Strategies to Support Students with Learning Disabilities in Math

By: Patricia Cortez, Lamees Mosam, Faith Orlans and Leah Snider

How Learning Disabilities Affect Math

- Deficits in working memory affect counting span
- Poor representational ability has been linked to poor word problem-solving performance
- Those with learning disabilities can have difficulty with expressive communication, which can hinder them from asking questions to clarify any difficulties they have in understanding and learning math.

Types of Learning Disabilities/Difficulties in Math

- Spatial Acalculia
  - Difficulty aligning numerals
  - Difficulty reading operational signs
- Estimating quantities
- Memorizing basic number facts
- Grasping math concepts
- Developing efficient memory strategies
- Consistent calculations
- Sequencing of steps
- Single-digit processing (accessing the meaning of symbols)
- Deficits in multi-digit skills (number system knowledge - how number are related)

How to Identify a Math Difficulty

- Awareness of place value
- Deficits in domain general factors (i.e. processing speed) AND numerical factors (i.e. number estimation)
- Poor arithmetic performance WITH average intelligence
- Trouble subitizing - can only count items in small collections
- Impulsive behaviour when faced with multi-step problems (randomly combine number rather than implement a step by step strategy)

General Strategies to Help Students in Math

- Explicit instruction (in selecting, applying, monitoring, and evaluating the use of strategies when solving word problems)
- Structured lessons on the use of visual representations (for problem solving)
- Avoid memory overload
- Review skills you've taught within a day or two
- Provide supervised practice
- Make learning meaningful
- Reduce processing demands
- Use visual/auditory examples AND real-life situations during math instruction
- Age-appropriate games
- Use graph paper for math problems
- Have students track their progress
- Use manipulatives/technology

Specific Strategies to Help Students in Math

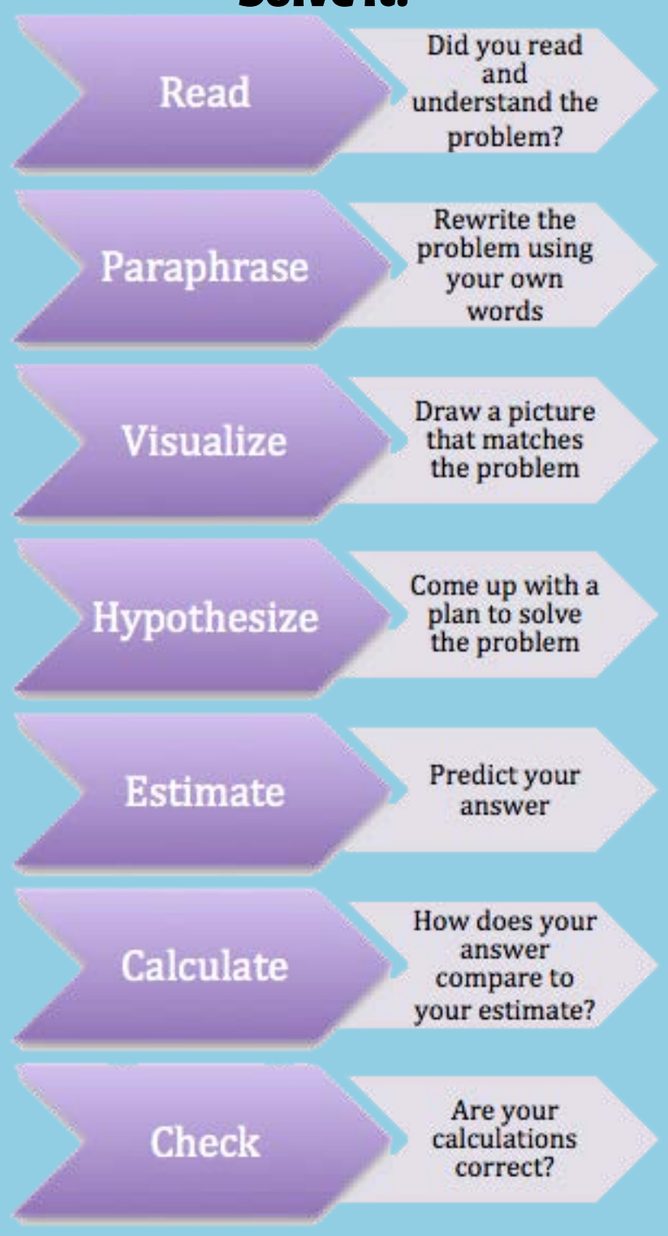
Number Lines

The goal of the number line is for students with Learning Disabilities to gradually shift their attention from thinking about a problem to thinking about the numbers involved in the question and how to use the numbers to solve it.

- Helps to bridge the gap between reading the question and understanding mathematically how to solve it
- Students need to underline the important information when creating a number line, irrelevant information should be crossed out to make it clearer
- Having too much information in the number line will make it confusing and will ultimately lead to the wrong answer
- Number lines are created by students, they help to create very meaningful representations and help to reduce the difficulty of the problem, therefore students are able to complete word problems at a faster pace
- Student progress needs to be monitored and assessed throughout the implementation of this strategy so that instruction may be adapted and tailored according to the students' needs

(Gonsalves & Krawec, 2014)

Solve it!



Students who have difficulties in math often struggle with the cognitive and metacognitive processes that are required for problem solving.

(Montague, Warger and Morgan, 2000)

Peer Tutoring

Students with learning difficulties are paired together and exchange the roles of tutor and tutee as they work together on math concepts. Such a system is effective as it allows for individual attention, as well as immediate feedback.

Students with learning disabilities may have challenges with expressive communication skills, which may affect their ability to ask questions to aid their understanding. Therefore, communication scaffolding tools such as guided sentences and prompts are provided for both tutor and tutee to use with one another, such as "Do you want some help?" and "What is the meaning of this equation?".

Structured peer tutoring was found to:

- promote helping behaviour
- improve conceptual math skills

Improve performance across the 3 R's

Studies have found that pairing with a more knowledgeable other, like an older student, also significantly improved students' proficiency in math.

(Tsuei, 2014; Gersten et al., 2009; Cowan & Powell, 2014).

References

Cowan, R., & Powell, D. (2014). The contributions of domain-general and numerical factors to third-grade arithmetic skills and mathematical learning disability. Journal of Educational Psychology, 106(1), 214-229.

Gersten, R., Chard, D.J., Jayanthi, M., Baker, S.K., Morphy, P., & Flojo, J. (2009). Mathematics instruction for students with learning disabilities: A meta-analysis of instructional components. Review of Education Research, 79(3), 1202-1242.

Gonsalves, N., & Krawec, J. (2014). Using number lines to solve math word problems: A strategy for students with learning disabilities. Learning Disabilities Research & Practice, 29(4), 160-170. doi:10.1111/ldrp.12042

Learning Disabilities Association of Ontario. (2019). Learn About LDs: Mathematics and LDs. Retrieved from https://www.ldatschool.ca/learn-about-lds/mathematics-lds/.

Montague, M., Warger, C. & Morgan, T. (2000). Solve It! Strategy instruction to improve mathematical problem solving. Learning Disabilities Research and Practice, 15, 110-116. Retrieved from https://search-proquest-com.myaccess.library.utoronto.ca/docview/62437802/71CE1A4F4BE641F7PQ/1?accountid=14771

Toll, S. W. M., Van der Ven, S. H. G., Kroesbergen, E. H., & Van Luit, J. E. H. (2011). Executive functions as predictors of math learning disabilities. Journal of Learning Disabilities, 44(6), 521-532. Retrieved from https://journals-scholarsportal-info.myaccess.library.utoronto.ca/pdf/00222194/v44i0006/521_efapomld.xml

Tsuei, M. (2014). Mathematics synchronous peer tutoring system for students with learning disabilities. Educational Technology & Society, 17(1), 115-127