, decimals, percentages, etc.



# CLASSROOM STRATEGIES

## How to Teach Literacy and Vocabulary in Math

- 1 Explain** - explain the term using familiar language and provide everyday examples (e.g., probability - flipping a coin - 50% chance)
- 2 Reinstate** - ask students to explain the term to each other in small groups and create an example
- 3 Show** - tell students to draw a visual representation of the word and ask them to explain
- 4 Discuss** - tell students to discuss the word with peers and instruct them to think of similar words (e.g., chance vs. probability)
- 5 Reflect** - students are encouraged to reflect on their original understanding (from step 2) and make any necessary changes
- 6 Play** - students should have a good understanding of the word now, therefore play a game that encourages them to demonstrate their understanding (e.g., jeopardy)

## How to support Language in the Classroom

- **Direction** - when teaching, it is important to face the child so your speech is clearer and the importance of certain words are conveyed.
- **Clear statements** - ensure all statements are clear and explicit. For example, instead of saying “*what is the answer to this question on the board*” say “*what does  $2 + 2$  equal?*”
- **Repetition** - give the initial instructions to class and then go back and repeat/rephrase the instructions one step at a time. Ensure you are clearly stating the instructions.
- **Multimodal Supports** - use different ways to teach your lesson. Ensure you provide your verbal lessons with pictures and gestures (e.g. *a number line*). Use a visual graphic organizer to help with lessons and write down key words.
- **Provide Key Definitions** - Repeating key words necessary for the lesson in a consistent context. Have a list of key words with the definition or example to allow the child with DLD to return to if necessary.



# CLASSROOM STRATEGIES SPECIFIC TO MATH

## Strategies to use for Math Word Problems:

**Simplify Language**

Rewrite word problems in shorter sentences and use familiar vocabulary.

**Chunk information**

Break the word problem into smaller parts and guide student through each step

**Graphic Organizer**

Use a graphic organizer to help lay out each step of the problem. This helps organize each step and limits confusion.

**Math Vocabulary**

Teach vocabulary and symbols needed in math explicitly. Keep a poster of signs on the wall to help remind students.

## **Mathematical Abilities in Children with Developmental Language Disorder (2019)**

By: Alexandra M. Cross, Marc F. Joanisse, and Lisa M.D. Archibald

This study demonstrates that students with a developmental language disorder struggled with mathematical tasks that had a higher demand for language (i.e. word problems). They performed lower than their typically developing peers on story problem tasks, counting, number transcoding, and arithmetic. Therefore, it is key to provide early intervention with extra modalities of teaching in math classes.

# WORD PROBLEM GRAPHIC ORGANIZER

## Step 1: Read

Write the problem below

Circle the important numbers

Highlight the question

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## Step 2: Plan

What operation will you use? (e.g., addition, subtraction, multiplication, division)

Write the equation to solve below:

## Step 3: Solve

Show your work below:

Remember to use tools like number lines to help you

## Step 4: Check

Is your answer reasonable? Why or why not?

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