

Math Learning Disabilities (MLD) and Teaching Students with MLD

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Abstract Mostly of students have difficulties in mathematics but some of them are born with those problems and are classify at the group of students with Math Learning Disabilities. This paper will give definition of MLD, types of dyscalculia, factors that cause it like: heredity, problems during pregnancy and birth, incidents after birth etc, and will give some strategies that are used for teaching students with Math Learning Disabilities. Some of those strategies are: involve students in Goal- Setting, Provide Advance Organizer, model strategic Behavior and Thinking, reinforce strategy application through Feedback, Relationships and Rules, Mnemonic Strategies, giving MLD students homework etc. This mean that, even that LD is lifelong issue, if parents and others professionals discover a child's learning disability early and provide the right kind of help, it can give the child a chance to develop skills needed to lead a successful and productive life.

Key- words Learning Disability (LD), Math Learning Disability (MLD), Dyslexia, Dyscalculia, Dysgraphia.

1. Learning Disability definition, symptoms and factors that cause it

1.1. Learning Disability(LD)- general definition

Learning Disabilities, as opposed to other disabilities such as vision impairment or paralysis, are invisible- or considered a hidden handicap. For this reason they tend to be misunderstood and their impact underestimated. Because learning disabilities cannot be seen, they often go undetected.

Recognizing a learning disabilities is even more difficult because they severity and characteristics vary. Learning disabilities vary from person to person. One person with LD may not have the same kind of learning problems as other person with LD.

LD is neurobiological disorder that affects the brain's ability to receive, process, store, express, and respond to information. With LD a person's brain works or is structured differently to think and remember. Learning disabilities can affect a person's ability to speak, listen, read, write, spell, reason, recall, organize information and calculate.

It is important to be shown that persons with LD are not "lazy" or "dumb". In fact, they usually have average or above average intelligence often they fall within the range of "gifted". Their brains just process information differently.

Since 1976, the number of students identified with LD has more than doubled; there are 3 boys for every 1 girl challenged by LD (Garett, 1998).

1.1.1 Common Learning Disabilities

Dyslexia- a language based disability; in which a person has trouble understanding words, sentences, or paragraphs.

Dyscalculia- a mathematical disability in which a person has a difficult time solving arithmetic problems and grasping math concepts.

Dysgraphia- a writing disability in which finds it hard to form letters or write within a defined space.

1.1.2 Math Learning Disabilities definition

The concept of dyscalculia is less well known. This article describe this term.

Individuals display a mathematics disability when their performance on standardized calculation tests or on numerical reasoning tasks is significantly depressed, given their age, education and intellectual reasoning ability (Mental Disorders IV (DSM IV)). When this loss of ability to calculate is due to cerebral trauma, the condition is called acalculia or acquired dyscalculia. Mathematical learning difficult that share features with acquired dyscalculia but without evidence of cerebral trauma are referred to as developmental dyscalculia (Haughes, Kolstad and Briggs, 1994). The focus of this review is on developmental dyscalculia (DD). Students who show DD have difficulty recalling number facts and completing numerical calculations. They also show chronic difficulties with numerical processing skills such recognizing number symbols,

writing numbers or naming written numerals and applying procedures correctly ((Gordon, 1992). They may have low self efficacy and selective attention difficulties (Gross Tsur, Auerbach, Manor & Shalve, 1996))

Not all students who display low mathematics achievement have DD. Mathematics underachievement can be to a range of causes, for example, lack of motivation or interest in learning mathematics, low self efficacy, high anxiety, and inappropriate earlier teaching or poor school attendance. It can also be due to generalized poor learning capacity, immature general ability, severe language disorders or sensory processing. Underachievement due to DD has a neuropsychological foundation. The students lack particular strategies necessary for acquiring and using arithmetic knowledge. They can learn successfully in most contexts and have relevant general language and sensory processing. They also have access to a curriculum from which their peers learn successfully.

Types of dyscalculia.- In order to discuss the types of dyscalculia that have been reported, it is useful to examine the areas of activity in which individuals completing an arithmetic task need to engage. As a first approximation, pupils need to manipulate the numerical information defining the task in the following ways; they need to:

- (1) read the data defining the task; this includes naming correctly each arithmetic symbol, including multi digit numbers, comprehending or retrieving its meaning, combining the meanings in the intended ways and discriminating relevant from irrelevant data,
- (2) decide what the acceptable outcome will be like,
- (3) link the task with earlier learning,
- (4) recall and apply appropriate procedures to the data given,
- (5) recall particular number facts,
- (6) manage, plan, monitor and evaluate the effectiveness of their efforts, and if these are judged to have been unsuccessful, to re work the task.

In a landmark article, Kosci (1974) identified six types of DD. Subsequent investigators, for example, Rosselli and Ardila (1997), have validated them. These types are:

- a difficulty using mathematical concepts in oral language, talking about mathematical relationships sensibly (verbal dyscalculia, Kosci (1974); aphasic acalculia, Rosselli & Ardila (1997)). Kosci noted two aspects of this type of dyscalculia : a difficulty (1) identifying spoken numerals (although the individuals could read the numerals, and (2) recalling the name of a quantity (although they could read and write the number).
- difficulty manipulating concrete materials, or enumerating a quantity. The difficulty here seemed to involve converting one's arithmetic knowledge to actions or procedures in relation to quantities (practognostic dyscalculia, Kosci (1974); spatial acalculia, Rosselli & Ardila (1997)).
- a difficulty reading mathematics symbols such as numerals (lexical dyscalculia, Kosci (1974); alexic acalculia, Rosselli & Ardila (1997)). Students with this difficulty can talk about mathematics ideas and comprehend them in oral discussion but have difficulty reading both individual symbols and number sentences.
- a difficulty writing mathematics symbols: (graphical dyscalculia, Kosci (1974); agraphic acalculia, Rosselli & Ardila (1997)). Students can comprehend mathematics ideas in oral discussion and can read numerical information but have difficulty writing their understanding in math's symbolism.
- a difficulty understanding math's ideas and relationships; (ideognostic dyscalculia, Kosci (1974); anarithmetia, Rosselli & Ardila (1997)).
- a difficulty performing specified mathematical operations; (operational dyscalculia, Kosci (1974); frontal acalculia, Rosselli & Ardila (1997)).

Any one student does not necessarily show all areas of difficulty. Any of the six types may occur, either in isolation or in combination.

1.2 Symptoms and factors that cause math learning disability

1.2.1 Symptoms (characteristics)

There are wide varieties of characteristics a student with a math learning disability may display. Some examples are: Does not remember and/ or retrieve math facts; does not use visual imagery effectively; has a visual- spatial deficit; is confused with math operations especially multi- step processes; and has a difficulty in language processing that may affect the ability to complete math problem solving.

Note: Students with LD may also show signs of anxiety or anger, due to stress caused by their inability to learn at a pace similar to their peers. In addition, learning disabled students tend to be forgetful, unorganized, and have difficulty maintaining a schedule

1.2.2 Factors that cause it

There is no single proven cause for a learning disability. Sometimes, there are many factors working together, other times the cause is entirely unknown.

The three general categories of causation can be classified as:

- 1) Heredity,
- 2) Problems during pregnancy and birth,
- 3) Incidents after birth.

2. Strategies for teaching MLD students

There is a range of math difficulties that students with learning disabilities can experience. Some students have difficulty with mathematical problem solving, or the kind of thinking needed to work out mathematics problems.

Students who have difficulties with sustaining attention may jump around and not perform the problem in a linear or organized method. For that the teacher is the primary person that helps students to exceed those difficulties.

At the teaching process it is important to keep student's attention. For that teacher should:

- Call upon students at random to read from books or to carry out examples on the chalkboard. This will force them to closely follow along, not knowing when their attention will be tested.

Note: Teachers should never set out to embarrass students by calling on them to read difficult passages or asking them to work a problem that they are clearly unable to do; further embarrassment and frustration might ensue and is clearly not a desirable result.

- Use students' names in examples during lectures. Hearing one's own name or a fellow student's name called and/or referred to, can immediately bring a student's attention back to the lesson.
- Move around the classroom to draw their student's attention. This action will prove to show that when the teacher is more involved with their students, they will find that their students are paying closer attention to the lesson at hand. Mobility around the classroom can also give the teacher a chance to see if the students are following along and/or taking appropriate notes.

Teaching students to use specific strategies help them learn how to approach mathematical tasks in a logical manner. We will give some of those strategies like:

2.1. Involve students in Goal- Setting

It is important that teachers seek ways to help students become more proactive and involved in planning their academic program. Certainly, one way to do so is to involve students in establishing math goals.

The teacher's primary role in the goal-setting process is to make sure that the goals are high enough, yet realistic for the student to achieve. Figure 1 (Susan P. Miller, Sherri Strawser & Cecil D. Mercer) lists suggestions for implementing a goal-setting conference

Figure 1. Goal-Setting Conference Suggestions

- Allow adequate time for the goal-setting conference (e.g., 10 to 15 minutes).
- Arrange to conference with students in a place that does not permit others to overhear.
- Encourage students to do most of the talking, that is, LISTEN!
- Begin the session by guiding students through a self-evaluation of their progress.
- Listen to students' ideas without interruptions or judgmental comments.

- If necessary, lead the students to revise their goals realistically by asking open-ended questions.
- Encourage students to set goals in skills at the acquisition, proficiency, and maintenance levels of learning. Students may refer to these goals as easy, average, and difficult goals.
- Record the results of the conference and provide copies for students. You may wish to develop a form for the conference that has space to record:
the time frame for the goals self-evaluation of progress in "easy" skills self-evaluation of progress in "average" skills self-evaluation of progress in "difficult" skills amount of time spent working on each skill prerequisite skills that they did not have goals for "easy, average, and difficult" skills amount of time they plan to work on each skill.

2.2. Provide Advance Organizers

Advance organizers provided at the beginning of a math lesson help students prepare for instruction. Typically, a verbal advance organizer tells the student what the lesson is going to be about, provides a rationale for learning the content, and ties the current lesson to previous learning. Advance organizers also can include prompts and cues for the student to use particular math strategies. Sample verbal advance organizers are presented in Table 1 (Susan P. Miller, Sherri Strawser & Cecil D. Mercer).

Sample Advance Organizers

"Remember yesterday when we learned to multiply using plates and bingo chips? Well, today we are going to learn how to multiply using plates and cubes. The problems will be the same type we did yesterday, so I know you'll be successful. Who can tell me about the adding-on strategy that we learned to save us time? . . . Good remembering! We'll use that strategy again today. Who remembers why it is important to learn to multiply? . . . Yes, those are good reasons."

2.3. Model Strategic Behavior and Thinking

Modeling is used frequently in mathematics instruction to show students how to perform a variety of algorithms. Specifically, the teacher writes a problem on the chalk board and then proceeds to solve it while the students watch. Modeling also can be used to show students how to use strategies that help them solve unknown problems. Modeling of this type involves showing students the strategy and letting them hear the related cognitive processes by "thinking aloud." In other words, the teacher demonstrates the steps to the strategy while verbalizing the related thinking.

2.4. Reinforce strategy application through Feedback

Once students have learned a new math strategy, it is important to reinforce the use of the strategy. Elaborated feedback routines are excellent opportunities for teachers to provide prompts or necessary re teaching when students fail to use a strategy and, consequently, make errors on their math work. Feedback routines are also useful for reinforcing students who used a strategy successfully and thus figured out some difficult problems. Figure 2 (Susan P. Miller, Sherri Strawser & Cecil D. Mercer) illustrates this process.

Examples of Strategy Use and Feedback

- Make at least one positive statement about the student's work, thinking pattern, or effort.
"I am very proud that you worked on your math for the whole independent work period today... Good job!"
- Specify the student's error pattern by focusing on the type or content of the error. Avoid using the word "you."
"When zero is added to any number, the answer is the number" instead of "For most of these problems, you didn't remember the rule for adding zero."
Demonstrate the correct completion of the problem using one of the strategies the student has been taught.
"I will show you how to do these problems. Look at the first problem. It says '5 plus 0 is how many?' Because the first number is 5, I start by counting 5 tallies. Then, because the second number is 0, I don't count any more tallies, which is the same as counting nothing. The answer is all of the tallies I have counted. I have counted 5 so the answer to the problem, 5 plus 0, is 5."
- Give the student opportunity to practice.
"Now please do the rest of the problems on the worksheet using the strategy."

- End with a positive comment about the student's performance and your expectations for future success with similar problems.

"Good job adding 0 in all the problems. I am sure you will use the strategy for all the problems in which a 0 is added to other numbers."

2.5. Relationships and Rules

When teaching mathematics to students with LD it is helpful to teach relationships and rules. Students can use relationships and rules to figure out challenging problems.

Math rules, such as any number divided by itself is one, also can help students determine problem answers when their memory fails them.

Figures 3 and 4 (Susan P. Miller, Sherri Strawser & Cecil D. Mercer) outline a variety of rules and relationships that students can use to help find solutions to unknown problems.

Examples of Mathematical Rules

Rules

Addition

- Any number plus zero is the number.
- Any number plus 1 is the next larger number.
- The order of numbers in an addition problem doesn't change the answer.

Subtraction

- Any number take away zero is the number.
- Any number take away the same number is zero.
- Any number take away 1 is the next smaller number.
- In subtraction, when the bottom number in the ones column is bigger than the top number in the ones column, the ten is traded. (Bigger number on Bottom means Break down the ten and trade).

Multiplication

- Any number times 0 equals 0.
- Any number times 1 equals the original number.
- 2 times any number equals the number added to itself.
- Changing the order of the numbers in multiplication does not change the answer.

Division

- 0 divided by any number equals 0.
- Any number divided by 1 equals the number.
- Any number divided by the same number equals 1.

Examples of Mathematical Relationships

Relationships

Addition & Subtraction

Addition and subtraction facts have the same numbers, but in different order.

$$\begin{array}{r} 9 \\ +4 \\ \hline 13 \end{array} \quad \begin{array}{r} 13 \\ -9 \\ \hline 4 \end{array} \quad \begin{array}{r} 13 \\ -4 \\ \hline 9 \end{array}$$

Because addition and subtraction are related, you always can state a subtraction problem as an addition problem.

$$\begin{array}{r} 14 \\ -8 \\ \hline \square \end{array} \quad \begin{array}{r} \square \\ +8 \\ \hline 14 \end{array}$$

To check a subtraction answer, add your answer to the number that is being subtracted. If the sum of these two numbers equals the top number in the subtraction problem, your answer is correct.

$$\begin{array}{r} 13 \\ - 5 \\ \hline 8 \end{array} \qquad \begin{array}{r} 8 \\ + 5 \\ \hline 13 \end{array}$$

Multiplication & Division

Multiplication and division facts have the same numbers, just in different order.

$$\begin{array}{r} 7 \times 6 = 42 \\ 42 \div 6 = 7 \\ 42 \div 7 = 6 \end{array}$$

Because multiplication and division are related, you can always state division problems as multiplication problems.

$$\begin{array}{r} 56 \div 7 = \square \\ \square \times 7 = 56 \end{array}$$

To check a division answer, multiply your answer by the number that the total is being divided by. If the answer to this multiplication problem equals the total, your answer is correct.

$$\begin{array}{r} 24 \div 8 = 3 \\ 3 \times 8 = 24 \end{array}$$

2.6. Mnemonic Strategies

Mnemonic strategies involve procedures that can be used to improve initial learning and later recall of important math information. Acronym mnemonics (i.e., forming a word from the initial letters of other words) used in mathematics can cue students to the steps involved in solving computation and word problems (Miller & Mercer, 1993). Research has shown that mnemonic memory devices are helpful for students with LD (Scruggs & Mastropieri, 1990; Watanabe, 1991). Table 2 (Susan P. Miller, Sherri Strawser & Cecil D. Mercer) lists several acronym mnemonics that can be used for math instruction.

Table 2. Acronym Mnemonic Devices Designed to Facilitate Memory

DRAW (Miller & Mercer, 1993)

Discover the sign.

Read the problem.

Answer or draw and check.

Write the answer.

FAST DRAW (Mercer & Miller, 1992B)

Find what you're solving for.

Ask yourself, "What are the parts of the problem?"

Set up the numbers.

Tie down the sign.

(DRAW steps are the same as above).

SIGNS (Watanabe, 1991)

Survey question.

Identify key words & labels.

Graphically draw problem.

Note operation(s) needed.

Solve and check problem.

SOLVE (Miller & Mercer, 1993)

See the sign.

Observe and answer (if unable to answer, keep going).

Look and draw.

Verify our answer.

Enter your answer.

3.7 Writing assignments on board

This is one strategy that I use with my students with Math Learning Disability and it is working well because students have positive results on their math learning. It works like this: Write rulers ore key things of lecture on the chalkboard. Figure 5 give one example.

Figure 5. Example of Writing Assignments

Multiplication Signs

+ · + = +
 - · - = +
 - · + = -
 + · - = -

Homework is also very important for students with MLD. It is important teacher to:

- Write assignments on the chalkboard as soon as they are assigned so that questions may be addressed and misunderstandings can be reduced.
- Periodically reminded students of what is expected of them and when it is due, so that M LD students form a *habit* of doing their schoolwork. This process not only helps MLD students to remember to do their work, but it also increases their chances of accurately completing assignments.
- Help students with a Math Learning Disability begin their homework during class if possible. This is assuredly not meant to decrease the amount of time spent at home on schoolwork, but to simply assure the teacher that MLD students are prepared enough to work on their assignments independently.

3. Conclusion

The good news about math learning disabilities is that scientists are learning more every day. Their researches provide hope and direction. It parents, teachers and other professionals discover a child's learning disability early and provide the right kind of help, and it can give the child a chance to develop skills needed to lead a successful and productive life. Even that LD is a lifelong issue, I think that it can manage and the primary role is the role of the teacher.

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