Egypt. J. Chem. **Vol. 68**, No. 6. pp. 695 - 703 (2025)

Egyptian Journal of Chemistry

http://ejchem.journals.ekb.eg/

A Comprehensive Review of Speech, Language, and communication interventions for children with Down syndrome

Rasha Sami

National Research Centre

Abstract

Objective:

Children with Down syndrome (DS) necessitate early interventions owing to pronounced delays in the improvement of speech, language, and communication. This in-depth study looks at numerous approaches to assist kids with Down syndrome in improving their speech and communication skills.

Methods:

It focuses on the best methods, like speech and language therapy, programs for parents to utilize, and tools that employ technology. It focuses on the best methods, like speech and language therapy, programs for parents to utilize, and tools that employ technology.

Key Findings:

The study highlights that early intervention and multimodal strategies can enhance expressive and receptive language, social communication, and phonological awareness. Multimodal techniques, like augmentative and alternative communication (AAC) and therapies from different specialists working together, have shown strong positive effects on communication for people with Down syndrome (DS). Parental engagement and early intervention are crucial for language development.

Implications for Practice:

Despite the documented excellent outcomes, further research is required to refine intervention strategies, particularly targeting the linguistic and cognitive challenges associated with Down syndrome. This review emphasizes the significance of early and cohesive interventions in the rehabilitation of children with Down syndrome.

Keywords*: Children; Down syndrome; language, social communication; phonological awareness; intervention and multimodal strategies.*

Introduction

Down syndrome (DS), a genetic disorder caused by the presence of a third copy of chromosome 21, has a specific cognitive profile that includes strengths in visual processing and social cognition and severe issues in working memory, executive function, and language development (Nadel, 2003). Children with DS have weak oral motor functions that cause multiple phonological errors and poor speech intelligibility. DS also exhibits expressive and receptive language delays, affecting their social and cognitive development. Different intervention plans have been applied to improve language outcomes, such as speech and language therapy, cognitive therapy, parent-implemented programs, and AAC [1]. This review article discusses recent research to determine the best practices for language development in children with Down syndrome [2].

Methods

This review adhered to a systematic literature review methodology. Relevant publications were located by electronic database searches in PubMed, Scopus, and Google Scholar utilizing combinations of the following keywords: “DS,” “speech therapy,” “language intervention,” “AAC,” “parent-implemented program,” and “communication disorders.” Studies published from 2000 to 2024 were incorporated. The inclusion criteria consisted of peer-reviewed studies that examined intervention strategies for children with Down syndrome, encompassing speech-language therapy, AAC, cognitive therapy, and technology-assisted methods. Studies unrelated to communicative results or solely concentrating on medical or surgical procedures were excluded.

A total of 45 studies were examined, including randomized controlled trials (RCTs), meta-analyses, systematic reviews, cohort studies, and case studies. Articles were evaluated for relevance, demographic features (children with Down syndrome), and emphasis on communication and language development.

*Corresponding author e-mail: drrashasami@gmail.com.; (Rash Sami).

Received date 24 April 2025; Revised date 17 June 2025; Accepted date 19 June 2025

DOI: 10.21608/ejchem.2025.378591.11646

This methodology provided a thorough and evidence-based comprehension of optimal practices in communication treatments for children with DS..

Review

While speech, language, and communication development are significantly affected in children with DS, the potential for improvement through early intervention is vast. This review examines various intervention methods, their efficacy, and the crucial role of parental involvement.

Speech and Language Development in Down Syndrome (Figure 1):

Receptive Language:

Individuals with DS have a relative advantage in receptive language (understanding spoken and written language) compared to expressive language. However, their receptive language development is delayed due to cognitive, neurological, and auditory processing impairments.

Research shows that children with DS have a more extensive receptive than expressive vocabulary (Chapman et al., 1998). They understand single words and basic phrases at levels comparable to younger children [3]. They benefit significantly from gestures, facial expressions, and visual aids to aid comprehension [4].

Despite these relative strengths, morphosyntactic comprehension is a challenge, particularly with:

- Complex sentence structures, including passive voice and subordinate clauses.
- Abstract linguistic concepts, such as figurative language and inference.
- Multi-step instructions due to limited verbal working memory [5].

Phonological processing deficits also hinder the ability to distinguish similar-sounding words, impacting overall comprehension. Event-related potential (ERP) studies indicate delayed brain responses to spoken language in DS, suggesting difficulties with real-time processing [6]. Hypotonia (low muscle tone) and hearing impairments can further delay auditory discrimination and phonological awareness.

Expressive Language:

Individuals with DS experience significant challenges in expressive language. This discrepancy between verbal language and comprehension can be attributed to neurological, cognitive, phonological, and motor difficulties [7]. Understanding these specific challenges is crucial in designing effective intervention plans.

Deficits in Expressive Language Development

- Delayed first-word production (24–36 months) and slower vocabulary acquisition lead to a limited expressive vocabulary [8].
- Severe deficits in syntax and morphology affect word order, verb tense, and subject-verb agreement [9].
- Phonological deficits contribute to poor speech clarity, including sound production inconsistencies, difficulty pronouncing multisyllabic words, and frequent phonological simplifications [10].
- Motor speech impairments impair articulation, such as childhood apraxia of speech (CAS) [11].
- Hypotonia and oro-motor dysfunction further impair articulation [11].

Individuals with DS are socially motivated and engaging but may struggle with the following:

- Turn-taking and topic maintenance in [13].
- Compensatory overuse of gestures and nonverbal communication [14].

The neurological basis of expressive language deficits includes limited verbal working memory, reduced brain volume in language-related areas, and typical hearing impairments [15].

Factors Contributing to Speech and Language Difficulties

1. Oral Structural Differences: Small oral cavity, high palatal arch, macroglossia, and dental misalignment affect articulation and speech clarity.
2. Hypotonia & Motor Deficits: Weak oral motor muscles affect speech coordination.
3. Neurological Impairments: Reduced cerebellar volume and altered brain connections affect speech production and motor coordination.
4. Phonological Processing Deficits: Impaired phonological awareness makes distinguishing similar sounds difficult.
5. Hearing Loss: Conductive hearing loss, common in DS, affects speech perception and phonological representation.
6. Cognitive Delays: Intellectual disability limits self-monitoring, speech error correction, and language learning.

Pragmatic difficulties are demonstrated in individuals wit. DS is socially engaged but cannot take turns in conversation, maintain topics, or engage in conversational reciprocity [16].
This review aims to foster a sense of compassion and empathy in the audience towards individuals with Down syndrome.

Cognitive Abilities and Their Impact on Language:

Individuals with DS typically have mild to moderate intellectual disability (IQ 30–70) [18, 19]

- Weak verbal short-term and working memory hinders language retention and sentence formation ([20].
- Better visual-spatial memory supports learning in structured environments [17].
- Impaired phonological storage and processing affect following instructions, conversation, and literacy development [20].
- Executive function deficits contribute to difficulty with problem-solving, cognitive flexibility, and impulse regulation [16].

Despite cognitive challenges, individuals with DS demonstrate:

- Strong social motivation and emotional intelligence [15].
- Compensatory social engagement for language impairments [15].
- Difficulty understanding social cues and others' perspectives [20].

Cognitive and language impairments in DS are linked to structural and functional brain differences, including:

- Reduced hippocampal volume, affecting memory and learning [13].
- Delayed myelination and smaller frontal lobes contribute to executive function deficits [15].
- Increased risk of neurodegeneration in adulthood [16].

Effects on Clinical Practice

Speech-language therapy for individuals with DS must be customized to their cognitive and linguistic profiles. This involves interventions that enhance working memory for speech sounds via multisensory learning approaches and repetition-based tasks. Visual aids like picture cards or structured syntax exercises, such as sentence-building games, can be effective. These strategies support the development of expressive language and, when required, AAC, enhancing pragmatic communication skills through instruction on conversational turn-taking, topic maintenance, and social interaction strategies. Utilizing visual learning strengths involves pairing spoken language with visual cues, including images, written text, or sign language, to enhance comprehension and expression [22].

Verbal Memory and Working Memory Training for Individuals with Down Syndrome:
Individuals with DS can improve significantly despite their challenges with working and verbal short-term memory. Language can be enhanced by improving the retention and processing of auditory information [23].

Challenges in verbal and working memory in Down syndrome [24]:
1. Limited Sentence Processing: Difficulties in comprehending and forming complex sentences arise from challenges with word order and syntactic structure.
2. Impaired phonological working memory: Challenges in retaining and manipulating speech sounds, which affect word articulation, vocabulary acquisition, and phonological awareness.
3. Slow Processing Speed: Impediments in encoding, storing, and retrieving verbal information result in challenges during real-time communication.
4. Poor auditory memory: challenges in recalling verbal instructions, word sequences, and narrative details that affect daily communication and academic performance.

Strategies for Improving Memory in Individuals with Down Syndrome [25,26]:
1. Multisensory Approaches:
• Integrate verbal information with visual cues (e.g., images, text, or gestures) to improve memory retention.
Utilize sign language or AAC to enhance verbal memory retention.
Participate in motor-based activities, such as finger tapping while articulating syllables, to stimulate diverse cognitive pathways.
2. Phonological Memory Training:
• Enhance repetition-based learning by consistently practicing new vocabulary, rhymes, and songs. Utilize syllable clapping exercises to enhance phonetic segmentation skills.

Utilize nonword repetition tasks to improve phonological memory and pronunciation abilities.

3. Strategies for Sentence Rehearsal and Chunking: Segment sentences and instructions into smaller, manageable units to improve recall..• Gradually enhance sentence complexity in repetition drills (e.g., progressing from "I see a dog" to "I see a big brown dog"). Visual sequencing tools can enhance story retelling and bolster memory for connected speech.

4. Visual and Auditory Memory Support: • Employ story maps and visual organizers to enhance recall and sequencing. Encourage using self-rehearsal techniques, such as verbalizing steps aloud or employing internal speech, to enhance memory retention. Integrate rhythmic patterns, including chanting or singing, to improve auditory memory.

5. Computer-Based Memory Training:

• Employ training programs to improve working memory capabilities, including Cogmed, Memory Booster, or Fast ForWord.

• Create interactive language games that require active listening, recall, and response to auditory stimuli.

An individual educational plan is tailored to the needs of each child with Down syndrome. Memory-enhancing techniques should be used in everyday communication and educational activities to empower children with Down syndrome to improve their language acquisition and retention. With their pronounced visual learning capabilities, integrating spoken language with visual and gestural supports can significantly enhance their language skills. [27].

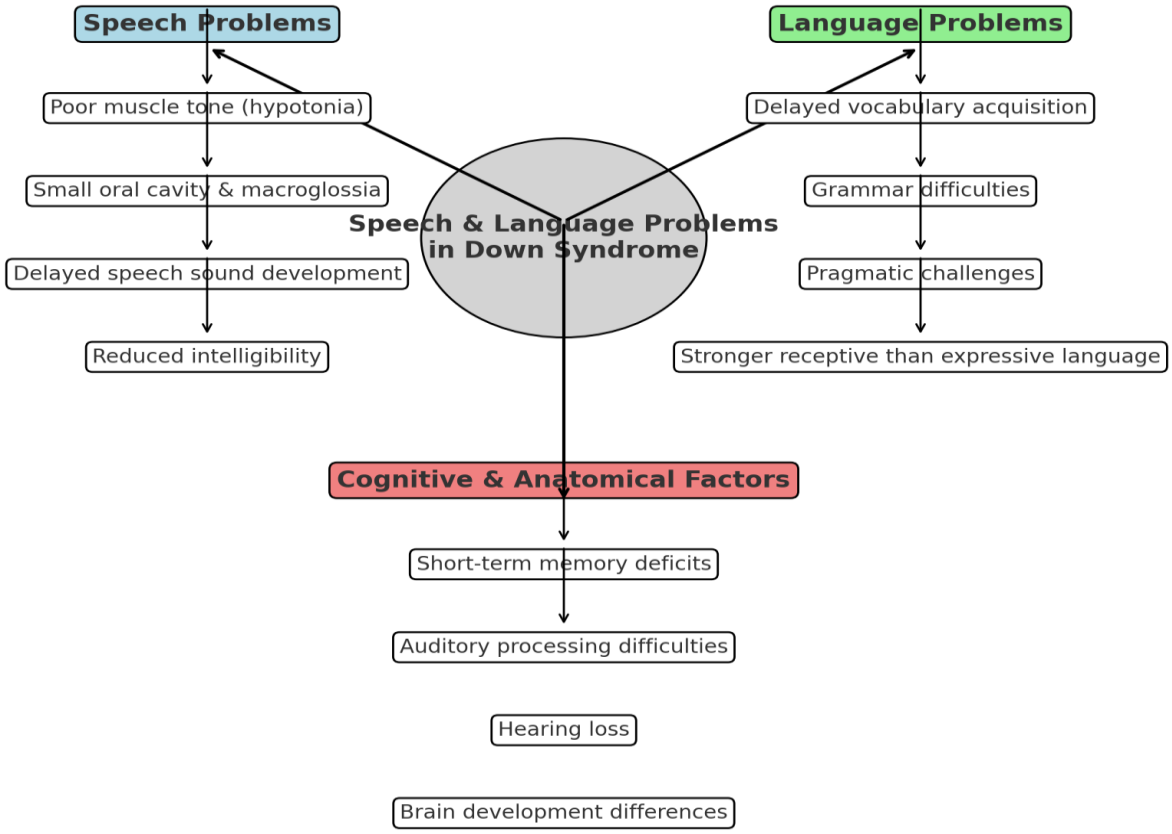

Figure 1: Speech and Language Problems in Down Syndrome

Types of Interventions (Figure 2):

Speech and language therapy (SLT) enhances communication abilities in individuals with DS. Interventions must be customized to correspond with the individual's cognitive profile, emphasizing critical domains, including expressive and receptive language, pragmatics, articulation, and memory.

Enhancing working memory and auditory processing:

SLT interventions must target deficits in working memory, a cognitive system that temporarily holds and manipulates information, especially phonological working memory. Strategies encompass Multisensory Learning, which involves integrating visual aids, sign language, and written words with spoken language to enhance auditory memory retention. Repetition-based learning involves regularly practicing new vocabulary, rhymes, and songs to strengthen phonological representations. Structured language training involves deconstructing sentences into smaller, manageable units and employing repetition to enhance comprehension and retention [28].

Expressive and Receptive Language Interventions

- Expanding Expressive Vocabulary: Visual supports, structured syntax exercises, and AAC systems help individuals construct complex sentences and enhance speech clarity [28].
- Improving Receptive Language: Simplifying sentence structures, using multimodal Learning (e.g., combining spoken words with visual cues), and incorporating auditory training programs improve comprehension [29]..
- Targeted Grammar and Syntax Training: Explicit speech sound training and structured language therapy have improved sentence formulation and grammar [30].

Pragmatic Language and Social Communication

- Social Communication Training: Role-playing, turn-taking exercises, and teaching topic maintenance enhance pragmatic skills [31].
- Parental Involvement: Early, high-dosage interventions in naturalistic settings, with parents actively involved, improve language input and children's communication skills [32].

Motor Speech Interventions

- Dysarthria and CAS Interventions: Research highlights the overlap of motor speech disorders in DS [33]. Dynamic Temporal and Tactile Cueing (DTTC) is a technique that provides visual and tactile cues to assist speech production and improve speech intelligibility.
- Oral Motor Therapy: Exercises targeting articulation and oro-motor coordination enhance speech clarity [34].

Narrative-Based and Literacy Interventions

- Narrative Skill Development: Children with DS can benefit from interventions focusing on storytelling and narrative retelling, improving expressive language.
- Phonological Awareness and Literacy: Training in phoneme identification and syllable segmentation has improved articulation and decoding skills [35].
- Electropalatography (EPG): Helps correct articulation by providing visual feedback on tongue-to-palate contact [36].
- AI-Based Communication Tools: These programs translate atypical speech patterns into readable text, supporting communication for individuals with DS [37].

Novel Approaches in SLT for Down Syndrome

- Key Word Sign (KWS) in Shared Reading: Studies indicate that embedding KWS prompts during shared book reading increases utterance frequency and improves parent-child interaction [38].
- Teaching Intransitive Verbs with Semantic and Syntactic Cues: Research supports using targeted cues to expand verb vocabulary in children with DS

Bridging Research and Clinical Practice

The lack of access to skilled professionals and funding creates barriers to implementation. Strategic investment and integration of research into clinical settings are necessary to ensure that individuals with DS receive optimal support. Multimodal strategies, such as structured training, innovative technological tools, and SLT interventions, can significantly enhance the communication abilities of individuals with Down syndrome, promoting better social interaction, academic success, and overall quality of life [39].

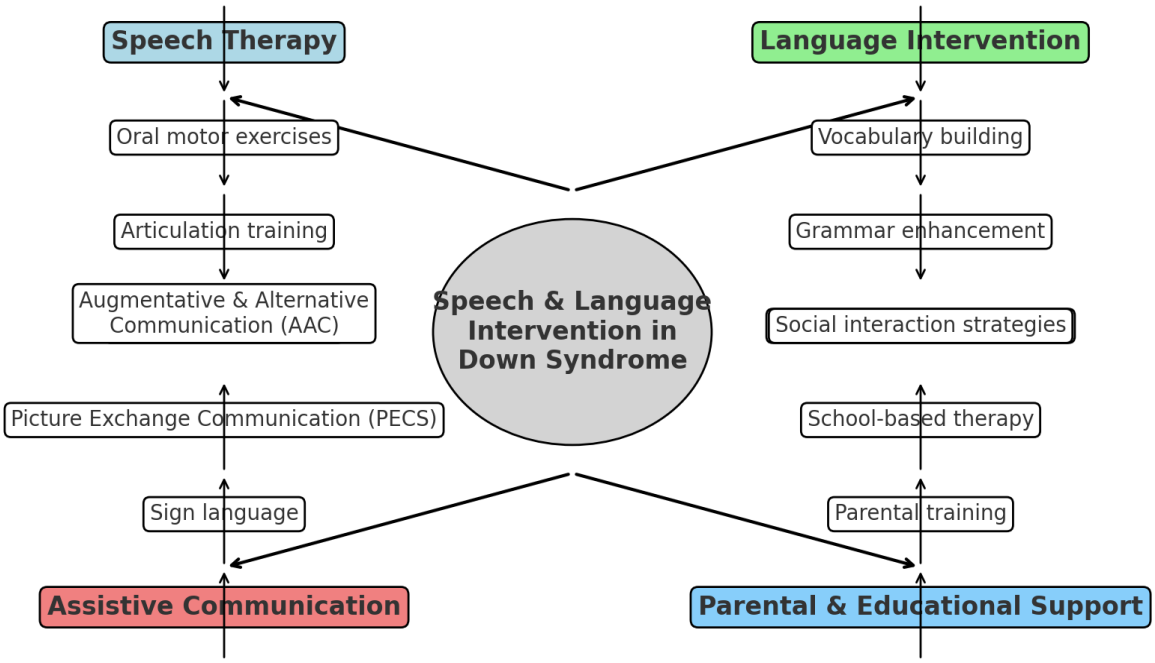

Figure 2: Rehabilitation of Down Syndrome

Conclusion

Speech therapy is crucial for children with Down syndrome, who constantly struggle with speech and language. Early, targeted interventions, including motor speech and phonological skills therapy sessions and parental participation, have significantly improved therapy outcomes. Technology development can further enhance therapy outcomes. Closing the gap between research and practice is essential to guarantee that everyone with DS receives appropriate and effective treatment.

List of Figures

List of Abbreviations

SLT: Speech and Language Therapy
DS: Down Syndrome
AAC: Augmentative and Alternative Communication
RCTs: randomized controlled trials
ERP: Event-related potential
IQ: Intellectual Disability
CAS: Childhood Apraxia of Speech

Declaration and Ethics approval
This review article does not involve human participants, patient data, or clinical interventions. Therefore, ethical approval is not required, and patient consent is not needed.

Consent for publication:
No individual data or identifiable information is included; consent for publication is not required.

Availability of data and material:
This article is a review article; all data and materials used in this study are derived from previously published research articles. The sources of information are fully cited and listed in the references section.

Competing interests:
The author confirms that there are no competing interests related to the publication of this article, as no financial, personal, or professional conflicts could have influenced its content.

Funding:
This research received no funding from public, commercial, or non-profit organizations.

Authors' contributions:
This is a single-author review article; therefore, no author contributions section is applicable. Dr. Rasha Sami was solely responsible for all aspects of this work, including conceptualization, literature review, data analysis, manuscript writing, and final approval of the submitted version.

Acknowledgments:
The authors have no acknowledgments to declare.

References

1. Canfield, M. A.; Honein, M. A.; Yuskiv, N.; Xing, J.; Mai, C. T.; Collins, J. S.; et al. National estimates and race/ethnic-specific variation of selected congenital disabilities in the United States. *Birth Defects Res. A Clin. Mol. Teratol.* **2006**, *76* (11), 747–756. https://doi.org
2. Smith, E.; Hokstad, S.; Næss, K. A. B. Children with Down syndrome can benefit from language interventions: Results from a systematic review and meta-analysis. *J. Commun. Disord.* **2020**, *85*, 105992. https://doi.org/10.1016/j.jcomdis.2020.105992
3. Finestack, L. H.; O'Brien, K. H.; Hyde, K. The effectiveness of a narrative language intervention for children with Down syndrome. *Am. J. Speech Lang. Pathol.* **2017**, *26* (3), 1086–1098. https://doi.org/10.1044/2017_AJSLP-16-0200
4. Martin, G. E.; Klusek, J.; Estigarribia, B.; Roberts, J. E. Language characteristics of individuals with Down syndrome. *Top. Lang. Disord.* **2009**, *29* (2), 112–132. https://doi.org/10.1097/TLD.0b013e3181a71fe1
5. Murthy, S. K.; Malhotra, A. K.; Mani, S.; Shara, M. E.; Al Rowaished, E. E.; Naveed, S.; et al. Incidence of Down syndrome in Dubai. *Med. Princ. Pract.* **2007**, *16* (1), 25–28. https://doi.org
6. O'Nuallain, S.; Flanagan, O.; Raffat, I.; Avalos, G.; Dineen, B. The prevalence of Down syndrome in County Galway. *Ir. Med. J.* **2009**, *100* (10), 329–331.
7. Wahab, A. A.; Bener, A.; Teebi, A. S. The incidence patterns of Down syndrome in Qatar. *Clin. Genet.* **2006**, *69* (4), 360–362. https://doi.org
8. de Groot, A.; Eijsvoogel, N.; van Well, G.; van Hout, R.; de Vries, E. Evidence-based decision-making in treating speech, language, and communication disorders in Down syndrome: A scoping review. *J. Intellect. Disabil.* **2024**. https://doi.org
9. Kent, R. D.; Vorperian, H. K. Speech impairment in Down syndrome: A review. *J. Speech Lang. Hear. Res.* **2013**, *56* (1), 178–210. https://doi.org/10.1044/1092-4388(2012/12-0148)
10. Velleman, S. L.; Rupela, V.; Andrianopoulos, M. V. Motor speech skills in children with Down syndrome: A descriptive study. *Int. J. Speech Lang. Pathol.* **2016**, *18* (1), 1–10.

11. Wettling Carpio, I.; Plaza T., E. G. Estudio de características perceptuales y de vot en una muestra de niños con disartria y apraxia del habla. *CORE* **2009**. https://core.ac.uk/download/46750792.pdf
12. Moraleda-Sepúlveda, E.; López-Resa, P. Language intervention in Down syndrome: A systematic literature review. *Int. J. Environ. Res. Public Health* **2022**, *19* (10), 6043. https://doi.org
13. Wild, K. M.; Vorperian, H. K.; Kent, R. D.; Bolt, D. M.; Austin, D. Speech and motor speech disorders and intelligibility in adolescents with Down syndrome. *Clin. Linguist. Phon.* **2018**, *32* (4), 292–312. https://doi.org/10.1080/02699206.2019.1595736
14. Frizelle, P.; Ceroni, A.; Bateman, L.; Hart, N. Speech and language therapy services for people with Down syndrome: The disparity between research and practice. *J. Policy Pract. Intellect. Disabil.* **2021**. https://doi.org
15. Hicks, N. R.; Mant, J. Using the evidence: putting the research into practice. *Br. J. Midwifery* **1997**, *5* (7), 396–399. https://doi.org/10.12968/bjom.1997.5.7.396
16. Wu, H.; Yin, T.; Hsieh, K.; Lan, H.; Feng, R.; Chang, Y.; Liaw, J. Integration of different sensory interventions from mother's breast milk for preterm infant pain during peripheral venipuncture procedures: a prospective randomized controlled trial. *J. Nurs. Scholarsh.* **2019**, *52* (1), 75–84. https://doi.org/10.1111/jnu.12530
17. Zullig, L.; Deschodt, M.; De Geest, S. Embracing implementation science: A paradigm shift for nursing research. *J. Nurs. Scholarsh.* **2020**, *52* (1), 3–5. https://doi.org/10.1111/jnu.12530
18. Zhang, S. Z. The Relationship Between Antisocial Personality Disorder and Criminology: Acquired Factors and Genetic Influences. *J. Educ. Humanit. Soc. Sci.* **2023**, *18*, 127–132. https://doi.org/10.54097/ehss.v18i.10967
19. González-Ferreras, C.; Escudero-Mancebo, D.; Corrales-Astorgano, M.; Aguilar-Cuevas, L.; Flores-Lucas, V. Engaging Adolescents with Down Syndrome in an Educational Video Game. *Int. J. Hum.-Comput. Interact.* **2017**, *33* (9), 693–712. https://doi.org/10.1080/10447318.2017.1278895
20. Calculator, S. N. Augmentative and alternative communication (AAC) and inclusive education for students with the most severe disabilities. *Int. J. Inclus. Educ.* **2008**, *13* (1), 93–113. https://doi.org/10.1080/13603110701284656
21. Kaczorowska-Bray, K. Specyfika rozwoju mowy u osób z zespołem Downa. *Logop. Siles.* **2023**, *11* (2), 1–28. https://doi.org/10.31261/logopediasilesiana.2022.11.02.02
22. Ricketts, J.; Dockrell, J. E.; Patel, N.; Charman, T.; Lindsay, G. Do children with specific language impairments and autism spectrum disorders benefit from the presence of orthography when learning new spoken words? *J. Exp. Child Psychol.* **2015**, *134*, 43–61. https://doi.org/10.1016/j.jecp.2015.01.015
23. Klusek, J.; Martin, G. E.; Losh, M. A comparison of pragmatic language in boys with autism and fragile X syndrome. *J. Speech Lang. Hear. Res.* **2014**, *57* (5), 1692–1707. https://doi.org/10.1044/2014_jslhr-l-13-0064
24. Cowan, N. The Magical Mystery Four. *Curr. Dir. Psychol. Sci.* **2010**, *19* (1), 51–57. https://doi.org/10.1177/0963721409359277
25. Pinter, J. D.; Brown, W. E.; Eliez, S.; Schmitt, J. E.; Capone, G. T.; Reiss, A. L. Amygdala and hippocampal volumes in children with Down syndrome: A high-resolution MRI study. *Neurology* **2001**, *56* (7), 972–974. https://doi.org/10.1212/wnl.56.7.972
26. Roberts, J. E.; Price, J.; Malkin, C. Language and communication development in Down syndrome. *Ment. Retard. Dev. Disabil. Res. Rev.* **2007**, *13* (1), 26–35.
27. Speech Sound Disorders in children. *Top. Lang. Disord.* **2011**, *31* (2), 93–95. https://doi.org/10.1097/tld.0b013e318217e4fb
28. Donnellan, A. M.; Hill, D. A.; Leary, M. R. Rethinking autism: implications of sensory and movement differences for understanding and support. *Front. Integr. Neurosci.* **2013**, *6*, Article 124. https://doi.org/10.3389/fnint.2012.00124
29. Deacon, S. H.; Kirby, J. R. Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Appl. Psycholinguist.* **2004**, *25* (2), 223–238. https://doi.org/10.1017/s0142716404001110
30. Liu, X.; Kong, X.; Liu, L.; Chiang, K. TreeGAN: Syntax-Aware Sequence Generation with Generative Adversarial Networks. *Proc. IEEE Int. Conf. Data Min. (ICDM)* **2018**. https://doi.org/10.1109/icdm.2018.00149
31. Ekici, B.; Sigan, S.; Uzunhan, T.; Aydinli, N.; Eraslan, E.; Çaliskan, M. Effects of oral motor therapy in children with cerebral palsy. *Ann. Indian Acad. Neurol.* **2013**, *16* (3), 342. https://doi.org/10.4103/0972-2327.116923
32. LeBoff, M. S.; Greenspan, S. L.; Insogna, K. L.; Lewiecki, E. M.; Saag, K. G.; Singer, A. J.; Siris, E. S. The clinician's guide to prevention and treatment of osteoporosis. *Osteoporos. Int.* **2022**, *33* (10), 2049–2102. https://doi.org/10.1007/s00198-021-05900-y
33. Van Bysterveldt, A.; Gillon, G. A Descriptive Study Examining Phonological Awareness and Literacy Development in Children with Down Syndrome. *Folia Phoniatr. Logop.* **2014**, *66* (1–2), 48–57. https://doi.org/10.1159/000364864

34. Shriberg, L. D.; Strand, E. A.; Jakielski, K. J.; Mabie, H. L. Estimates of the prevalence of speech and motor speech disorders in persons with complex neurodevelopmental disorders. *Clin. Linguist. Phon.* **2019**, *33* (8), 707–736. https://doi.org/10.1080/02699206.2019.1595732
35. Fabus, R.; Raphael, L.; Gatzonis, S.; Dondorf, K.; Giardina, K.; Cron, S.; Badke, B. Preliminary case studies investigating the use of electropalatography (EPG) manufactured by CompleteSpeech® as a biofeedback tool in intervention. *Int. J. Linguist. Commun.* **2015**, *3* (1). https://doi.org/10.15640/ijlc.v3n1a3
36. Esmaeilzadeh, P. Use of AI-based tools for healthcare purposes: a survey study from consumers' perspectives. *BMC Med. Inform. Decis. Mak.* **2020**, *20* (1). https://doi.org/10.1186/s12911-020-01191-1
37. Vos, T.; Abajobir, A. A.; Abate, K. H.; Abbafati, C.; Abbas, K. M.; Abd-Allah, F.; et al. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* **2017**, *390* (10100), 1211–1259. https://doi.org/10.1016/s0140-6736(17)32154-2
38. Frizelle, P.; Allenby, R.; Hassett, E.; Holland, O.; Ryan, E.; Dahly, D.; O'Toole, C. Embedding key word sign prompts in a shared book reading activity: The impact on communication between children with Down syndrome and their parents. *Int. J. Lang. Commun. Disord.* **2022**, *58* (4), 1029–1045. https://doi.org/10.1111/1460-6984.12842
39. Lieven, E. Usage-based approaches to language development: Where do we go from here? *Lang. Cogn.* **2016**, *8* (3), 346–368. https://doi.org/10.1017/langcog.2016.16