



NAVIGATING SPECIFIC LANGUAGE IMPAIRMENTS: INSIGHTS FROM LANGUAGE PROFESSIONALS AND NEUROSCIENCE

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ABSTRACT:

Objective: This study aims to ascertain the value and potential applications of neuroscience in aiding minors with Specific Language Impairments (SLI), focusing on linguistic levels, techniques, and developmental milestones.

Methods: Language professionals participated in a survey comprising closed-ended and open-ended questions regarding language development, neurobiology, and minors' learning of DSL. Participants included psychologists, speech therapists, and hearing and speech specialists.

Results: Findings underscore the significance of early intervention, particularly at the lexical and syntactic levels, to foster expressive abilities. Active methodologies are recommended to enhance motivation for learning, with particular emphasis on the developmental stage between 2 and 6 years.

Conclusion: Leveraging neuroscience in early childhood education and language development facilitates tailored interventions, accommodating individual needs and fostering successful learning outcomes for minors with Specific Language Impairments.

Keywords: Neuroeducation, developmental phases, linguistic levels, techniques, specific language disorders.

INTRODUCTION:

Language: Since language enables us to communicate our thoughts, feelings, wants, knowledge, and other things, it is one of the most essential tools available to humans. The environment in which a person grows can influence language development in a variety of ways, affecting that person's future intellectual, social, psychological, and physical growth. Therefore, it is crucial to prioritize learning and developing the language on an expressive and global level starting at a young age.

Relationships, emotions, stimulation, personality, biological maturity (of the neurological, auditory, speech, and cognitive systems), and learning processes are some of the elements that influence the development of this capacity (Table 1) (Rinaldi et al., 2021).

There are two distinct phases to language acquisition: the preverbal phase (10–12 months), during which onomatopoeic sounds are produced and gestural and affective communication occurs, and the linguistic phase (15–18 months), during which word acquisition starts based on the organs' healthy development (breathing, speech, resonance, and articulation). Following these two stages, we will move on to the more complex process of grammatical inclusion. Towards the conclusion of the second year of life, he will start to introduce and join sentences, adding new words and removing parts that serve as connectives (Tong et al., 2023).

Table 1: Language development throughout time	
Age	Characteristics
Newborn	Crying
Three months	guttural, chirp, vocalizations
Six months	Syllabication
Nine months	Babbling (bisyllabic)
12 months	Palaver
18 months	chattering (attempts to speak in a stream)
24 months	Phrasing (join two words)
30 months	Prayers

As a result, there are various linguistic levels in the language that need to be considered as it develops:

- Phonology is the study of sounds, the minor units of the language system, and comprise words. To communicate and comprehend the bean, children must be able to distinguish between, generate, and blend the many sounds of their mother tongue.
- Morphology and syntax are combined to make morphosyntax; the former deals with the structure that words and their various versions form. Syntax demonstrates how words can be combined and make sentences more or less complex, allowing us to create sentences and convey our views.

Words and sentences get meaning thanks to semantics. It concerns how words represent things in concrete and abstract worlds, enabling us to comprehend and communicate ideas and concepts. The toddler gradually picks up this linguistic component as his development suggests that he is learning new words and using them to carry on meaningful conversations. The quantity of words or vocabulary a person uses is known as their lexicon, and it varies based on the person and their age, as well as the jargon they employ (age, occupation, nationality, etc.) (Adlof, 2020).

Language about other people or situations, encompassing the verbal and nonverbal tools employed in various encounters, is called pragmatics. Learning a language requires more than just producing grammatically correct phrases; you also need to be able to modify your style according to the context in which you are using it (Delage et al., 2021).

Disorders of the specific language (SLI):

Many young children experience Specific Language Impairments (SLI), a change that significantly impacts their intellectual, emotional, social, and personal capacities and causes issues in many aspects of their lives. Based on the DSM-V's classification, we can conclude that they fall within the category of neurodevelopmental disorders, defined by impairments in the use of the nervous system and the development of spoken, written, and gestural language. This problem occurs in 15% of preschoolers and 3-6% of school-age children. Moreover, children are more likely to experience it, mainly if there is a prior family history (Alduais et al., 2022).

The symptoms of SLI start to show between the ages of 18 and 36 months, and because they are persistent and treatment-resistant, they persist throughout adulthood. The minor's various language abilities are assessed to determine the diagnosis; these abilities vary based on the minor's age and the demands that prompted the exam. Generally, direct observation is carried out, interviews and questionnaires are carried out with the closest environment (family and educators), various assessments of their learning ability are carried out, and various standardized tests are carried out on their use of the language at a given moment. By comparing the minor's language abilities to those of his peers, these techniques will identify the problems and establish the therapy goals (Nicoll et al., 2023).

The most apparent characteristic of children with SLI is their obvious delayed language onset, which starts later than their classmates. However, depending on the child's age, we can also draw attention to other traits. For example, preschoolers often struggle to learn new words, take longer to form sentences and find it difficult to follow directions since they don't grasp what is being asked. And when they speak, they use improper grammar. While older kids and adults struggle to construct longer, more complicated sentences, they struggle to choose the right words, not get metaphorical language, have reading and writing issues, and frequently make grammar and spelling mistakes. It is essential to keep in mind that because of brain plasticity, children with SLE recover more quickly than adults, who are more likely to develop degenerative disorders (Singer et al., 2020).

Due to their extreme heterogeneity, SLIs may need to be classified using a variety of grounds, including clinical, empirical, and mixed. After considering all of this, it was determined that the practical categorization was the most appropriate. However, the neuropsychiatric classification was also an option (Table 2) (Bazyra et al., 2022).

Table 2. Classification of TELs		
	Types of TEL	Main features
practical	Expressive TEL (TEL-E)	Their vocabulary is receptive, their phonology is discrimination proper, their syntactic comprehension is adequate, and their memory is standard. During spontaneous speech, there are a lot of grammatical errors and word omissions due to expressive semantics and rapid motor sequence execution being challenging.

	SLI that is Expressive/Receptive (ER-SLI)	difficulties with language comprehension, including issues with syntactic and phonological understanding and memory limitations
	TEL-E and TEL-ER as primary	The main ones can be further separated into acquired (adult and childhood aphasia) and evolved (simple language delay, hearing muteness, and dysphasia).
Neuropediatrics	TEL in cytogenetics	TEL secondary The ESES syndrome, POCS syndrome, and Landau-Kleffner syndrome typically manifest following language acquisition.

Many subtypes of SLI can present with language understanding and expression changes because individuals with SLI can have difficulties at all language levels (phonology, lexicon, semantics, syntax, morphology, and pragmatics). Because all language skills are interrelated at varying degrees, issues are likely to exist in one or more of the other four components if there is a deficiency in one of them. Additionally, the abnormal neural structural and functional features cause symptoms to be noticeable from a young age and exhibit a wide range of expressions of this condition based on genes, structure, functioning, and behavior, resulting in people who have it frequently posing a higher risk in terms of social, emotional, and intellectual issues (Al-thresher, 2020).

Neuroeducation:

The field of neuroeducation arose as a new way of thinking where psychology, neuroscience, and education came together (Figure 1). Its main goal was to make it possible to understand how the brain functions by fusing it with the various processes of learning, memory, language, attention, and sensory systems. By developing programs that foster growth and steer clear of these detrimental elements, educators and families will be able to recognize the various risk factors that arise during brain development and minimize or eliminate dangers. Because of this, it has been noted that a few risk and protective variables may impact minors and alter some of their neural connections favorably or negatively (Lammertink et al., 2020).

Some of the factors that can affect a child's development include genetics (such as chromosomal alterations, low birth weight, and the mother's consumption of folic acid), experiences or their psychosocial environment (such as abuse, secure attachment, social failure, shelter education, and family stability), and the environment (such as overprotection, discrimination in the social group, and family stability, for example). Therefore, teachers can instruct more efficiently, enjoyably, and suitably, fostering high-quality education and allowing teachers more significant control over these elements if they can comprehend how the brain functions (Bogaerts et al., 2021).

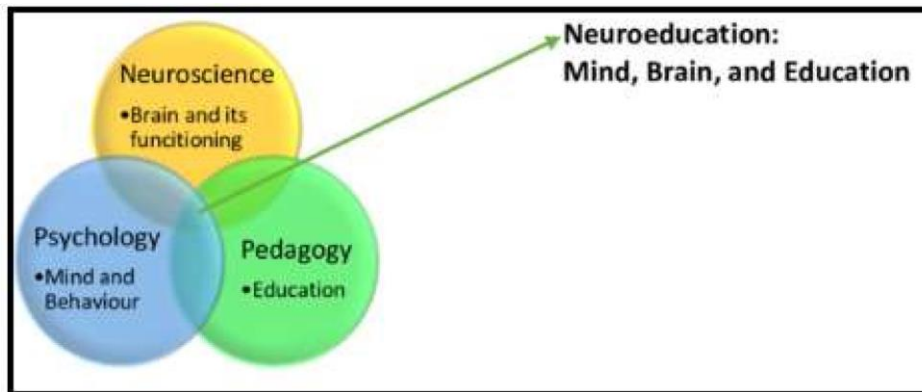


Figure 1: Neuroeducational components

Numerous studies in neuroscience have shed light on the structure and function of the brain, advancing our knowledge of its workings and improving the abilities of teachers and students alike. This has improved instruction and ensured that minors receive a high-quality education. Because of this science's contributions, we may learn about educational techniques and approaches that eliminate bad pedagogical practices affecting our educational systems (Ilardi et al., 2020).

The brain is an organ that changes throughout life but changes most dramatically during pregnancy and the early years of life. "Sensitive periods" can be distinguished, even if a child's brain is predisposed from birth to be able to extract from experiences all the information required for his development. Since effective pedagogical practices will activate brain circuits, educators need to understand the brain's transformation processes and evolutionary phases and the malleability of these processes in early life to provide the necessary meaningful experiences. As a result, the early years are crucial for determining an individual's future quality of life. This is when the brain forms, grows, and develops due to children's plasticity, allowing experiences to mold the brain's structure and function. This is based on the idea that deliberate actions can significantly enhance learning (Goffman & Gerken, 2023).

As a result, it is evident that educational techniques need to change, placing greater emphasis on creativity, imagination, music, movement, etc. By bringing some excitement and attention to minors, we hope to disrupt the monotony of traditional education and promote the joy of studying. The research discussed below relates to the rise in DSL because it is becoming more common to come across young people who struggle with language. Using the analysis done on these components as a guide, it is noted that the study's goal is to confirm the value and potential applications of neuroscience in the language acquisition of young people with DSL. However, it can also be applied to young people without any disorder (Jackson et al., 2021).

METHODOLOGY:

This study used a mixed methodology, with quantitative questions used to determine the precise number of answers and options received so that trends could be identified and qualitative questions allowing language specialists to assess the role of neuroscience in SLI. Given that reality was grasped starting from people's encounters with the occurrence, the study used a phenomenological design. Additionally, it was conducted in a natural setting using information directly from various subject matter specialists (Bowers & Ramsdell, 2023).

Participants:

The participants in this study were all professionals working in the domains of psychology and education. Twelve people, 91.7% women and 8.3% men, were included in the sample that answered the questionnaire. They were all language specialists, with 8.3% specializing in psychology, 83.3% in speech therapy, and 8.4% in hearing and speech (AL). It should be mentioned that their selection

was made possible by the fact that they could be reached and that they could then reach other individuals who were pertinent to the study. Knowledge of DSL and neuroeducation were the variables that affected the research; these were uncontrollable during the process, but they impacted the data as the replies were based on their knowledge (Turker et al., 2021).

Tool:

A questionnaire was selected as the primary data collection instrument; the questions asked for specific information on certain topics to which respondents had to respond based on their knowledge and experience. Participants were encouraged to provide anything they thought would be attractive to the research, with no word limit on their responses. The survey was conducted in two sections: first, information about the individual conducting the survey (gender, work environment, years of experience, and nationality) was obtained through four questions. Secondly, research questions related to the elements under investigation were asked and comprised two types of questions: one was multiple choice (7 questions). In contrast, the other five questions were intended to justify the previous response (Rashaid et al., 2023).

Depending on the subject matter, the questions have been divided into three blocks: those meant for neuroeducation are at the top, followed by those that address language acquisition and critical developmental features, and lastly, those meant for SLI. There will be lots of room for explanations of the solution, enabling us to evaluate their understanding of the subject and how they handle these scenarios in class. We will also be able to encourage them to apply all of their prior knowledge and expertise on the subject (Christou, Andreu, et al., 2022).

This survey consists of the following questions: A. Personal identification/questions 1.

Identification.

2. Nationality.

3. Professional situation.

4. Years of expertise

B. Questions concerning neuroeducation.

1. What does the phrase "neuroeducation" mean?

If the previous response is affirmative, could you define the term?

2. How may neuroeducation be used in the process of learning a language?

C. Questions concerning language learning.

3. Which language levels do you believe neuroeducation can have the most impact on?

4. What approaches to music, games, etc., are best suited to positively rewire the brain and foster language development?

5. What kind of component, in your opinion, has the most significant impact on kids' learning?

6. What language development stage is most important for a child's proper development?

7. Can language development proceed without speaking, listening, or understanding?

8. Which fundamental reading abilities do you think are most crucial?

D. Concerning TEL questions

9. Because of its affectation, which language functions most closely align with SLI? (More than one option may be chosen.)

10. Based on your perspective, which methodology is best suited for diagnosing SLI?

11. There have been attempts throughout history to classify the many TELs in a particular way. Which do you believe is the most appropriate?

12. Based on your observations, what kind of SLI is most prevalent in the formative years of (preschool) education?

Procedure

The project's work timeline is broken down into the months that each of the sections listed here was completed, and the end product would be as follows:

Table 3. The Scheme				
SCHEDULE	December - January	March	April	May
Information search	X			
Creation of the survey		X		
Sample access and selection			X	
treatment application			X	
Information collection			X	
Data analysis				X
Elaboration of the report				X

RESULT:

Twelve professionals, predominantly female (Figure 2) and of Spanish nationality, participated in the study. Operators for speech therapy also stand out (Figure 3), with employment histories ranging from one to twenty-five years (Vassiliu et al., 2023).

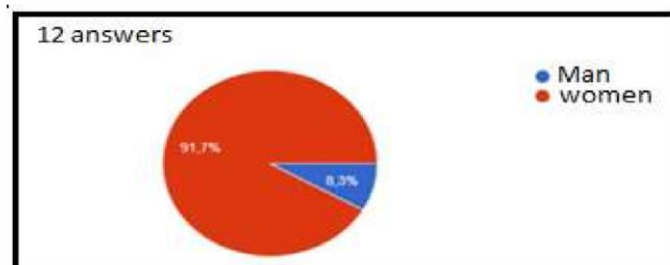


Figure 2: Recognition

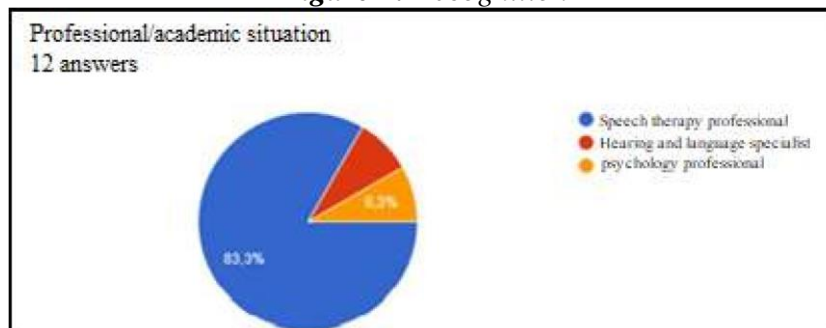


Figure 3: Context

The results of the neuroscience block demonstrate that everyone interviewed knew what neuroeducation was. Still, nobody was able to define it or emphasize how important it can be in fostering minors' learning, regardless of whether or not they have a disability. They are aware,

therefore, that neuroeducation is helpful in various contexts since it makes it possible to pinpoint developmental stages, encourage learning, suggest novel approaches, assess minors, offer the most significant intervention, and more (Blackstone et al., 2022).

Regarding the outcomes of the language development block, the participants state that the language levels are interconnected because certain language levels serve as the foundation for others and, when combined, enable sentences and speech to have a logical sense. As they get more developed via practice, all these components will be required for communication. Despite this, some parts are more significant than others based on their role in the language. Participants stated that while all aspects of language are damaged in these individuals, some aspects, like vocabulary, stand out (Christou, Coloma, et al., 2022).

Additionally, they suggest that while all of the evolutionary stages of language development are crucial, the period between two and six years is susceptible since it is during this time that language changes will be most significant, particularly in vocabulary and syntax, and it has the most extended lifespan. Moreover, they emphasize that there is no one perfect methodology for language development; instead, the approaches that respondents value the most are those with dynamic qualities that support young people's motivation to learn while constantly considering their needs, goals, and stages of development (Pitt, 2020).

It's also important to note that some participants emphasized that oral language is not the sole form of communication and that, occasionally, further steps must be taken to meet the needs of children. Working with minors affected by DSL requires the ability to recognize their symptoms. To do this, a thorough diagnosis based on multidisciplinary assessments must be made to determine which areas of the child are genuinely affected. Following this, ongoing monitoring must be done to track the child's development. Moreover, they claim that the most prevalent problem seen in early childhood education facilities and classrooms is expressive SLI (Martínez et al., 2023).

DISCUSSION:

Neuroscience can be very helpful in education because it helps us identify the general and, more specifically, the linguistic development phases minors are in. This enables us to provide strategies tailored to the minors' needs and limitations at every stage, allowing the educator to respect those development moments rather than generalize. Additionally, it will enable us to determine the potential problems they may be suffering from and the reasons behind them, enabling us to better intervene on their behalf and support their learning using the most effective techniques for each situation. Because of this, early stimulation programs that ensure language and cognitive development must be developed, providing minors with support and a secure learning environment (Eghbaria-Ghanamah et al., 2020).

It should be mentioned that one interviewee is against neuroeducation since, in his opinion, the word is just a way to market logical therapies that already exist and don't offer any new information. They encourage learning or, in our instance, the acquisition of language. Since there is an inbuilt basis for language learning through imitation mechanisms that influence linguistic maturation (you learn to speak through practice), all of the language's constituent parts must be able to communicate, meaning that language pieces are interconnected. The Teachers Federation indicates that minors do not only need linguistic input for the production and creation of language since, to reach that level, they must also have previously learned to process, elaborate, and organize information to manipulate it and emit the required behaviors or verbalizations (Binos et al., 2021).

Since language processing is neurological, our ability to intervene and assist kids will improve as more brain connections are formed, and we gain a greater understanding of the learning process. Because of this, the majority of those surveyed think that neuroeducation might have a significant positive impact on all facets of language. Despite the preceding, lexicon and pragmatics received the most votes because the brain is wired to process information, and expression and comprehension let the brain use the language and get ready to learn new words. According to the pragmatics option,

minors must communicate successfully and pick the necessary language (Schrimpf et al., 2021). To do this, the designated learning periods must be honored. This will help the kids acquire pragmatics, which can occasionally be tricky. Given the above, we suggest that comprehending speech entails applying several higher-order cognitive abilities that modify our neural activity. The lexicon is the initial stage in comprehending and using language; it activates the information stored in our memory and converts it into an external representation. Thus, one could argue that sufficient development of prior vocabulary is required for minors to acquire language and communicate effectively (Wu et al., 2023).

Because "there is no single adequate methodology, but each of them is positive if applied to the age and stage of development," as one participant put it, the interviewees' approaches to using neuroscience to study language are pretty diverse. because one or the other may be better for molding our minors' brains, depending on the circumstances." It's crucial to remember that no system works if it's not supported by encouraging remarks that bolster newly learned material and give kids a sense of significance and validity. Additionally, the interviewees' approaches are all dynamic since encouraging their drive and focus on learning is the most crucial thing to do. Because of this, many people surveyed choose games and hobbies like music (Fiveash et al., 2021).

The most often mentioned game is symbolic because it lets kids express themselves freely and learn from each other through imitation. However, games incorporating resources like poems and onomatopoeia are noteworthy because they help kids learn vocabulary and grammar rules. Moreover, as previously mentioned, the foundation of literary education is play. It's important to remember that while there are many different games, not all are appropriate for children with unique learning challenges (SLI). For example, some games, like building games, can make it difficult for kids to express themselves appropriately. Their thoughts, feelings, and misconceptions about what their peers try to teach them (Galassi et al., 2020).

Free and symbolic games are also the best options for kids since they are enjoyable pursuits that foster social skills, knowledge, introspection, and expression. Symbolic games allow us to promote sufficient learning in minors by fostering linguistic abilities, internalizing healthy habits, encouraging ethical values, positive views, etc. Additionally, it allows them to act out various roles and behaviors, encouraging them to use their imagination to make up stories. In doing so, they learn to communicate, interact with others, comprehend their surroundings, and behave appropriately in different situations. Not only will the approaches above benefit minors impacted by SLI, but they will also benefit all kids who are at full language development (Hale et al., 2022).

Most interviewees feel it significantly influences learning since the environment is around them and may or may not develop all of a child's linguistic skills. Thus, whether or not diseases and abnormalities are present, positive and supportive environments can aid in the language learning of all minors. For instance, it's well known that SLIs have a hereditary component, but if their operating environment doesn't provide stimulation, their performance will suffer. Their possibilities of developing new abilities will rise. Learning is a process that needs sufficient assistance and a variety of experiences to be developed. When two people have the same IQ but live in different surroundings with different stimuli, the person who moves in a good atmosphere that stimulates them will always be favored. Life skills are more important than intellectual talents (Gkintoni et al., 2021).

Anyway, it's important to note that some respondents also mentioned that each person has a genetic predisposition. This can be the most critical factor at a young age because they are still too young to fully absorb environmental effects. One may argue that, even though a neutral or unfavorable environment can later impact them, genetics is the initial obstacle that needs to be overcome to continue the learning process and meet the objectives. To provide appropriate language stimulation, the family setting must support the development of multiple experiences and supply the resources required for this learning. Our genes, the foundation of our entire being, are shaped by particular experiences we receive from our surroundings (Gkintoni & Dimakos, 2022).

There are three unique phases of language development, and each is crucial because it takes place during a period of increased brain plasticity, facilitating learning and laying the groundwork for future knowledge. The preverbal phase, which lasts for the first few months of life, lays the groundwork for language and communication and fosters the best possible growth, which serves as the foundation for learning. The linguistic phase begins when children start to utter a series of sounds that resemble adult words, beginning with the lexicon's formation and progressing to the pronunciation of sentences that contain one or more meaningful elements (holophrastic). Lastly, learning can progress most during the first sentence phase, which is one of the longest. Additionally, the brain is better prepared during spoken language exercises; all regions are closed (Mavrelou & Daradoumis, 2020).

A child with a problem can learn the necessary verbal skills at this point and then go on to learn vocabulary. Thus, it may be said that this final stage, which gives rise to various linguistic processes, is the most important in language learning and development. It would be challenging to complete development if these components failed because the communication process necessitates numerous interdependent areas. This is because inadequate input would be accessible. In addition, participants suggest that in the event of a disruption to a sensory learning channel, exceptional steps would be necessary to facilitate appropriate growth, as there would be insufficient mechanisms to foster language (López, 2023).

All the people interviewed overwhelmingly agreed that comprehending is the foundation of the initial sentences; therefore, knowing what you hear is necessary before producing. On the other hand, since these individuals do not have an ear canal but can participate in conversations and comprehend what is being said, some refer to people with hearing difficulties. Beyond speech and language, communication can occur in various ways, but in simpler or less sophisticated ones. They also discuss alternative forms of communication, like Complemented Speech, which enhances spoken language through more excellent physical language (Barbosa, 2021).

Since there are many potential causes of SLE, it is critical to understand the signs of neurological problems, which can also involve psychological and social factors. This calls for an interdisciplinary approach to treatment and problem-solving. Recent studies have determined which parts of the brain are causing aberrant activity by utilizing a variety of magnetic resonance imaging brain images. Furthermore, even though there are no appreciable distinctions between the expressive and left frontal areas, it was discovered that the TELs exhibit a similar tendency, with waves and peaks seen in both frontal areas and dipoles in the mid-temporal region and left area. The expressive-receptive SLI is called TEL (Kovács et al., 2022).

In this regard, it is essential to note that the most frequent external variables causing SLI affect lexicon and semantics, affecting word meaning. Relationships with people in a context are crucial for the development of this language domain, and issues arise when a child receives insufficient or no stimulation during the period between the ages of three and five, which corresponds to the emergence of first words and is marked by the minors' preparation for oral language practice. On the other hand, illnesses brought on by internal causes might also exist; they are distinguished by changes in the brain areas in charge of processing sensory data (Filippi et al., 2022).

By keeping all of these factors in mind, we may come up with methodological solutions that meet their needs in every way by considering their skills and challenges, accommodating their requests, and considering the educational support they require. As I previously stated, expressive language development starts in the early years of life and is encouraged when a child enters early childhood education at three. During this time, minors expand their vocabulary and learn the various language components. To accomplish this goal, appropriate stimulation must be provided, which unites sentence structure, articulation, semantics, and intended usage of the language in all situations (Stepanchenko et al., 2021).

Play is one of the most effective strategies for working with minors affected by DSL because it motivates and entertains them while also assisting them in... expressing themselves. It is important to emphasize that this stimulation must occur in the family and the educational context (Gertners, 2021).

CONCLUSION:

The use of neuroscience in early childhood education and language development presents several chances to recognize and address each child's unique requirements. This enables us to tailor tactics to individual profiles, resulting in more efficient and productive learning and identifying language development phases and potential dysfunctions. Knowing the neurological underpinnings of language shows how interwoven all of its components are and how imitation and practice are the keystones of language acquisition, forming new neural connections and emphasizing the significance of supporting and intervening for minors during these stages.

When it comes to linguistic tasks in school, neuroscience-based methods provide a range of ways that may be customized to each kid so that engaging strategies, such as games or music, are used. Always check if it suits your child's age and developmental stage. It should be mentioned that these techniques help all minors, not just those with SLI, develop their language skills. An unfavorable environment can severely impact a child's development, whereas a positive and supportive setting will boost language acquisition in all children. The environment can play a significant role in a child's language development. Simultaneously, learning is mainly influenced by heredity.

The preverbal, linguistic, and first sentence phases are the three main stages of language development. The brain is more malleable and capable of learning throughout these stages, establishing the groundwork for later language acquisition. To accomplish this, it is critical to have a firm grasp of language, realizing that certain aspects of communication must be cultivated before thriving in others. That communication is not limited to speaking. In summary, neuroscience in language development and education offers a solid basis for comprehending and meeting each child's unique needs. A supportive environment, tailored approaches, early stimulation, and attention to linguistic components are all critical in fostering appropriate language development.

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