The Help Group HelpLetter

EMERGING TRENDS IN AUTISM, LEARNING DISABILITIES AND ADHD

The Origins of a Math Disability

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Despite the common belief that a Math Disability (MD) is primarily associated with deficits in nonverbal learning, research shows that most students do poorly in math due to a combination of challenges. The importance of these research findings is relevant to how academic teams assess the origin of a student's MD. Proper assessment is essential to providing appropriate treatment throughout the child's school-age years. The following summarizes the deficit areas associated with math disabilities and offers guidelines to assist teams in providing more specified treatments.

Prevalence of Math Disabilities

Most research on Math Disabilities report consistent prevalence and prognostic rates. Problems with math occur in about 6% of children and are persistent over time, with one study reporting that 95% of children with MD in Grade 5 continued to show evidence of MD in Grade 11. Poor math skills significantly impact everyday life and future opportunities for employment, levels of income, and productivity.

The National Assessment of Educational Progress, a survey of The Nation's Report Card in 2005, reported that 64% of fourth-grade students failed to demonstrate a "proficient" level of required math skills. Moreover, the National Research Council of the National Academy of Sciences reported in 1999 that very few interventions have been successful in increasing mathematics scores in low-performing children. The Council concluded that the failure of the interventions was a consequence of a lack of understanding that different types of MD necessitated different types of interventions.

Common Learning Problems associated with Math Disabilities

Four deficit areas have been identified in Math Disabilities. To intervene effectively, each deficit area requires a type-specific intervention.

Type 1 – The Traditional View: Difficulties with Visual-Spatial Processing

Some students struggle to understand their visual world, which can have a significantly negative impact on understanding math concepts. While this deficit is actually only

observed in a small subset of students, teachers and others in the academic community are often trained that this difficulty in processing nonverbal information is the core deficit in math disabilities.

Students with significant difficulties in visual-spatial processing sometimes meet criteria for a Nonverbal Learning Disability (NVLD). These children also have difficulty with certain areas of math, for example, reading a map or telling time. However, not all areas of math are impacted. A recent study by Russell Barkley, one of the originators of the NVLD profile, reveals that children with NVLD can demonstrate proficient math abilities when performing certain types of math tasks, especially those that draw on their robust verbal skills. In fact, students with NVLD were found to be equally proficient to their normative peers in learning multiplication facts.

Thus, accommodations might include teaching students to use verbal skills or other multimodal strategies to understand math concepts requiring visualization.

Type II – Difficulties with Retrieval of Math Facts

Poor math fact retrieval is frequently reported by parents of children with MD. They often describe that their child has trouble recalling math facts on command, such as multiplication coefficients. Difficulties with memory recall are also characterized by poor retrieval of procedural facts. Procedural knowledge includes the understanding of algorithms, or the step-by-step procedures needed to perform calculations. As procedures become more familiar and developed, they may be represented by knowledge of repetitiously learned arithmetic facts retrieved from long-term memory (e.g., 3 + 2 = 5).

Research indicates that some students with MD make errors because they have difficulty retrieving, or remembering how to calculate the solution, as opposed to making errors based on calculation. Panagiotis Simon (2007) studied three groups of children, a group with math disabilities, a group with overall poor achievement and a group of typically achieving students. While all three groups made errors in math calculation, the MD group had the most difficulty with recalling the sequence needed to complete the math task. Anecdotal assessment of common academic tests such as the Woodcock-Johnson III Tests of Achievement often reveals that a student understands the question and can apply the correct algorithm to complete the operation, but their efforts are negatively affected by poor recall of multiplication facts.

Unlike Type 1, these students do not require alternative instruction to understand the concept, instead they need help with memory retrieval; a factor that may also be pervasive in other academic domains. Accommodations such as the use of a calculator and sequenced index cards are often helpful.

Type III – Inefficient Problem Solving

Some students with MD have difficulty solving math problems efficiently. They may understand the concepts and know their facts, but they cannot apply them in a timely or efficient manner. For example, a student may be able to calculate an answer to a math problem if it is written in a numeric format, but not if it is written within a story, or word problem. In this case, a student may know that 4 x 6 = 24, but may have trouble determining the answer to, "If four people each have six dollars, how much money do they have altogether?" These types of challenges are usually centered on inefficient efforts in calculation. This child could use addition to solve this problem, but multiplication would be a more efficient means of acquiring the correct result.

Inefficiency in problem solving is often related to deficits in executive functioning. Executive functioning is defined as a cluster of higher-order capacities, which include selective attention, behavioral planning and response inhibition, and the manipulation of information in problem-solving tasks. Math requires a complex set of attention factors and often taxes those with executive functioning deficits.

These students require practice on the efficiency of problem solving. Time spent on preparing to solve problems will yield better results than time spent on memorizing math facts. For example, students would benefit from highlighting all of the problems on a page that could be solved using the same procedures.

Type IV – Difficulties with Attention to Detail

Mistakes caused by inattention can derail a student's performance on math tasks. In fact, analysis reveals that minor calculation errors are often the cause of incorrect problem solving. For example, students may misalign a long division problem and wind up with an error in calculation. These types of minor errors are not attributed to misconceptualization, inefficiency or poor memory retrieval, but rather inattention to the details.

Lynn Fuchs (2007) found that attention, or distractibility, as rated by classroom teachers, was the most robust predictor of poor math performance. In other words, nonverbal conceptualization, memory, and executive functioning are all less predictive of poor math achievement than the ability of a student to regulate their attention. Students with poor attention to detail often do not check their work, or will sacrifice accuracy for speed.

These students need frequent reminders to check their work. Helpful math exercises should include practice checking for mistakes, predicting an answer before attempting the calculation, and predicting the types of errors inherent in certain math calculation. As with groups II and III, they do not need to reconceptualize math problems, they just need to slow down and utilize strategies to check their work.

In Conclusion

Math Disabilities are a prevalent and pervasive syndrome that will affect an individual's ability to function independently and effectively throughout the lifespan. Most clinicians trained to assess Math Disabilities usually focus on processing issues, such as nonverbal processing disorders. However, a review of the literature suggests that MD is a much more diverse experience, with at least four types of recognizable deficits. Some children have difficulties with retrieval of facts or sequences, some cannot apply the correct sequence efficiently, and some make minor errors which are undetected due to inattention. Interestingly, three out of the four categories have more to do with attention than they do with the processing of nonverbal information.

Assessment of the types of errors that individual students make in math is vital to providing the appropriate set of interventions. Unlike reading or writing, practice alone cannot result in change. However, interventions that remediate areas specific to a child's type of Math Disability result in the most effective treatment.