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Reading, writing and mathematics learning disabilities

Dyslexia, Dysgraphia, Dysorthographia, Dyscalculia

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Abstract:

Dyslexia, Dysgraphia, Dysorthographia and Dyscalculia are specific learning disabilities caused by a neurological disorder. This paper presents short definitions for each of them, describes their characteristics adding day to day examples and explores intervention best practices. And in the process, attempts to dismantle myths and stereotypes about individuals that suffer from this difficulties, showing that they are not doomed to fall behind if provided with specialized support.

Keywords: Dyslexia, Dysgraphia, Dysorthographia, Dyscalculia

Specific Learning Disabilities

Specific learning disabilities (or learning disorders) are a generic term for a variety of constrains that affects individuals in reading and writing processes and in mathematics related tasks. Making things even worst, some individuals may suffer from more than one of these conditions.

Children with specific learning disabilities have a neurological disorder that interferes in the way their brains collects and processes information (Cruz, 2009). These kids aren't "dumb" or "lazy"; on the contrary, there are cases in which they exhibit better performance than their classmates in specific subjects. The problem is that there's frequently a discrepancy between their IQ (Intelligence Quotient) and what they can actually do in an academic sense (Correia, 2008); their IQ can be average or superior but despite of that they show unexpected problems in learning how to read, write and make math

operations.

Specific learning disabilities are lifelong conditions, they'll persist even if individuals are provided with the ideal support/intervention. But that shouldn't work as an excuse to indifference because it doesn't mean children can't succeed. They "just" need to be taught to understand their condition(s) nature, learn how to mitigate it and persevere on doing so.

This can be harder to do than one might think, though, because children with learning disabilities are often shy and sad, have a low self–concept/self–esteem and, in some occasions, display interpersonal relationship problems. Therefore, it's crucial that family and all educational professionals working with them (teacher, psychologist, therapist. . .) can help in the process and also contribute their vocations and fields of study they can master. Check Leonardo da Vinci, Thomas Edison, Albert Einstein or even John Lennon (just no name a few); they were all dyslexics but that didn't prevent them from leaving such different but did not prevent leaving indelible marks in our history.

Dyslexia

reading learning disabilities

From the latin *dis* (deviation) and *lexia* (reading), dyslexia is a learning disability that causes difficulties in the reading process stages.

> It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. International Dyslexia Association, 2002

Dyslexics reading problems are neurological in origin and associated to a deficit in the phonological component of language. Because of a phonemic awareness shortfall (Martins, 2013), diagnosed individuals have a difficult time understanding that words are composed of letters and letters have specific sounds and that complicates the

process of isolating and blending this sounds, therefore affecting learning to read and the instrumental use of reading, regardless of the IQ.

Dyslexics can't distinguish similar–sounding words or words that share common beginning/end sounds, which entails mistakes when reading. Thus, basic learnings such as the alphabet, the days of a week, months and seasons can become huge challenges for these children, who also denote difficulties in remembering names (things, people, animals) and organize sequences, for example when asked to sort images from an story after listening to the text.

And because their condition makes reading so hard, they pronounce words syllable by syllable or letter by letter and stop all the time, which inevitable slows down the process and often makes readings incomprehensible. Due to their phonological deficit and partially as an attempt to surpass their handicaps (practice of guessing), dyslexics have a tendency to add, omit and/or invert some letters from the words ("read" as "red", "wet" as "went", "left" as "felt"), replace letters in similar words (like "home" instead of "house") and to mistake graphically symmetrical letters (like "b" and "d", "p" and "q" or "u" and "n"). Of course, each of these practices contributes to deflect them from the original text and its meaning.

In spoken language, dyslexics have troubles in structuring their thoughts, in the use of proper vocabulary and, sometimes, to understand when someone is speaking to them. Usually, they use simple phrases and, because of their limited vocabulary, resort successively to the same words despite context variations. Choosing the right words to express what they want to say is challenging and repetitions in sentence building are frequent – « We went to the zoo and… » (pause) « We went to the zoo by bus and… » (pause) « We went to the zoo by bus and we saw monsters, I mean, monkeys » (monkeys and monsters have a similar beginning).

Due to the mentioned characteristics, educators should expect dyslexic children to reveal a slow work pace with lots of highs and downs. Don't be surprised if in one occasion a child reads correctly three words in a row and in the next day can't recognize it (Coelho, 2013). Patience is virtue.

But there are some strategies that can and should be used to deal with these difficulties.

In the classroom, dyslexic children can benefit from being seated near the teacher in order that doubts can be addressed as soon as

they emerge. Additionally, teachers should be prepared to identify any distracting stimulus, such as electronic devices or a particular loquacious classmate, and, when possible, take the necessary measures to circumvent this situation. However, the use of spell checking software and authorization to record lessons should be evaluated.

Teachers should weight on the benefits of "pairs work" and promote it (Hennigh, 2003), practice that can be very useful for example if the teacher has a high number of students to assist or can't find enough time to give dyslexic children the additional share of attention they need. Unfortunately, that's the case in Portugal, where schools don't always have the number of special education professionals necessary to do a thorough work with all the children that need it, hence the importance of being able to diversify strategies. And a classmate tutor is a good one to follow.

Regarding students evaluation, it should be understood that dyslexic children will take more time to read and understand the questions and answer them, therefore long and/or complicated questions should be avoided. Adapted tests and oral exams should be an option whenever they are applicable.

And last but by no means least important, there's the empathic bond. Whether that is shown in the form of big smile, a gesture of affection or simply a "high five", dyslexic children can really benefit from the positive reinforcement. Reading is such an hard activity for them that they expect the teacher (or whoever the educator is at a precise moment) to get proud when they succeed in reading a complete sentence or pronouncing one word without pauses. However, educators should be especially careful not to complete the words children are trying to read – that task is their task and it's important that they see and articulate all letters and the respective sounds, otherwise they will not strive. Enormously important is also to refrain from asking dyslexic children to read aloud for classmates, unless they show willingness to do it.

There's never a "too late" to teach a dyslexic; but there are no miraculous solutions either. However, professional individualized intervention and persistence do get results.

Dysgraphia

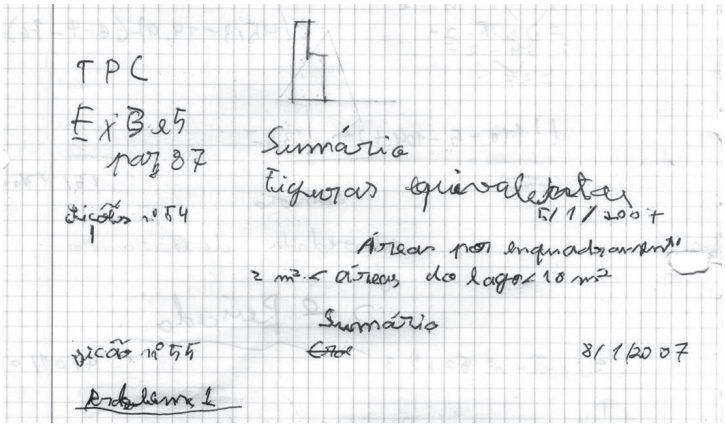
writing learning disabilities

From the latin, *dis* (deviation) and *grafia* (writing), dysgraphia is a neurological condition characterized by poor handwriting notwithstanding an average IQ and the ability to read. Because of the disorder, dysgraphics letters are badly drawn, incoherently sized and inadequately differentiated.

No one that is learning how to write can immediately do a beautiful calligraphy. Everyone experiments difficulties in the process. Who among us has not started by doing just some imprecise sketches? Dysgraphic troubles, however, are of a totally different kind. These individuals draw incomprehensive letters in advanced stages of the writing process learning. Letters are distorted, too big or too small, too thick or too thin (sometimes almost unnoticeable), slanted and erratically spaced (heaped on some occasions, too separate on others). The resulting text is difficult to understand or even unintelligible.

Dysgraphic's notebooks are completely unorganized (cf. fig. 1), showing no respect for lines, strikethroughs and torn pages, "lift writing" (tendency to go up and down) and incoherent use of the sheet size.

Figure 1. Dysgraphic child's Math notebook



Some dysgraphic children have their own special way of holding the pen or pencil (sometimes extremely incorrect) and their writing pace tends to be too fast or too slow. Some of them need a lot of time to write just a few words because they can't execute the writing movements in a mechanized way, hence the ubiquitous tremblings and distortions.

An essential part of helping a dysgraphic to overcome his/her troubles is working on motor development (Torres & Fernández, 2001) which is critical for an improved handwriting. It's important that children assume a correct body posture while writing and train gross/soft motor skills in order to dissociate movements, allowing them, for example, to understand the difference between an A2/A3 sheet (they need to use the arm to draw a circle) and an A4/A5 sheet (they just need to work the wrist). Painting exercises, freehand drawing, circular wrist rotations, outline and fill exercises are advised in this regard.

Visual motor coordination it's another area that has to be worked. Make sure that children look at the results of their writing while doing it, so that they can make real time corrections in the hand movements, preserve their writing inside the margins and on the notebook lines and achieve better drawn letters, appropriately sized and equally spaced. And, of course, an extra mile should be walked to teach children the correct letters shapes, but also to practice their "mental image" of letters.

These tasks will not go without setbacks. Kids will be the first

ones to doubt their capabilities, therefore it's important that educators do exactly the opposite. If the result from a session is an almost unreadable sentence, be sure to praise that perfect letter that probably can be found in the middle of a word. And don't expect abrupt improvements, children will need time to practice and must feel they have it. However, relaxing exercises are a good option in helping to reduce frustration, tension, pressure, stress and anxiety states, which they are sure to suffer from in their not always successful attempts to write better.

Dysorthographia

writing learning disabilities

From the latin, *dis* (deviation) plus *orto* (correct) and *grafia* (writing), dysorthographia is a learning disability characterized by an inability to assimilate grammatical and orthographic rules, consequently affecting spelling, sentence segmentation and phoneme conversion.

Individuals who suffer from this disorder write slowly and hesitantly and their texts display a plethora of spelling mistakes that, in the worst case scenario, makes them almost incomprehensible. They also have troubles to organize, structure and compose correctly texts but, contrary to dysgraphics, have no issues with drawing properly shaped letters. Due to their difficulties in converting phonemes into graphemes, one of dysortographics' main characteristics is their difficulty to transform spoken language into writings. However, troubles associating sounds with letters and words may also be revealed during reading because dysortography can be associated with dyslexia.

Needless is to say that dictations and copies are not recommended exercises for dysortographic children because the former will only serve to confront them with their problems and the later will not necessarily teach them anything.

Common types of misspellings are:

— add, omit and/or invert letters and syllables ("baby"/"bb"; "liberty"/librt");
— phonetic errors ("as" in the place of "has" or "arow" as "arrow");

— confuse letters with a similar sound ("d" instead of "t", "f" instead of "v", "b" instead of a "p");
— change graphically symmetrical letters ("d" and "b", "p" and "q", "u" and "n");
— conjugation and grammar errors ("it's" as "its", "then" as "than", separate words on newline);
— merge or separate letters/syllables/words incorrectly;
— punctuation errors.

Spelling errors are dysortographics most visible challenge, but when working with dysortographic children one needs to take into account less obvious concerns that should help them dealing with the source of their problems, like visual and auditory perception. Some exercises in this respect may be putting together similar/different shapes; find differences in similar images; and identifying sounds (animals, objects, songs with rhymes, sayings that share initial/final consonant).

Of course, intervention in specific misspellings is also needed. It's critical to identify them, explain it to children and work on it. Exercises may involve cutting letters from old magazines/newspapers and use it to write correct sentences on paper cards; isolated phoneme/syllable tasks; and writing word families, among others. Furthermore, educators should make an effort to increase these children vocabulary introducing them to new words and making them comfortable to ask about their meaning. Interpersonal relationship is very important and the more engaged children are in their learning process better the results.

Beyond misspellings, educators should also try to understand if children's incorrect or incomplete written answers are simply due to a lack of knowledge or emanate from difficulties in understanding the questions. Or even from a shortage of time to answer. Dysortographics will often need more time to answer, hence reading the questions aloud for all the class should be considered. As it should oral evaluation and some tolerance to minor importance misspellings.

Dyscalculia

math learning disabilities

From the latin, *dis* (deviation) and *calculare* (calculate), dyscalculia is a « learning disorder that interferes negatively with the math skills of students who, in other aspects, are normal » (Rebelo, 1998, p. 230), a broad term for a lifelong neurological condition that propels a wide range of effects such as the inability to understand and manipulate numbers, symbols and math concepts.

Mathematics is probably the subject that produces the most of fear among students. But for children suffering from dyscalculia things will surely look even more frightening and this condition can not only complicate their academic performance but also have a negative impact on their everyday life.

Dyscalculia characteristics differ from individual to individual and have been associated with visual–spatial and language processing weaknesses and a memory deficit. Some children reveal difficulties remembering numbers and math functions and therefore troubles in automating their recognition and writing. Because of this they'll frequently confuse similar/symmetric numbers, like "3" and "8", "2" and "5" or "17" and "71", "523" and "325". And if asked to organize these numbers in a numeric sequence, mistakes ought to be expected. Recognizing numbers on electronic devices can also be challenging for this children.

Troubles understanding exercises and consequently to decide how to solve them are also common because these children have difficulties understanding math concepts (addition, subtraction, division, and difference, total), rules and formulas – « John has five balls and Antony three balls; how many balls are in total? » can be a challenging exercise if "total" meaning is uncertain (even if they can solve 3 + 5). And if they can decide how to proceed, they often resort to their fingers to help them even in the simplest forms of basic arithmetic operations. Also, educators should be prepared to get answers like: 2 + 5= 10 (confusion between addition and multiplication symbols) or 2 x 5= 100 (confusion between "10" and "100").

Other dyscalculia characteristics are shortage of problem solving strategies, cognitive rigidity and difficulties changing between tasks. These children can have troubles solving an operation like 4 + 2= ? just seconds after solving 2 + 4= 6 or to fin the solution to 2 + 5 immediately after giving the correct result to 2 + 4.

Quantities retention is another problem. When asked to produce the total for a count, dyscalculics will frequently repeat counting instead of providing the sum result. This could be a huge problem when handling money, for example, situations in which dyscalculics have also problems in distinguishing prices or calculating changes.

Reading the time, especially from analog clocks, is also hard; quarters "after" and "to" can easily be confounded.

As a consequence from all the above difficulties, dyscalculics often develop a fear of failure that can be increased by classmates mocking or educators lack of preparation to deal with this disorder, which may lead to additional decreasing of children self–confidence and self–esteem.

Children should still be corrected when giving wrong answers but it's essential that their specific troubles are understood and worked in a proper way. Help, however, should not be mistaken with lack of exigency. Children are the ones who have to do the job, not educators. But it's educator's responsibility to understand when it's time to take a break from individualized work to prevent situations of extreme stress.

Adaptations for classroom work and evaluation may include (but are not limited to) allowing the use of multiplication tables; planning specific activities, including the use of games and concrete objects (wood numbers, magnetics, plastics forms) that children can observe and touch thus providing a tangible image to abstract concepts (example: side, vertex, angle, base, height and area); less exercises with simplification of problem's statements; adding time for problem solving; introduce math software.

And of course, whenever possible it's important that educators can explain with real–life examples why math is so important in children lives, which of course should be a concern when teaching math to any child.

Final considerations

Children with (specific) learning disabilities will need (specialized) support in (specific) matters at some point of their lives and the ones responsible for ensuring equal conditions for academic success must make sure they provide the necessary tools to effectively respond to the task and make a positive difference.

This is particular true for our public institutions that can't disregard these children condition and wash hands from their troubles. On the contrary, our collectively constructed societies are reasonable to expect for the effort and measures that can, to the extent possible, bring us closer to the larger goal of equal opportunities.

But educators have an important role to play in these children lives too. It's crucial that teachers, pedagogues, psychologists and all other professionals who closely relate with them are prepared to understand their problems and take the right steps to, individually or in a joint effort, offer adequate intervention to the (special) needs of their students. And parents, of course, have a particular responsibility that should lead them to learn about their kid's problems to be able to help them and work together with education professionals – schools will work mainly towards delivering learning outcomes but children expect to find (special) understanding and support at home.

No matter your role and how hard your jobs may seem at times they pale in comparison with these children's learning difficulties. Give up can't be an option. For any of us.

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