FROM RESILIENT DYSLEXIA TO FLUENCY.

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Abstract: *Considering teaching students with dyslexia and other learning difficulties, neuroscientists claim that they are the sorts of neurodiversity. Such deficiencies happen due to a neural base and depend on biological and environmental factors. Furthermore, they influence the development of reading skills. In new research presented at the Cognitive Neuroscience Society, scientists report on the factors that cause the risk of developing dyslexia and other learning disorders (LD). Reading is the process when the brain "rewires" neural circuits, which are involved in such tasks as visual and speech processing and attention and cognition. In the light of psycholinguistics, learning language is a complicated cognitive process consisting of language perception, acquisition, and production. This article revises teaching English, considering learning psychology, neuroscience, linguistics, and appropriate methods to train working memory and other ways to overcome learning difficulties (LD). It will also describe three cases of success of very challenging students.*

Keywords: *neurolinguistics, neuroscience, psycholinguistics, dyslexia, learning difficulties, working memory.*

Introduction

Educators have always tried to discover why some students learn quickly while others struggle with reading, writing, and decoding; even multiple training does not always work. Dr. Patael from Tel Aviv University has researched some children with resilient dyslexia to find out whether their brain structures differ from the ones in neurotypical kids. He hypnotized whether the success in reading depended on the density of neurons in a specific region of the brain. (The Science of Psychotherapy, 2018). Scientists scanned young children's brains for MRI to find the answer to this question and tested their reading ability three years later. They found that a higher density of neurons in three-year-old kids indicated their potential abilities to read at an older age.

The research claims that psycholinguistics today is one of the first scientific areas to talk about the close relationship between language, speech, thinking, and human consciousness. This discipline investigates working memory, the psychological processes involved in learning and using a language, and its general comprehension, production, and first and second language acquisition. (Kennison, 2017). Therefore, it will help find potential problems with dyslexia and teach students with resilient dyslexia appropriately with the help of neurobiological and psycholinguistic support.

Training working memory is crucial while teaching dyslexic students. It is a set of processes that allow us to store and temporarily use the information to perform complex cognitive tasks such as understanding speech, reading, applying mathematical abilities, learning, or reasoning. Working memory is a type of short-term memory. Thanks to working memory, we can correlate new knowledge with previously acquired ones, which enables us to learn and keep information in mind. (Bailey, 2022). Working memory is essential for decision-making and the correct functioning of executive functions. Therefore, its impairment is associated with deregulatory syndrome and various learning disorders such as ADHD and dyslexia or dyscalculia. Many specialists in psychological and pedagogical diagnostics need neuropsychological testing tools that can be used to measure executive functions accurately (Dingfelder, 2005).

Dyslexia in light of neuroscience.

Dyslexia is a reading disorder characterized by difficulty in "decoding" the information received and navigating between the visual form and the sounds of written language. However, some people diagnosed with "resilient dyslexia" demonstrate a high reading comprehension level (Gordon, 2022). For the last few years, scientists have tried to find the exact ways to overcome the decoding disorder and extract meaning from texts. Neurologists, psychologists, and teachers in special schools understood this too, and in the 1970s, suggested that dyslexia had a neurological basis. Dyslexia has become a term for less neurological impairment in reading ability in children. However, the presence of neurological causes in dyslexia has only recently been definitively determined (Meri et al., 2020).

According to the researchers from Tel Aviv University, the work helped understand the cognitive mechanisms dyslexic children use to cope with texts despite their relative weakness in decoding. The new data could also help invent new strategies for teaching reading, for instance, researching the left dorsolateral prefrontal cortex (DLPFC), which is crucial for decoding ability and reading comprehension in general (Patael et al., 2018). The research

suggests new approaches that develop cognitive function and working memory. If a child enters first grade, the practice of simply learning the alphabet may not be enough for him. Games and activities that stimulate working memory, such as baking cakes or playing strategy games, can help here. Over time, this will contribute to a better understanding of the text.

The researchers from the University of California examined 55 English-speaking children aged 10-16 with good reading skills. Nearly half of the study participants had dyslexia. The research data enabled the researchers to find out the difference between participants' reading ability and decoding skills. Next, the scientists scanned the children's brains in MRI and compared the images with the results of the calculations. As a result, it turned out that in the area of the brain responsible for executive functions and working memory, the DLPFC of the left hemisphere in "resistant dyslexics" has a large amount of gray matter. (The Science of Psychotherapy, 2018)

One of the biggest findings in reading learning in recent years is that most interventions to detect and treat dyslexia in schools have come too late. Over the past decade, long-term studies of young children were done in Nadine Gaab's laboratory at Harvard Medical School. Research has shown that the brains of children who subsequently develop dyslexia are already atypical even before they go to kindergarten. Learning differences are often not identified until childhood or adolescence, but differences in brain development may be present as early as prenatally (Gaab, 2019). She claims that at three months, children already have the basic infrastructure, thanks to which it is possible to predict their future success in reading. Gaab's team scanned the brains of 140 infants at genetic risk for dyslexia and followed them over time to study changes in their brain structure and function. According to the latest data, 45 of the children tested were already 5 or 6 years old, which allowed the researchers to match their brain scans from infancy to the age they were taught to read.

"Our data suggest that the structural framework of the brain is formed during infancy, which serves as a foundation," explains Gaab. "Speech and reading may be processes that refine this brain framework." The human brain has executive functions responsible for cognitive processes that help humans read, understand and learn. Children with dyslexia find it difficult. Therefore, they need neurobiological and psycholinguistic support (Meri et al., 2020).

A psycholinguistic approach to dyslexia.

Psycholinguistics is the study of mental aspects of language and speech. Noam Chomsky claims that this discipline investigates and describes psychological processes that allow humans to master and use language. In the psychological aspect, dyslexia is considered a delay in developing mental functions, particularly those that normally provide the reading

process. It primarily concerns how language is represented and processed in the brain (Baxter et al., 2022). Psycholinguistics research investigates the cognitive processes, such as perception, memory, and thinking, which are involved in the common use of language, for instance, reading a book, writing a composition, understanding a lecture, and holding a conversation (Nordquist, 2019). In light of the forenamed, it suggests modern methods that enable kids with learning disabilities (LD) to perceive, store and reproduce information.

A psycholinguist Dan Slobin described psycholinguistics as a science and pointed out that its methods and tasks aim to study language and speech. The focus is on the problems of philosophy and psychology, such as the nature of human language, mind development, and others. "The psychology of cognitive development promises an eventual universal theory of the growth of the mind. The psycholinguistic theory of this theory requires detailed information on the acquisition of a variety of native languages" (Slobin, 1973, p.176).

The main goal of psycholinguistics in this field is to work on knowledge of the relationship between language and the human brain. Scientists suggest this process involves a certain mental algorithm, which helps produce the necessary speech during communication. Thus, Chomsky believes that language acquisition is innate and is activated by environmental stimuli (Baxter et al., 2022). Dyslexia, as a sort of neurodiversity, makes language acquisition slow, and children struggle with reading and writing. Nevertheless, the main goal of special education classes and schools is that each student, regardless of their neurophysiological and psychological characteristics and study style, can take a worthy place in the class team and successfully master the skills and abilities provided for by the school curriculum. One of the most important tasks while working with dyslexic students is training their working memory (WM). (Churchill, 2023).

The role of working memory in language acquisition.

The role of working memory (WM) in language acquisition cannot be overstated. WM is a cognitive process that helps us to hold and utilize information. It enables us to listen, remember, follow instructions, and formulate answers while being asked questions. WM includes short-term memory stores, such as verbal and visual-spatial ones. Verbal short-term memory stores information expressed in numbers, words, and sentences, while visual-spatial short-term memory stores images, pictures, and information about location in space. It also has a component that helps us resist distractions and maintain focus when engaged in a task. (Smith-Spark, 2007).

"Motor learning, and classical conditioning of motor responses in particular, has been consistently linked to cerebellar function in humans" (Nicolson & Fawcett, 2008, p.125). The latter is based directly on the mainstream cognitive theory, which suggests automaticity as a major requirement for skilled performance. Automating is slow in dyslexic children because WM deficits make it extremely difficult to synthesize information while reading. Reading a paragraph requires a person's WM to hold on to each letter, the sound associated with each letter, the words that letters build, and the sentences constructed from those words. The reader must retain this information long enough to combine the sentences and comprehend the text. This demand overwhelms a person with dyslexia (Smith-Spark, 2007). As a result, LD students get low grades, although they do not have a lower mental capacity or IQ than regular children.

English as a foreign language is extremely complex for Hebrew speakers because the latter is written from right to left, and its letters completely differ from the Latin ones. Nevertheless, most children learn it quickly and easily due to computer games and films without translation. LD students might speak English fluently but have severe difficulties in the classroom because they often get distracted. Moreover, problems with WM and deficits in the phonological process cause misspellings and misunderstandings of instructions and tasks. (Nicolson& Fawcett, 2008). As a result, students get frustrated and give up.

"While the written language may seem complex enough on its own, children can have their personal strategies." (Ruddel et al., 1994, p.58). The research in neuroscience and psychology suggests that when LD students enjoy learning, it enhances their short-term memory, stimulates their long-term memory to keep the information, and makes them interested and focused. They get motivated to speak English when they understand films, songs, and computer games. In addition, the educational process succeeds when they get good grades and achieve their learning targets. Thus, in my classes, many non-readers play table games or online ones, which helps me to avoid discipline problems.

Usually, I use flashcards that enable them to connect letter patterns with associated sounds. When this stage is over, they connect specific letters with objects in the flashcards and pictures. This way, they enlarge their vocabulary and start speaking step by step. Since they have poor verbal WM, I must repeat such games but diversify the classroom activities. Initially, they give short answers while being asked, but later, they try to describe what they see in the pictures. At the same time, I give them spelling, vocabulary, sentence-structure games, and short texts to enhance their cognitive processes and develop reading comprehension skills. It creates relations between mental and physiological processes and mirror neurons and their role in language creation (Witkowski, 2020).

Three cases of success.

Churchill (2023) claims that students who learn a second language are often "restricted by environmental factors to the quantity and quality of input they receive." As a remedial teacher, I agree that they often lack appropriate training WM with the help of multisensory learning. Now it is time to share my experiences teaching challenging students in their twenties and studying in college. Since English is compulsory for Israeli matriculation, they had to know it at least on level B1.

Case 1. Liron.

She was the second of four children. She had ADHD and dyslexia. In the 9th grade, she had severe reading, writing, and general understanding difficulties. In the 10th grade, she still did not speak English, and the material for level B1 was challenging. In the 11th grade, Liron started watching films without translation, which helped her activate her passive vocabulary. I advised her to download YouTube songs and memorize vocabulary and grammar structures. She did it, and step-by-step, she started speaking and doing literature texts for levels B1 and B2. In the 12th grade, her level was between B2 and C1. Finally, she gained 5 points for the Bagrut and passed all the exams. Due to multiple training of the working memory, her average grade was about 80.

Case 2. Pavel.

He was a new immigrant, an only child, and his parents had divorced. For some reason, he did not study English in Russia and had to study two languages simultaneously in Israel. His problems were ADHD, dyslexia, depression, and lack of communication. In the 9th grade, he only played table games, mainly cognates. Perhaps, he was a visual learner and trained his WM with the help of the images. First, they were vocabulary games. Later, I offered him to choose some words to make sentences. When he enlarged his vocabulary, he started doing elementary reading comprehension tasks. In the 10th grade, he was quite good at strategies and started reading simple texts on level A1-A2. In the 11-12th grades, he made great progress. His spoken English was between A2 and B1, and finally, he gained 3 points for Bagrut. He passed the exams quite well.

Case 3. David.

He was the youngest of three children. His problems were ADHD, ASD, dyslexia, and dysgraphia. In the 9th grade, he missed many lessons. In the 10th grade, he attended the lessons, but he still refused to participate in the class activities. He only played video games on his tablet. He learned with the help of multiple audio and visual aids I recommended, and his

vocabulary improved, although he still struggled to speak English. In the 11th grade, he started participating in class discussions. He mainly asked questions, got motivated to be involved in spoken activities, and achieved level A2. In the 12th grade, he spoke English quite well and gained 3 points for Bagrut, despite multiple spelling mistakes and unreadable handwriting. Finally, he passed due to accommodations offered by the Ministry of Education.

To sum up, such "resistant dyslexic" students had resilient dyslexia, and they still misspelled despite multiple training. Nevertheless, their vocabulary greatly extended, and they started speaking English quite well due to thorough training in their WM. Due to multiple repetitions of vocabulary, grammar, and training of reading strategies, especially in a game, their WM enabled them to memorize much more vocabulary and produce spoken English.

Conclusion.

Although dyslexia has been considered a learning disorder for a long time, the diagnosis was based on comparing reading skills with average readers. Simply put, a child could be diagnosed with dyslexia if their IQ score was average but flunked standardized reading tests. These diagnoses were random and often based on different criteria. Thus, a child lagging behind in the class could be diagnosed with dyslexia, while an even more lagging child could be told that he could not read well. Multiple repetition and multisensory training improve neural connections that promote brain activity (Witkovski, 2020).

Dyslexic students face greater challenges in learning ESL, and it takes them much more time to be fluent in reading and prepare for final exams. Although many speak English fluently, they confuse letters, word order, sentence structure, and grammar tenses. Often children who cannot read and write do not consider themselves capable. It is crucial that students with resilient dyslexia" develop all their strengths. Technology makes life easier for children who struggle to read and write in accordance with the psycholinguistic approach to dyslexia.

Therefore, remedial teachers should offer spelling, vocabulary, and grammar games every lesson and give short quizzes every week. I create self-checking online activities, and they help my students a lot. To help them pass the matriculation exam, the Israeli Ministry of Education uses the psycholinguistic approach and offers them oral or computerized tests.

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