Chapter 6

Language, Cognitive-Communication, and Social-Communication Interventions

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Introduction

The development of language, communicative abilities (listening, speaking, gesturing, reading, and writing), and social communication (recognizing communication intent, interpreting social cues, understanding emotional intent, using eye contact, using language to resolve conflict)[1] are integral to the ongoing development of emotional, cognitive, and behavioral function. Furthermore, there is a complex interplay between language, communication, cognition, and psychosocial and emotional well-being.[2] Children and youth with neurological disorders (both developmental and acquired) often present with developmental delays and/or impairments in language, cognitive communication, and social communication. Interventions to habilitate, rehabilitate, and promote ongoing development are fundamental to cognitive rehabilitation for children and youth with neurological disorders.

Guiding Principles: A Developmental Framework and the International Classification of Functioning, Disability, and Health

Our understanding and conceptualization of the interrelationship between language, cognition, and function has grown dramatically over the past four decades. This chapter aims to review and summarize current evidence to support the development and remediation of language, communication, and social communication within the guiding framework of the World Health Organization International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY).[3] The ICF posits that "Health is about human functioning, the capacity of individuals to live a full life as an individual and as a member of society"[4] and, "Healthy development of the child is of basic importance; the ability to live harmoniously in a changing total environment is essential to such development".[5] To this end, we will consider specific neurological impairment as a health condition that impairs body structures and function (delayed or impaired language, cognition, and social communication), its subsequent limitations on performance of activities (e.g., completing a school project), and the resulting restrictions on full participation in meaningful roles of the child (e.g., daughter/son, friend, student, sibling). We consider the personal and environmental factors (e.g., family and school) in order to place the domains of habilitation and rehabilitation within the context of learning, activities, and inclusion.

There is an increased understanding that language continues to develop well into adulthood and that language mastery underlies academic and social success. Academic and family and social environments have a profound influence on the development of language[6]

and an established body of literature supports parental and communication partner training as an integral component of the rehabilitation and habilitation process.[7–10] As children and youth undergo rapid changes in brain structure and function, we take a neurodevelopmental approach to therapies targeted at each stage of development.

Definitions: Language, Cognitive-Communication, and Social Communication

There has been much historical debate as to a definition of language. For purposes of this chapter, we expand upon the definition of Noam Chomsky (1957) as "a set (finite or infinite) of sentences, each finite in length and constructed out of a finite set of elements" (p. 7).[11] Our definition of language includes a lexicon (vocabulary), organized into novel sentences according to a finite series of grammatical rules including syntax, semantics, morphology, discourse, pragmatics (social use of language), and literacy. Thus, language is content and rules while communication is the way we use language for *listening* to apply meaning (i.e., understanding, rather than hearing), *speaking* (conversational and expository discourse), *gesturing*, reading, writing (narrative, descriptive, expository, persuasive), and *thinking*, which is inherently language-mediated.[11,12]

The term "cognitive communication" reflects the bidirectional relationship between language and communication and cognition. Thus "cognitive-communication disorders" refer to any difficulties with any aspect of communication (listening, speaking, gesturing, reading, writing, and thinking) that is affected by disruption of cognition and cognitive processes including attention, memory, organization, problem solving, reasoning, and executive functions.[13,14]

Social communication can be defined as "the synergistic emergence of social interaction, social cognition, pragmatics (verbal and nonverbal), and receptive and expressive language processing" (p. 182).[15] Social communication is also heavily influenced by a number of cognitive domains and processes, including theory of mind and executive functions.[16,17]

Social communication refers to the ways in which language and nonverbal communication behavior is used within social situations and overtly has four components:

1. The ability to *use language* for different purposes (e.g., greet, inform, gain attention, demand, command, request).
2. The ability to *adapt language* to meet the needs of the listener or situation (e.g., talking differently to a baby versus an adult, speaking louder when there is noise, awareness of the listener's knowledge, giving more or less information when needed).
3. *Following the often "unspoken" rules* of conversation and storytelling (e.g., taking turns in conversations, eye contact, proximity, using facial expressions and gestures).
4. *Facial expressions and gestures*. The rules of conversation are often different across and within contexts, cultures, and families. It is therefore important for a person to quickly understand and adapt to the rules of the communication partner(s).[18]

Collaborative Multidisciplinary Teamwork

Communication by its very nature involves social reciprocity. Development and use of language for learning and social purposes occurs across all the child's environments and settings and requires the support of all members of his or her health care and educational

team. Speech-language pathologists (SLPs) work in a variety of settings, including health care, education and the community. As such, SLPs provide unique, specific knowledge and expertise within multidisciplinary teams aimed to increase communication and social competencies in children and youth with a variety of impairments, including congenital and acquired neurological disorders. Other health-care providers who indirectly address communication issues include physicians, neuropsychologists, and occupational therapists (OTs). Educational team members who also play an adjunct role in communication issues include general and special educators, school-based SLPs and OTs, and school psychologists. The student-child and family are also essential parts of the team. Within the multidisciplinary context, the SLP may assess and target specific language skills of comprehension and expression including reading and writing, cognitive-communication skills, and social and pragmatic communication. Collaboratively, the SLP, along with other members of the school team and often with input from the health care team, supports the development of functional goals that facilitate optimal neurocognitive and social development, academic success, and transition to adulthood. The parent, the special education teacher, and other support staff share the role of implementing strategies suggested by the SLP and other team members for maintenance and generalization of key social communication behaviors that are addressed as goals and objectives in the child's rehabilitation plan and/or Individualized Education Program (IEP). For the older child or adolescent, the SLP also works collaboratively with team members to develop and implement strategies and support those cognitive domains that directly impact literacy and all aspects of communication.

Finally, in keeping within the framework of the ICF, we advocate for the development of functional goal setting that includes the child's (and parents' where age appropriate) collaboration to support success at the level of participation.[19,20] Examples of functional goal setting may include "The child will be able to follow and understand the story presented in story circle. The child will be able to communicate the main idea of the story. The child will be able to participate in activities about the story such as creative play, music, art and answering questions." We suggest the use of Malec's Goal Attainment Scaling as a method of scaffolding goals into smaller and measurable subgoals.[21]

Target Populations

While this chapter aims to address the literature for all children with neurological impairments, we will focus primarily upon those etiologies for which there is an established body of intervention literature. Acquired brain injury (ABI) is an overarching term that encompasses many types of neurological impairment in children and youth. According to the World Health Organization, an ABI is defined as damage to the brain, which occurs after birth and is not related to a congenital or a degenerative disease. These impairments may be temporary or permanent and cause partial or functional disability or psychosocial maladjustment.[3–5] Examples of ABI in children and youth include stroke, tumors, infection such as meningitis, and anoxia. A Traumatic Brain Injury (TBI) is a type of ABI defined as an alteration in brain function, or other evidence of brain pathology, caused by an external force.[22] Common etiologies of TBI include falls, motor vehicle crash, assaults, and sports-related injuries. This chapter will also address developmental neurological impairments such as cerebral palsy, autism spectrum disorders (ASDs), and language delay.

The Early Years: Infants and Toddlers, 0 to <4 Years

Infants are born prewired to communicate with neural specialization for language learning. Language, cognitive, and social-communication skills are progressively fine-tuned over time through meaningful interactions with others. Cerebral maturation beyond the age of 1, characterized by rapid maturation of the frontal executive, visuospatial, somatic, and visual-auditory regions, leads to an ever-evolving rhythmic interplay between language and cognitive development at an impressive rate, thus facilitating a stage of intense language and social communication development.[23] Speech and language acquisition, with early environmental and/or professional support of foundational social communication skills, is a critical developmental task for young children, as it sets the foundation for positive social, language, and cognitive outcomes.[24,25] Thus, the goal of any evidence-based SLP early intervention program is to improve the social communication, cognitive, and language outcomes of young children.

The rapid neurodevelopment during infancy and toddlerhood leaves the child's brain inherently vulnerable to any disruption caused by congenital factors, disease, or injury. The focus on early identification of various pediatric neurological disorders has led to an increased need to identify best practices for intervention and early intervention that provides opportunities for rich linguistic and social processing experiences to support neural pathways that feed into later language development (i.e., joint attention, intentional communication).[25–27] There is increasing sensitivity of current assessment protocols to diagnose ASD at an earlier age, and the need to focus on intervention targets and strategies that yield the best outcomes.[26] Preferred early intervention targets rely on an awareness of various areas of normative development, including sensory-motor, attention, social-emotional, and communication, as deficits in these areas have the most potential to impact social skills, language, and cognitive communication development at later stages.[25,26]

An ABI in early infancy may be associated with persistent, long-term sequelae, including developmental challenges with attention, language, discourse, and executive functions and a tendency toward challenges with social communication skills compared to normative developmental expectations, particularly in the case of severe injury.[28,29] It has been posited that the relationship between the rapid stages of cerebral and cognitive development is likely at the root of this vulnerability, as any disruption to this intricate reciprocal relationship can result in long-term or later developmental cognitive deficits.[28,30] In applying an ICF lens to the intervention needs of infants and toddlers with neurological impairments, it is important to consider normative developmental targets (see Table 6.1)* as well as social and environmental factors.

Naturalistic Developmental Behavioral Interventions

The majority of early intervention programs for very young children identified with neurological impairments were designed for children with ASD, but have functional application for other populations of children with functional communication impairments. Naturalistic developmental behavioral interventions aim to nurture a child's social, cognitive, emotional,

* While the table does not include syntax and phonological development, there are areas of communication challenge that are often addressed by speech-language pathologists.

Table 6.1 Developmental Progression: Infant and Toddlers: Ages: 0 to <4 Years Old

Age in Months	Cognition[23,31–33]	Social Cognition and Communication[23,31,32,34]	Language[6,23,31,32]
0–3	*Development of environmental and sensory awareness:* • See up close stationary and moving objects more clearly • Distinguishing between tastes • Detecting volume and pitch differences • Seeing all of the colors • Making facial expressions to respond to the environment • Anticipate things (such as sucking when seeing a bottle or nipple)	• Eye gaze and smiling • Responds to emotional reactions of others and can change behavior	• Recognizes mother's voice • Neuro-specialization for language learning • Preference for human speech over nonspeech sounds
3–6	*Development of perceptual skills:* • Recognizing familiar faces • Responding to people's facial expressions • Recognizing familiar sounds (and reacting to them) • Imitating facial expressions	• Cooing in response to speech • Babbling (4–6 months) • Responds to own name	• Attends to sounds within the environment • May vocalize in response to speech • Responds to own name by scanning environment • Fixes gaze on the speaker
6–9	• Beginning of simple categorization • Understanding how inanimate and animate objects are different • Distinguishing between pictures with different quantities of objects • Determining how far away something is based on its relative size	• Initiates vocalizations to another person • Varied vocalizations for various emotional states (i.e., laughing; crying when parent leaves the room)	• Understands some nouns (i.e., common objects) • Imitates familiar sounds and actions
	• Staring longer at things that are "impossible" (including objects that are suspended in midair)		

9–12	*Growing physical mobility allows for more environmental exploration and mental awareness of it.* • Understanding object permanence (knowing that an object still exists even if you can't see it) • Imitating basic actions • Responding using sounds and gestures • Enjoying looking at various picture books • Beginning to manipulate objects in new ways, such as by trying to put one item inside another or turning them over	• Separation anxiety may begin and peak at 10 months • Imitates gestures and facial expressions	• Vocalize to attract attention • Illocutionary stage: individual intents expressed with gesture/vocalization (i.e., waving bye; pointing to object while saying "uh" • Sensitive to native language speech patterns (i.e., consonants, vowels, sound sequences) • Word stress patterns and prosody • Understands approximately 50 words • Begins to relate symbols to objects
12–24	• Searches for lost objects • Solves concrete problems by trial and error. E.g., 'This switch does not turn on the TV, so which one does?' • Very preliminary emergence of theory of mind (ToM), i.e., ~ age 2 shows awareness of the difference between thoughts in the mind and things in the world	• At 12 months, pointing to things he or she wants to play with or engage with • Simple turn-taking/sharing games (i.e., peek-a-boo; patty cake) • By age 2 can talk about what he or she and others want and like and feel	• First true words learned (12 to 14 months) • Labelling and increased receptive vocabulary • Following simple directions (14–16 months)
24–36	• Further preliminary emergence of ToM, i.e., by 36 months, can distinguish between an object (the block) and thoughts about the object (the block as a bus or train) through pretend play	• Verbal turn-taking • Uses polite words and phrases for requests (i.e., "please") • Introduces and changes topics • Expresses emotions • Clarifies messages when asked to do so	• Expansion of communication intents (i.e., requests information, answers questions) • Increased frequency of word use over gesture • Asks questions (i.e.. "What's that?") • Uses one-word and two-word phrases • Expansion of communication intents (i.e., symbolic play)
	• Increasing reasoning and problem-solving abilities. Understands that if I do X something (Y) will happen …. Cause and effect • Increased attention and memory for stories and songs and games • Early emergence of concept of quantity and spatial awareness of size and shape and depth	• Early understanding that people will feel happy if they get what they want and sad if they do not • Able to see that there may be a difference between what they want and what another person wants • By age 3, can talk about what people think and know	• Uses words to gain attention (i.e., "Hey!") • Engages in short dialogues

and language development in natural communication environments, and to enhance parents' awareness and use of strategies that support positive affect and social engagement.[35,36]

The Early Start Denver Model (ESDM) is an intensive early intervention technique for children aged 12–48 months diagnosed with ASD. ESDM integrates various play-based strategies with applied behavior analysis (ABA) principles, and is delivered within the child's natural environment(s) by an interdisciplinary team of ESDM trained and certified clinicians, such as SLPs and the child's parents.[25] ESMD uses developmentally-based curriculum to target identified areas for skill development, including expressive and receptive language, social communication, play skills, and cognition.[25,37] Therapy sessions are individualized to focus on interpersonal exchanges and shared engagement with real-life materials and activities.[37] In a randomized controlled trial (RCT) of ESDM for children diagnosed with autism between the ages of 18 and 30 months (N=48), children were randomly assigned to either the ESDM group or to an "assess and monitor" (A/M) group. The ESDM group received 20 hours per week of ESDM by clinicians, for 2-hour sessions twice per day; parent training of 5 hours per week; yearly assessments, and various community services selected by the parents. The A/M group received yearly assessments, monitoring, and appropriate referrals to community intervention. Two years after the start of intervention, children who received ESMD intervention demonstrated significantly increased cognitive ability, as well as improved language and adaptive behavior skills. The bulk of the improvement in the ESMD group was thought to be related to significant increases in expressive and receptive language skills.[37]

The Hanen Centre in Toronto, Canada, is focused on improving the communication outcomes of young children through early intervention programs, while embracing the pivotal role of parents and caregivers.[7] The Hanen program, More Than Words, was developed to teach parents and caregivers of children with autism to use everyday opportunities and naturalistic language stimulation strategies. Hanen-certified SLPs facilitate a manualized training program for parents to improve their child's social skills, reciprocal interactions, and language comprehension. An RCT of 62 children diagnosed with ASD and their parents compared the "More Than Words" parent-implemented intervention program to a "business as usual" control group and measured changes in the child's communication skills and parental responsivity at critical junctures over 3.5 months of intervention. Parents demonstrated moderate increases in their responsivity with the "More Than Words" intervention, and reported extremely high consumer satisfaction of the program.[38]

Hanen's It Takes Two to Talk (ITTT) program was designed to teach parents of young children identified with language delay practical strategies to support their child's language in everyday, natural settings.[8] The program involves six to eight group training sessions for parents facilitated by an ITTT-trained SLP, with a focus on teaching, modeling, and practicing naturalistic language stimulation strategies (i.e., observe, wait and listen; follow your child's lead).[8] Efficacious results have been reported in the form of improved turn-taking interactions, use of "targeted" words across contexts, and generally increased vocabulary. Parents also demonstrated a more responsive, facilitative communication style.[39] In another investigation, the ITTT intervention program was associated with improved interactions between children with cerebral palsy aged 19–26 months and their parents.[40] After 4 months of ITTT intervention, results indicated a positive shift toward parents being more responsive and less directive, and children initiating and requesting more in communication interactions.

The Early Social Interaction (ESI) project is a parent-implemented program for young children diagnosed with ASD that teaches parents strategies to support social communication development in everyday situations.[41] In an RCT, families of children aged

16–20 months were assigned to either an individual-ESI or group-ESI intervention (*N*=82). Over 9 months, the intervention groups followed a manualized Social Communication, Emotional Regulation, and Transactional Supports (SCERTS) curriculum to support the child's active engagement in natural contexts. The researchers reported significantly greater improvements on child outcome measures for social communication, developmental level, and adaptive behavior for the individual-ESI home coaching approach.

The Social ABCs program is a parent-mediated intervention for toddlers with suspected or diagnosed ASD rooted in adapted pivotal response treatment principles and strategies. It is directed by parents, who are coached by an interventionist trained in both pivotal response treatment theory and the Social ABCs program.[36] The multisite pilot study included 20 children aged 12–23 months and their parents, with 12 weeks of parent coaching, 12 weeks of program implementation, and follow-up assessment after 3 months. The manualized intervention is designed to occur over 6 months, and includes topics such as "enhancing communication" and "managing behavioral challenges."[36] The results indicated significant gains in children's functional communication and language skill development, in line with typical developmental rates, and positive parental feedback on their ability to learn the programs techniques.[36]

Individual Language Interventions

SLPs also implement other evidence-based language intervention techniques to support functional communication skills.[42] The Picture Exchange Communication System (PECS), is a modified ABA program for early nonverbal symbolic communication training, in which children are taught to use pictures in exchange for a requested item.[43] The majority of end-users of PECS are children with ASD; however, there is literature demonstrating its potential efficacy to promote functional communication with other populations of individuals with developmental disabilities and complex communication and/or cognitive needs, such as children with cerebral palsy.[43] There are six different phases of instruction, ranging from how to communicate, discriminating between pictures, to commenting. Smith et al.[44] discuss the evidence for various individual, spoken ABA programs, such as Pivotal Response Training (PRT), which was found to have positive effects on functional language and play skills, and in reducing functional deficits.[42,44] There is substantial evidence for social communication and language intervention programs that focus on naturalistic developmental behavioral interventions and acknowledge the vital role of parents and caregivers by building their responsiveness to their child and by teaching parents facilitative strategies to support their child's development of functional communication. Through "increased social orienting, opportunities arise to foster positive affect sharing through approaches that capitalize on the child's motivation and interests, and on building positive, reciprocal interactions with social partners."[35]

The Preschool and Early School-Age Years (4 to 7 Years)

During preschool and early school-age years, development of language skills continues to be essential to support academic skill development. See Table 6.2 for more information about normative developmental skills in preschool and early school-aged children. Social communication also continues to be an essential component of intervention for children with neurological impairments.[35] As early intervention has been deemed critical for positive language, social communication, and cognitive outcomes, the majority of the literature

Table 6.2 Developmental Progression: Preschool to School Age: Ages: 4 to < 7 Years Old

Cognition[6,23]	Social Cognition and Communication[6,13,23,31,34,45,46]	Language[6]
• Preoperational period of brain development overlaps with maturation in visual and acoustic functions[6] • Emergence of mental images, use of referential words, sequencing events, and intentional actions to achieve a goal (tactics) • Continued refinement of sensorineural cognitive functions (i.e., object permanence, idiosyncratic words, intentions, trial and error) *Executive Functions*: • Inhibition: rapid improvements noted in complex response inhibition tasks[31] • Working Memory: by age 6 the "executive component of working memory is sufficiently developed to be used during complex tasks that require coordination of WM subcomponents" • Shifting: 4-year-olds can shift between two "simple response sets" within the context of a story • Increase in attention span • Increasingly developed school-readiness skills (i.e., counting, drawing, sorting, cause and effect, etc.)	• Develops basic understanding of theory of mind (ToM) • "Early-developing intuitive awareness later become more reflective and explicit"[46] • Continued development of ToM beyond 4- to 6-year-olds, as seen in ToM tasks (i.e., growth in understanding of first-order to second-order false belief tests)[13] • Sarcasm, bluff, irony, and double-bluff well understood by age 8 • Increasingly developing effective utterances to discuss feelings and emotions • "Uses indirect requests; correctly uses deictic terms (e.g., this, that, here, there) • Narratives include sequence of events with unfocused chains, characters and themes[46] • Frequently shifts topics	• Understands meaning of upward of 10,000 different words • Uses common parts of speech (i.e., nouns, pronouns, adjectives, articles, verbs, adverbs, prepositions, and conjunctions) • Uses negation (i.e., I *don't* want to play with her today) • Uses past-tense (i.e., played), present-tense (i.e., playing), and future-tense verbs (i.e., will play) • Uses increasingly complex sentence structure, with addition of varied grammatical morphemes (i.e., present progressive –ing); multiple embedded clauses (i.e., She wanted *to play with her friend before she went to dance class*); coordinate conjunctions (i.e., I want the bubble gum *and* you can have the candy) • Asks Wh-questions (i.e. *When* are we going to the park?)

focuses on infants and toddlers. It is, however, our clinical impression that interventions outlined for infants and toddlers can be readily applied to the preschool population, with an increased focus on peer supports. As young children prepare to enter the education system for the first time, the development of functional social communication skills for positive peer relationships may be achieved through individual intervention, and through peer-mediated intervention programs.[35,47]

Peer-Mediated Intervention Programs

For many children, childcare and school provide ideal environments to practice and learn functional social skills via play with peers. Children with social communication challenges, however, may not attune to the subtle nuances in communication interactions in the same way, and require specific guidance to facilitate their social communication skills.[48]

Enlisting typically developing peers to be "responsive communication partners" aids in positive gains in functional language and social communication skills for children with social communication impairment.[47,49,50] Katz and Girolametto[47] examined peer-mediated intervention on social communication skills, specifically child responses and initiations, for children with ASD aged 4 to 5 years. An SLP and early childhood educator trained typically developing peers to facilitate initiating and responding skills in three of their classmates diagnosed with ASD. The peer interventionists learned about playing together and ways to interact with peers to promote friendships. The results of the multiple baseline design revealed that children with ASD increased initiations and response to peers, and maintained these gains 4 weeks post-intervention.

Similarly, Barber and colleagues[50] also noted positive outcomes for "peers as clinicians" using a multiple baseline design across participants to measure the impact of "stay, play, talk" strategies. Three preschoolers with ASD were matched with typically developing peer buddies, recruited based on educators' reports of their demonstration of empathy and support of peers. Three pretraining sessions with the peer buddies were scheduled to teach the concepts of "staying" with their friend during play; how to "play" with their friend, and how to "talk" to their friend. Clinician researchers provided targeted prompts to the peer buddies consistent with the goals of the intervention (i.e., "I like how you're *staying* with your friend"). Results revealed positive changes in the initiating and responsive social interactions of children with ASD.[50]

In another study, paired peer-mediated intervention was examined using PECS to target functional communication of four "minimally verbal" children with ASD (ages 3–5 years) and seven typically developing peers.[49] Social interactions occurred across preschool routines (i.e., play centers, snack time). All children with ASD had been using PECS at varying levels for the prior 6–12 months with an adult partner. Social communication measures of child–peer and peer–child interactions were coded in short intervals to note frequency of peer-directed interactions, the mode of communication used by the child (i.e., spoken, PECS, gesture), and engagement during dyadic play. Findings indicated a treatment effect in the form of increased peer-directed communication, particularly during snack time, and increased social engagement.[49]

The SLP plays a pivotal role in supporting early language and social communication development. The studies above provide evidence for the need to promote functional communication and peer interaction skills within a natural social context, particularly for young children with developmental disorders, who are susceptible to both social and language deficits. Given that several referenced above were case studies, more research is needed to better understand the efficacy of peer-mediated interventions.

The School-Age Years 7–13

By the time a child enters grade school, close to adult-like competence is demonstrated in communicative attempts. By age 7, most children have speech patterns similar to those of adults and speak in complete sentences, with a sufficient grasp of vocabulary, syntax, and pragmatic skills to function in a variety of surroundings.[6] In addition to communication demands of the home environment that dominate early development, children entering formal education expand their communication environments to include school and the community (for activities, teams and interests). At school entry, expected developmental trajectory for language and communication includes ongoing maturation of existing grammar and

lexical knowledge; school-aged children speak in longer, more complex utterances, take on increasing independence and leadership in conversational exchanges, explanations, and discourse, and begin to develop relationships with an expanded communicative community as a result of increasing sophistication in social and communication skills. By grades 1 and 2, most children begin to acquire literacy skills as a result of explicit instruction within the school system.[6]

Furthermore, a significant shift occurs in learning from recognition of facts, recall of basic information and learning to read during early elementary school, to the more complex "reading to learn," using newly acquired literacy to broaden access to knowledge and skills.[6] Nippold describes the increasing importance of literacy skill development as a bidirectional facilitative relationship with advances in metacognition, acquisition of linguistic and world knowledge, expansion of vocabulary knowledge, complex syntax, and the emergence of proficiency in understanding and use of figurative language.[6] Between 6 and 10 years of age, brain maturation includes ongoing development of sensory-motor functions; emergence of executive control supports this ongoing surge in independence and skill development.[23] Significant cognitive, communicative, and linguistic developments continue to occur throughout the childhood years for much longer than had been posited in the historical literature on language development in children.[6] Increased complexity, nuance, and sophistication of these developments in communicative competence is subtle, and improvements during these years represent a refining of emergent skills.

Neurodevelopmental or acquired neurological disorders can disrupt or alter neurocognitive development. Recovery from injury to a young child's brain can have a significant impact on areas vital to mastery of the typical skill development needs for independent and successful communication. Brain and skill development are enhanced by the availability of positive learning experiences, ongoing positive social interactions and a home setting rich in experience; conversely, injury, illness, stress, social isolation, and lack of educational opportunities negatively affect optimal development.[50] With maturation of communication skills, peer influence and a strong interest in friendships assume increased importance in the child's life. At school entry, developmental or acquired neurological impairments may appear more pronounced when viewed next to same-age typically developing peers than they did when viewed primarily in a supportive home or rehabilitation environment, which could be controlled to a greater extent.

One of the challenges when considering the communication strengths and needs of school-age children with neurological impairment, particularly for those with an acquired rather than congenital disorder, is that surface communicative presentation may be intact to the uninformed listener; speech clarity may generally be good, and children may speak in intelligible sentences. Thus, subtle injury-related or neurodevelopmental impairments may be more difficult to perceive overtly. Speech-language assessment and intervention then is vital from an educational, goal selection, and programming perspective to ensure that additional skill deficits do not contribute to any individual's impairment as a result of being missed by uninformed participants to rehabilitation efforts.

When applying the ICF-CY[3] to rehabilitation needs of school-age children with neurological impairments, the focus must be twofold: (1) to help the child acquire normative developmental skills to the best of his or her ability and (2) to support participation in the increasingly complex social and learning environment with a growing number of communicative partners and expectations. For more details about normative developmental skills in school age, see Tables 6.3 and 6.4.

Table 6.3 Developmental Progression Middle Childhood: Ages: 7 to < 9 Years Old

Cognition[13,23]	Social Cognition and Communication[13,23,51]	Language[6,13]
• Looks for reasons behind things – asks more questions • Understands cause and effect, makes more in-depth connections • Starts planning ahead • Increased attention span – may sit and attend for 45 minutes • Collects things • Shows interest in specific activities that interest them	• Has moments of insecurity – requires much encouragement • Changes between being helpful or upbeat to being rude and selfish • Enjoys being part of a team, group, or club • Becomes more easily influenced by peers • Begins to see things from others' point of view • Moods shift from happy to impatience or drama	• Comprehends what they're reading, moves from *learning to read* to *reading to learn* • Learns vocabulary through reading • Uses words to talk through problems • Begins to play with words to make puns, jokes, and riddles stemming from phonological, lexical, or syntactic ambiguity • Tests out bad words for shock value • Uses writing to express feelings, tell stories, and summarize information • Begins to use metalinguistic competence to enhance understanding and use of language in all domains • Begins to think abstractly

Successful speech-language interventions need to address functional requirements for enhancing quality of life, not simply look at overall general skill development. Acquiring enough vocabulary to thrive in math class will be overshadowed if children spend their recess and lunch time alone, and parents, while happy enough to have their child cope with the curriculum, typically express their strongest wish for their child to be accepted socially.

Finally, early impairments resulting in passive communicative intent, or reduced use of conventional communication signals, may be exacerbated in the busy classroom environment. Thus, improved robustness of communication attempts and resilience in finding successful social communication strategies must be preschool intervention goals to be expanded in the increasingly sophisticated environment. Impairments such as those in working memory, response time, and word finding may be tolerated poorly in busy classroom settings, and students may be unable to participate fully in group-learning opportunities as a result.

Developing peer interactions for those with neurological impairments can be especially challenging: social communication deficits, a hallmark feature of ASD, may be a more prominent limitation in reaching a child's potential in school. The use of poorly filtered remarks and inappropriate sharing of personal or private information has also been reported as a common feature in both communication literatures of TBI and ASD populations.[54] Impairments in recognition of facial expressions can lead to difficulty in responding to conversations or to information provided by others.[54] Difficulty perceiving anger or frustration can compromise successful communication and lead to frustration from communication partners. Similarly, children with TBI have greater difficulty with both emotion recognition and conversational skills than typically developing children.[55] Recognition of vocal emotion in verbal interactions may be impacted by impaired processing speed, poor flexibility, and inattentional focus.[1] Failure to determine that a teacher or peer has become frustrated with interaction attempts will be viewed negatively by others around the student,

Table 6.4 Developmental Progression Junior/Preadolescence: Ages: 9 to < 13 Years Old

Cognition[3,52]	Social Cognition and Communication[6,51–53]	Language[6]
• Emergence of abstract thought • Able to see both sides of an argument or differing points of view; increasingly able to see others perspective • Emergence of reasoning abilities, able to establish and modify rules, emergence of hypothesis development • Emerging ability to predict consequences • Increasing ability to see relationships between ideas • Emergence of awareness of the "bigger picture" and emphasis on fairness and justice • Increasing need to know and understand "why" • Increasing problem-solving abilities • Strong ability to memorize facts • Increasing organization, classification abilities • Increasing periods of concentration up to several hours at a time by age 12 • Realization or awareness that thinking is an ongoing process or stream-of-consciousness, with each thought triggering a new thought	• Increase in ToM skills and knowledge about others' mental states and attitudes • Emerging need to "fit in," have a sense of belonging • Peer group becomes increasingly important, enjoys joining clubs, groups, teams, etc. • Able to recognize "faux pas," i.e., saying something that is inappropriate or could be misconstrued – such as mistaking a boy for a girl or a customer • in a restaurant for a waiter[52] • Development of strong individual friendships • Emergence of viewing themselves as independent from adults (increases with age) • Defiance and/or rebellious behavior associated with emerging independence • Can evaluate behavior with insight • Emergence of self-talk to self-regulate behavior and emotional response to situations (impacted by fatigue) • Beginning to "try on and evaluate" different identities and discover who they want to associate with • Increasing development of empathy, however, can also be "mean" to others • Enjoys cooperation and some competition • Increasing enjoyment of humor, jokes, and puns • Increasing competence in reading nonverbal communication and facial expressions	• Vocabulary increases to approximately 20,000 different words • Understands abstraction and meanings of double-function words (e.g. hard, cold) • Able to use morphological analysis to understand compound words (e.g. birthday, applesauce) • Emergence of derivational morphology (i.e., changing a root word by adding a prefix or suffix to alter the meaning of a word; e.g., dance + "er" = dancer, happy + "ness" = happiness (continued development of vocabulary, use of derivational morphology highly influenced by exposure to the printed word) • Emerging and increasing comprehension and expression of abstract language • Increasing complexity of spoken and written sentences through use of subordinate conjunctions such as "because, after" and adverbial conjunctions such as "also, then" • Increasing understanding of adverbs that convey likelihood and magnitude (e.g.. definitely, possibly, probably, somewhat, extremely) • Emerging and increasing understanding of ambiguous sentences, e.g., "The chicken was ready to eat" • Understands and explains meaning of common proverbs and idioms • Increasing understanding of sarcasm (using contextual cues) • Development of interest and enjoyment in reading chapter books • Automaticity of word reading attained

igniting a chain of negative and unwanted reactions as a result. Difficulty recognizing what comments should not be shared (comments about the appearance of another person, private bodily functions, or secrets) can produce additional barriers to developing social supports with peers in any population with neurological deficits.

Use of humor and slang in school-aged children is believed to a play role in building and strengthening relationships with peers, coping with embarrassment, and expressing emotions, and these may be important skills to assist in gaining credibility with a potentially supportive social group.[6] Poor vocabulary knowledge, slow processing speed, and difficulty moving beyond literal interpretation of phrases, for example, will all impact a child's ability to laugh with peer groups, with the result that he or she may be singled out for laughing too late, too loudly, or too long.

The ability to sustain focused attention is vital for comprehension of language and the learning requirements of the elementary school classroom. Language of classroom instruction increases in length and complexity while written texts begin to contain subordinate clauses, modifiers, and complex sentence constructions as well as refer to information in text presented earlier. Children who cannot sustain attention are therefore unable to use information to predict, summarize, infer, or make conclusions based on comparing text presented previously with current written material. They fall further behind, becoming frustrated with efforts that are not providing results.

It is noteworthy that at this time, there is a relatively limited body of evidence-based programming available for rehabilitation of language, cognitive communication, and social communication in school-age children with neurological impairments when compared with early intervention, adolescents, and adults. One program that was developed to maximize individualized language, communication, and learning goals in the classroom is the Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH).[56] TEACCH is widely used in the public school system. The intervention uses assessment findings from formal testing procedures to create goals embedded in a curriculum designed for each individual based on specific skill deficits. Careful control over environmental factors (reducing distractions), organization of activities to reduce frustration and care to fade dependence on adult helpers are all hallmark features of TEACCH. Core components of TEACCH include the use of external organizational scaffolding to help compensate for weakness in executive function and attention difficulties, and consistent use of visual support (including picture or written cues). In addition, proactive attention to address physical setup, use of a systematic approach to work or learning tasks, and ensuring skills are mastered independent of cuing or prompting by a support person are cornerstones of TEACCH. In a recent meta-analysis examining the efficacy of TEACCH in children and adults with ASD, effect sizes were small and caution was advised due to small number of available studies.[56]

Narrative Skills Interventions

Case reports provide preliminary support for narrative skills training in school-age children. Three early elementary school students with neuromuscular impairment and concomitant general language impairment participated in a 10-week program, based on the Functional Language Intervention Program for Narratives (FLIP-N).[57] The intervention had a positive effect on literate language and functional narratives. In a single case study using

a quasi-experimental design, Marks and Stokes[58] found narrative-based interventions to be beneficial to word-finding deficits in one eight-year-old student with language impairments.

Social Communication Interventions

Peer training and support programs have received much attention due to encouraging results for individuals with diagnoses of TBI[10] and ASD.[59] In structured settings, typical peers interact with the child needing support to seek, prompt, and reinforce specific social behaviors. While they have encouraging success rates, the significant time and setup requirements needed to implement this type of support means they are not always practical to implement in some school settings.[59]

The Social Communication Intervention Program (SCIP), a direct treatment program designed for children with pragmatic disorder with or without ASD, was investigated in 88 school-aged children with pragmatic and social communications needs, using a RCT design. Children between age 6 and 11 received either 20 hours of direct SCIP treatment taken directly from an intervention manual, or regular treatment services. SCIP treatment sessions targeted higher level language skills, semantic impairments, and training in social interaction and interpreting social cues. Although standardized tests of language did not show changes, parents and teachers reported increased conversational competence and classroom learning.[60]

LEGO® Therapy is a social communication intervention program which uses adult-supported peers and has success with children with ASD. In this treatment, a small group plays together with LEGOs® while challenges to successful participation are identified and potential solutions for navigating rule infractions are offered and supported by the adult. In a cohort study, 16 children participated in 18 sessions after school. Working together as a group of three, each child assumed a "job" (someone to describe what to do, someone to find the appropriate pieces, someone to assemble the pieces) to build a LEGO® set as the goal of treatment. The results showed increasing attention and resilience to overcoming challenges while playing with innately motivating materials in a natural learning context. Following intervention, social interactions increased and maladaptive behaviors decreased.[59]

The Social Use of Language Programme (SULP) was developed for school-aged children with ASD and LD and uses intrinsically motivating materials to support participation.[59] As part of SULP, a supportive adult presents various social challenges linked to specific skill goals using monster stories, and potential solutions or strategies are enlisted from a small peer group.[59] This cohort study included 15 school-aged children in an 18-week program. The social interaction scores on the Gilliam Autism Rating Scale (GARS) showed less robust improvements for maladaptive behavior when compared to the LEGO® Therapy treatment, although support for the use of engaging and naturally occurring resources was noted.[59]

The Conversation Club curriculum[61] was developed for children with ASD to support spontaneous peer conversation by targeting specific skill development (e.g., learning to orient and attend to partners, practicing identifying key words and strategies for repairs to simple breakdowns in conversations).[61] A pilot study of four participants with social cognition deficits, including ASD, used analysis of video recordings pre-, peri-, and post-treatment. While results are not yet available, peer support and targeting deficits directly in development functional communication skills may yield promising results.

Communication Partner Training Interventions

In a review of treatments for children with lower functioning ASD and children with intellectual disability provided by nonspecialists, Reichow reported that use of support personnel in treatments for communication skill development showed some promise.[62] Given the unique social restrictions for children with neurological impairments and the notion that successful treatment must focus on enabling each individual to a play meaningful role in his or her community, communication partners may play a vital role in supporting rehabilitation and enhancing access to fuller participation in social environments. Treatment of school-age children becomes increasingly complex with their greater independence, expanding the circle of community, and the explosion of higher level literacy and cognitive skills. Requirements for working memory, focused attention, and the ability to synthesize knowledge from a number of different sources interplay with increasingly nuanced and subtle ongoing language development.

Adolescence: The Middle and High School Years 13 to <19

Adolescence marks a period of significant maturation and consolidation of language, cognition, and social communication, mitigated by rapid neurological development and environmental influences.[63,64] Ongoing maturation of regional neurocircuitry and pathways, particularly in frontal brain regions, occurs through myelogenesis, supporting the further development of executive functions well into early adulthood.[63,64] Steady increases in processing speed continue throughout ages 11–18 years.[65] However, concurrent and significant changes also occur within the limbic system, which can negatively impact self-regulation, impulse control, and decision making, as well as heighten emotions and risk-taking behaviors.[64] Language continues to evolve with increased vocabulary, as well as comprehension and oral and written expression of increasingly complex and abstract information. In addition, the ongoing development of literacy, i.e., reading and writing, become crucial for academic and vocational success.[6] During adolescence, the cycle of increasing literacy further depends upon and supports later language development through reading and writing. Exposure to literate language through reading books then becomes a critical source of vocabulary learning, which in turn can stimulate the use of complex language and syntax in spoken and written discourse.[6] Adolescence is also an integral time for the development and refinement of social relationships that includes the peer-group and can expand to romantic and vocational relationships.[66]

During adolescence, language, cognitive communication, and social communication abilities expand in order to meet the increasing complexity of academic and social demands, emerging vocational demands, and future planning.[67,68] For more information on normative development in adolescence, see Tables 6.5 and 6.6. Furthermore, in current culture, today's adolescents are more connected, more mobile and more social than ever before, and many social relationships have a virtual online component. Neurological impairment can alter or delay the developmental trajectory and have significant impact on participation in social and academic environments. Thus, interventions to support social and academic communication competence and transition to adulthood are of particular importance for adolescents with neurological impairment.

The limited intervention literature for adolescents is focused primarily upon ABI (including TBI) and ASD, and some upon a theoretical framework of LD. While there is

Table 6.5 Developmental Progression Mid-adolescence: Ages: 13 to < 16 Years Old

Cognition[23,32]	Social Cognition and Communication[23,32,69]	Language[6]
• Surge of frontal lobe development supports increased abilities in abstract thought • Increased metacognitive awareness • Increased ability to identify logical relationships within a problem and apply a systematic logic (i.e., hypothetical deductive reasoning statements such as "if–then"), to solve problems • Increased ability to reason from known principles (form own new ideas or questions) • Increased ability to consider many points of view according to varying criteria (can compare or debate ideas or opinions) • Emergence of executive functions with goal-directed behavior, increased attentional flexibility, inhibitory control, and working memory but requires external structure for success	• Peak emergence of the "social self" • Easily switches language use between contexts (e.g., with peers vs with teachers) • Uses sarcasm with peers, parents, siblings • Enjoys and uses "inside jokes" and humorous anecdotes for self and peer- group identification (and exclusion) • Peak of self-consciousness, self-awareness and need to "fit in" • Peak sensitivity to social rejection • Increasing development of medial prefrontal cortex • Understands and enjoys linguistic ambiguity in advertising, jokes, riddles • *Note*: Developmental regression in inhibitory control in early adolescence has been identified based on influence from social factors[69] • Increasing emotional empathy and beginnings of romantic social attachment	• Vocabulary increased to approximately 30,000 different words • Understands both physical and psychological meanings of double-meaning words (e.g., cold, bright) • Follows complicated instructions • Knows when they haven't understood and emerging confidence in requests for clarification • Able to create and tell long and very complicated stories • Increasing knowledge of prefixes and suffixes • Increasing proficiency in using context and morphological analysis to determine meaning of unfamiliar words both in reading and conversation • Increasing length, complexity, and proficiency in written language • Increasing ability to use literate vocabulary (combined reading and written vocabulary) in formal speaking and writing • Emerging ability to use complex language to reason, formulate hypotheses and arguments • Understands and uses key features to describe abstract nouns • Mean-length conversational discourse = 8+ words • Use of moderately difficult conjunctions such as even though, furthermore

a paucity of evidence for adolescents with other neurological disorders, it is our clinical impression that there are some areas of overlap, and many of the studies outlined below may have efficacious applications for those with similar impairments, regardless of the underlying etiology. We recognize that intervention evidence from one population cannot be directly translated to another as the intervention outcomes may differ. However, we suggest that target domains and methodological interventions themselves, while not formally studied in other adolescent populations with neurological disorders, may be applicable and may provide a starting point for clinicians.

Table 6.6 Developmental Progression Late-adolescence: Ages: 16 to < 20 Years Old

Cognition[13,23,32,63]	Social Cognition and Communication[1,13,63,70]	Language[8]
• Continued development of executive functions (EFs), which mediate a complex interplay with thinking, ToM, social and emotional reasoning and judgement, and language development through abstraction and inferencing • Continued development of executive functions with associated increases in working memory, ability to manipulate and integrate multiple, increasingly larger and more complex pieces of information simultaneously toward one goal • Increased goal-directed behavior and self-regulation	• Increased EFs facilitate; • Social and emotional development, heightened awareness and understanding of social context with increased social competence • Leads to continued development of more complex relationships, including romantic and vocational relationships • Social and cultural influences are highly salient • Increased development of executive functions also allows for increased initiation of behavior and communication, and increased self-regulation • Increased flexibility in thinking allows for increased social perspective taking • Uses context clues to understand sarcasm in absence of intonational cues (i.e., inflection, tone of voice) • Understands and uses function of sarcasm in humor and muted criticism • EFs facilitate the development of personal rule sets that efficiently guide behavior	• Knows the meaning of at least 40,000 to 50,000 words • Increasing proficiency with comprehension and use of abstract language • Defines abstract nouns using "Aristotelian form" (e.g., Peace is a condition in which people live in harmony and free from conflict) • Develops understanding of subtle differences between semantically similar adverbs of magnitude (e.g., severely, moderately) • Knowledge and use of morphology continues to expand (root words, suffixes, prefixes) • Continues to improve upon use of literate vocabulary in contexts requiring formal speaking and writing • Increased complexity of language use for academic and vocational purposes • Mean length utterance (MLU) increases in conversation, for expository discourse (ability to explain a topic), persuasive writing (use of logic and reasoning to defend and argument, thesis) • Uses difficult subordinate and adverbial conjunctions (e.g. provided that, moreover, furthermore, similarly)

Language and Literacy Interventions

A large body of research over the past 20 years has support of Self-regulated Strategy Development (SRSD) as an evidence-based practice for teaching writing to at-risk students. A strategy is defined as a series of ordered steps that facilitates the adolescent's successful performance on a task.[71] The aim for application of SRSD is to enhance mastery of the higher-level cognitive processes necessary for writing, develop independent reflection and self-regulation of the strategy used while writing, and develop positive attitudes while writing. SRSD consists of six stages, founded on evidence-based instructional theory: (i) develop and activate background knowledge; (ii) discuss the strategy; (iii) model the strategy; (iv) memorize the strategy; (v) support the strategy; and (vi) independent performance.

Graham and Harris conducted a meta-analysis of 18 studies to examine the efficacy of SRSD for written expression for children and adolescents with LD.[72] SRSD was

found to increase composition length in adolescents. Furthermore, specific components of SRSD related to self-regulation (i.e., goal setting, self-monitoring, self-recording, self-statements, and teacher modeling) had a significant positive impact on writing performance. Overall, studies in the meta-analysis revealed improvements on specific indicators of writing including fluency, organization, length, and quality; increased critical elements (e.g., setting, character); and increased clarity of topic sentences.[72] Moreover, there was evidence of increased vocabulary, as well strategy transfer to overall student planning. The authors also include a comprehensive table of the specific strategies used in each of the studies along with a description of each strategy and its application. This is of particular relevance, as interventions involving metacognitive strategy instruction are recommended for adolescents with LD, attention deficit/hyperactivity disorder (ADHD), and TBI given shared impairments in working memory and executive functions and their impacts on higher level reading and writing.[68,73,74]

In a recent review article, the available research on literacy interventions for adolescents with TBI was highlighted, using a framework based on the LD literature. Consistent with our approach, the authors advocate that there is a substantial body of literature regarding reading and writing interventions for adolescents with LDs that may be applicable to those with TBI.[68] To support *reading interventions*, the authors posit three key features, including scaffolding, individualization, and metacognitive awareness. For scaffolding, they suggest that successful interventions should allow for high levels of success by sequentially manipulating and increasing task difficulty. Second, they advocate for interventions that are conducted either individually or in a small group setting of up to six youth. To promote metacognitive awareness, they advocate for directed response questioning, a process whereby the adolescents are taught to use self-questioning while engaging in literacy tasks. These authors also identified that available interventions to support reading build three primary foci: (1) word recognition or reading fluency skills; (2) decoding skills; or (3) comprehension skills. For those with difficulties in word recognition, fluency, or decoding, they suggest a number of established, research-based, and commercially available intervention programs which target these specific skills, including "Alphabetic Phonics," "Barton Reading and Spelling System," "Orton-Gillingham," "Project Read," and the "Wilson Reading System." All have been found to improve the reading abilities of adolescents with reading difficulties.[68,72] To improve word recognition skills, they cite evidence that sight words can be drilled with flashcards using scaffolding, reading texts that approach errorless levels of reading accuracy can be beneficial, and repeated oral readings can be timed to increase reading speed.

In this same review, the authors further emphasize the need for metacognitive strategy training as an integral component to improve reading comprehension and writing skills. They suggest teaching individuals how and when to use specific strategies, including summarizing paragraphs, expanding summarization to larger sections of text, activating and making connections to prior knowledge, comprehension monitoring and repairing, and self-questioning about genre-specific elements (e.g., for narrative texts, asking self-questions about characters or theme) throughout the reading process. They stress the importance of direct feedback to adolescents as they think aloud to demonstrate use of strategies and to promote independence and generalization of reading comprehension strategies. Similar to reading comprehension, Krause and colleagues argue that interventions to support writing skills should also focus primarily upon metacognitive awareness and skills. Programs should provide provision of explicit instruction for all

steps in the writing process, explicit instruction regarding various conventions specific to each writing genre (e.g., persuasive essay, narrative essay, or compare–contrast essay), and frequent guided feedback to students about the strengths, weaknesses, and overall quality of their writing.[68]

Cognitive-Communication Interventions

Evidence to support interventions for cognitive-communication impairments is emerging; however, there is less literature in this area, reflective of the inherent challenges and complexities of conducting intervention studies for this age group. While the results of studies to date are promising, most studies have relatively small sample sizes or may be at the feasibility stage, and thus generalizability is cautioned and further research is needed before conclusions can be made.

For example, in a case study of two adolescents with TBI and severe memory impairment, Oberg and Turkstra[75] evaluated the effects of encoding to facilitate verbal learning. Encoding was defined as the process which facilitates transfer of target information from short-term into long-term memory. However, as the encoding strategies involved manipulation of the information, a more current theory would posit that it facilitated transfer from working memory to long-term memory. For verbal information, elaboration may include associations with other semantically, acoustically or visually related information. Intervention strategies included review words, match to synonyms, generate definitions, fill in blanks in sentences with target words, generate definitions with use of a dictionary, generate sentences, and then give self-generated sentences and definitions to a classmate for feedback. The authors found significant improvement in expressed word knowledge at the conclusion of the therapy with gains maintained at 1 month, suggesting that this technique may be effective for teaching specific information and vocabulary required in an academic setting. This study is reflective of early attempts to begin evaluating specific interventions for cognitive-communication impairments. Given the small sample size, we recommend caution in generalizing the findings.

Cook et al.[76] conducted a single-blinded, randomized controlled pilot study to compare the effects of two forms of cognitive interventions: gist reasoning (top-down) versus rote memory learning (bottom-up) on the ability to abstract meanings, recall facts, and utilize core executive functions within a cognitive-communication context (i.e., working memory, inhibition) in a sample of 20 adolescents with TBI. Ten adolescents completed the "gist reasoning training" using the Strategic Memory Advanced Reasoning Training (SMART) program, as compared to 10 who participated in the rote-learning intervention. The authors defined the higher order cognitive capacity of gist reasoning as the ability to strategically comprehend and convey generalized, core meaning(s) from complex information and a critical skill to enhance advanced long-term learning. Participants in the SMART group exhibited significant improvement in their ability to abstract meaning as compared to those who engaged in the bottom-up (i.e., nonstrategic, information gathering) control group. Benefits of SMART were reported to extend to untrained aspects of immediate memory, nonverbal reasoning, executive functions (i.e., working memory, inhibition and cognitive switching), and improvements in daily functional activities. Gains were maintained at 6 months post-training. Additionally, adolescents reported significant functional gains in daily-life domains of social communication abilities, work productivity, home management, and general well-being.

Pragmatics and Social Communication Interventions

There are a number of studies to support the training of social communication in adolescents with ABI and ASD and this body of evidence has been building steadily.[77,78] In an earlier study, Wiseman-Hakes and colleagues evaluated the efficacy of a peer group training intervention program to improve pragmatic communication skills for six adolescents with ABI.[78] The intervention was based on the manual, "Improving Pragmatic Skills in Persons with Head Injury,"[77] adapted for use within a group and with the addition of specific metacognitive strategies to facilitate insight and awareness. In addition to the program syllabus, participants were taught to give feedback, cue their peers on communication behaviors, rate their own communication performance, and were provided with structure and scaffolding to build and practice conversational exchanges in natural environments. Positive gains were maintained 6 months post-treatment and translated into functional social gains. For example, one parent reported that after the program her son was able to "hang out" with his brother and friends and just be "one of the group." Findings from this early pilot study suggest that a peer group setting may be beneficial for treating adolescents with pragmatic communication difficulties.[78]

Agnihotri and colleagues[79] built upon the work of Wiseman-Hakes[78] to examine an intensive group-based theater training program as a means of improving social skills in a small group of four adolescents with ABI and one control participant.[79] Goal Attainment Scaling was also used to assist in the setting and measurement of individualized functional participation goals. Led by trained professional theater artists, this multidisciplinary program provided theater training including voice work, breathing, movement, physical warm-up, character development, script analysis, writing skills, three-dimensional awareness, group dynamics, story development, mask work, and clowning, among others. Improvements in pragmatic communication skills and social and participation goals were observed across participants, and maintained at 6 and 8 months of follow-up. All the participants had identified a treatment goal of making friendships, and functionally, all of them reported improvements in their satisfaction with making friends. Generalizability of the findings from this small sample study is cautioned; however, results are promising.

Tse et al.[80] examined a group-based social skills training program for 46 adolescents with Asperger syndrome and high-functioning autism (divided into small groups of six to eight). The program combined psychoeducational and experiential methods of teaching social skills, with emphasis on learning through role-play. Each group meeting followed a standard sequence of activities, as follows: (1) Check-in: Each member discussed events and problems from his or her week. Other group members were encouraged to ask questions and offer suggestions; (2) Review of last week's skill: Leaders asked if participants had a chance to practice the previous skill; (3) Introduction of a new skill: Participants were asked to talk about their ideas on a particular social skill and may be given a card describing the new skill; (4) Role-play: Participants practiced the new skill in pairs, one pair at a time, while the rest of the group watched and gave feedback; (5) Snack break: Participants were encouraged to interact with one another during the break; (6) Activity: Group games such as charades were played; (7) Closing: Participants were encouraged to say goodbye to each other. The curriculum covered the importance of feelings, eye contact, nonverbal cues, conversation skills, negotiation, and social etiquette. The authors reported increased scores on social competence measures and decreased scores on measures of problem behaviors post intervention. Interestingly, the adolescents themselves reported more perceived skill improvements than did their parents; however, the parent-reported improvements did suggest that social skills learned during the group sessions generalized to settings outside the treatment group.

Likewise, a pilot study was conducted to evaluate the efficacy of a group-based social skills intervention program for 27 youth with Asperger's and high-functioning autism.[66] Social Competence Intervention (SCI) was based on cognitive behavioral principles and designed to challenge thinking patterns idiosyncratic to this population. The program included the use of metacognitive strategies, self-monitoring, and self-regulation, as well as exposure and response situations. The curriculum addressed participants' difficulty with perceiving and understanding emotions, deficits in theory of mind, and challenges to executive functioning that negatively impact social interactions. Moreover, the program also focused on teaching and implementation of strategies that would inherently address impairments in theory of mind rather than overt teaching of skills. The SCI contained five constructs and targeted skill sets including (1) recognition of facial expressions; (2) sharing ideas with others; (3) turn taking in conversations; (4) recognizing feelings and emotions of self and others; and (5) social problem solving. The results of the study indicated significant improvement on parental reports of social skills and executive functioning. Evidence of significant improvements on direct participant assessments measuring facial expression recognition, theory of mind, and problem solving were reported. Given that all participants were boys, the efficacy of this intervention with girls is less certain.

There are social communication interventions for adults that may benefit adolescent populations. For example, Dahlberg and colleagues also studied the benefits of a group treatment program for social communication skills in a randomized treatment and deferred treatment control trial.[81] This study involved a sample of 52 adults with TBI (mean age 41) and utilized an intervention manual, "Social Skills and Traumatic Brain Injury: A Workbook for Group Treatment".[82] Their social skills treatment program focuses on four important key components, including: (1) co-group leaders from different clinical backgrounds (i.e., SLP and social work); (2) emphasis on self-awareness and self-assessment, leading to individual goal setting; (3) use of the group process to foster interaction, feedback, problem solving, a social support system, and awareness that participants were not alone; and (4) a focus on generalization of skills, addressed through involvement of family and friends, and weekly assignments completed in the home or community. As part of the intervention, Goal Attainment Scaling was also utilized such that participants could develop and work toward individual functional goals.[21] The use of GAS is also an important aspect of this study as it is an effective means of functional and individualized outcome goal-setting and provides a flexible system of measuring outcome goals, based on a 5-point scale. Goal Attainment Scaling has been found to be efficacious for individuals with brain injury.[21] Levels of goal attainment were expressed objectively in terms of concrete behaviors that could be observed and recorded. Goals were developed with input from individual participants with assistance from the group leaders, which helped foster self-awareness and the capacity for goal-setting through use of a formal, structured process. Participants in the social communication skills treatment had improved communication skills maintained on follow-up in addition to reports of improved overall life satisfaction.

With rapidly emerging advancements in technology, virtual reality (VR) holds a promising new method of social communication interventions. Kandalaft conducted a feasibility study to examine the use of an individual VR social cognition training (VR-SCT) program for young adults with high-functioning autism.[83] The intervention utilized an engaging commercially available VR program, and included avatars of participants and therapist and a VR-SCT intervention manual. VR-SCT was developed to provide realistic and dynamic opportunities for participants to engage in and practice and receive feedback on meaningful

young adult social scenarios. After logging onto the VR system, participants were instructed by the clinician or coach inside the VR and then directed to a social situation at a specific location and with a specific person with whom to interact (the clinician avatar). Social scenarios were constructed in order to emphasize the learning objective of the session in varying contexts, such as meeting new people, dealing with a conflict, negotiating financial or social decisions, and interviewing for a job. Study findings included increased facial emotion recognition and emotion voice recognition in addition to significant increases on social cognitive measures of theory of mind and emotion recognition. Functionally, improvements in real life social and occupational functioning were also reported post-training. The authors concluded that VR-SCT is an interactive and visually stimulating approach to treatment. Their preliminary data suggest it to be a promising, dynamic practice of basic to complex social skills that will enhance meaningful young adult social skills and functioning.[83]

Communication Partner Training Interventions

As communication involves social reciprocity, interventions to support communication partner training are becoming increasingly recognized as integral to the rehabilitation process and in facilitating successful communication. Starling et al.[9] conducted an RCT to examine a program whereby SLPs trained seven secondary school teachers to modify their instructional language techniques, compared to six control teachers. The aim was to assist teachers in modifying their oral and written instructional language to support student success. Teachers were trained with specific instructions across four areas including written language, oral language, information processing, and direct vocabulary instruction. The results indicated a significant increase in use of the language modification techniques by the trained teachers compared to the control group, which was maintained over time. Of further importance, the group of students taught by the trained teachers showed a significant improvement in written expression and listening comprehension, relative to the control group.

TBI Express is a social communication partner training program for adults with severe TBI and their families. In an RTC, authors compared people with TBI together with communication partners (JOINT), without partner involvement (TBI SOLO), and a waitlist control group (CTRL) with follow-up at 6 months post-treatment.[84] The TBI Express Communication Toolkit involves teaching of strategies for: (1) collaborative intent; (2) cognitive support; (3) emotional support; (4) methods for asking questions in a supportive nondemanding manner; (5) turn-taking; (6) elaboration of topics; and (7) strategies to support elaborative organization in conversation.[10] The program also includes support materials that can be downloaded from the TBI Express website as well as videos for demonstration.[84] TBI Express led to perceived improvements in everyday communication ability of people with TBI and their family member. Communication partners who were trained to use positive communication strategies experienced significantly better interactions following the training, compared to those who did not receive training.[10] While this study was conducted upon an adult population, it is our clinical belief that the principles and the methodology may be applied to an adolescent population.

Aphasia in Childhood

A chapter on intervention for language impairment in children with neurological disorders would not be complete without a discussion on interventions for aphasia. Aphasia is an impairment in communication skills resulting from brain injury, and is manifested in expressive and receptive language impairment depending on the area of injury and symptom

presentation. Aphasia is most commonly observed after a left hemisphere stroke. Given that stroke is much more common in adults than children, the majority of the literature on stroke-induced aphasia is garnered from adult populations. That said, the incidence of childhood arterial ischemic stroke is 1 to 2 children per 100,000 per year and left hemisphere stroke can be associated with aphasia in children, at least acutely after injury.[85] Because interventions for adult stroke patients with aphasia may be applicable to children, key studies and systematic reviews are presented below.

A systematic review included 57 RCTs of speech and language interventions (i.e., any formal intervention geared towards improving functional communication), social support, or other speech and language interventions. Of these, 27 RCTs included speech and language intervention versus no therapy, and found that "speech and language therapy benefits functional use of language, language comprehension (for example listening or reading), and language production (speaking or writing), when compared with no access to therapy, but it was unclear how long these benefits may last."[86] In addition, higher intensity and frequency of language intervention was felt to improve functional communication and decrease severity of aphasia symptoms in daily living situations.[86,87] The most common speech and language interventions use best practice guidelines for the treatment of aphasia, which include a combination of "linguistic and communicative-pragmatic approaches individualized to the baseline profile of each patient."[87]

There are many intervention strategies that utilize methods based on impairments, specific communication needs, or some hybrid of methods, and continued evaluation is needed to assess the effectiveness of these methods. An example of an impairment-based method is constraint-induced language therapy (CILT), which forces a person to use impaired language by constraining a facilitative communication strategy, such as gesture. A systematic review of CILT included 10 controlled trial studies, and found "moderate evidence for more intensive treatment and the positive effects of CILT".[88] Other communication-based interventions for aphasia include communication partner training, such as Supported Conversation for Adults (SCA) with aphasia. Trained volunteers support meaningful communication interactions in real-life settings with visual tools and scaffold questioning, often within an aphasia support center setting.[89] As discussed throughout this chapter for other types of language impairment, trained communication partners can improve functional communication for individuals with aphasia. Living with Aphasia-Framework for Outcome Measurement (A-FROM) was designed to "help plan intervention in a way that ensures outcomes with real-life impact for individuals and families living with aphasia." While intervention studies of adults with aphasia are promising, caution is needed when considering similar interventions with children, especially at younger ages.

Case Example 1

Ben is a 2-year-old boy diagnosed with ASD. He started preschool part-time a few months ago and it is not going well. Ben's mother enrolled him in the preschool program because she believed that peer social interactions would help encourage his verbal communication. Ben has a history of language delay, and has received speech and language intervention with an SLP since the age of 18 months, to develop his expressive and receptive language skills. He is sometimes echolalic, speaks in mostly single words for requesting, has difficulty using and understanding gestures, and engages in

solitary play. He has difficulty with joining play routines, reading social cues of other young children, and sharing toys. Ben's preschool teachers note that he becomes easily frustrated during circle-time, transitions, and in play centers, and lashes out at other children by biting, hitting, and scratching. The daycare has informed Ben's mother that they cannot manage him. A remote behavioral consultant is involved, but onsite behavioral supports are not available to help manage his behaviors.

Ben's difficulties with social communication skills (i.e., joint attention, lack of gestures, perseverative routines, etc.) are limiting his ability to successfully participate in his preschool program. His parents' goal is to learn strategies to support Ben's functional verbal communication skills, and to increase Ben's ability to have positive social interactions with peers and family members by improving his social communication skills. The Mullen Scales of Early Learning (MSEL), a scale that assesses five developmental domains, including receptive and expressive language, was administered pre- and post-intervention, and confirmed the appropriateness of these goals. There is strong evidence for changes in positive parent–child interaction patterns with parent-mediated intervention programs, and some evidence that may indicate improvements in language comprehension and severity of behaviors in children with ASD.[90] The Social ABCs[36] intervention program is implemented by the SLP. Over the next 12-weeks, an SLP coached Ben's mother within the home on the use of intervention techniques found in the manualized program, which includes eight modules (i.e., the ABCs of Learning, Enhancing Communication, etc.), emphasizing the principles and techniques of parent responsiveness, positive affect, and ABA. Ben's mother also received real-time coaching as she interacted with Ben, and was positively reinforced when she accurately used the strategies. Ben's parents implement the strategies with Ben during naturalistic play opportunities over the subsequent 12 weeks on their own, with gradually tapering home visits from their interventionist over the first 8 weeks. At the 3-month follow-up, the receptive and expressive language domain scores of the MSEL improved. Although practice effects cannot be fully ruled out, qualitatively, significant gains were noted in Ben's functional spoken communication, including his commenting, gesturing, and smiling.

To continue to support generalization of Ben's goals and successes within the Social ABCs program, the SLP would do the following:

- Consult with Ben's team (i.e., OTs, early childhood educators, family members), on strategies to support Ben's verbal communication and social communication skills.
- Suggest everyday opportunities for strategy utilization (i.e., playground, grocery store, play group).
- Continue to monitor Ben's intervention plan and goals.

Case Example 2

Ashley is an 8-year-old girl with a history of pragmatic language and social language difficulties who sustained a moderate TBI four months ago. She was playing at the park when she slipped on a play structure and hit her forehead on the ground. Loss of consciousness was reported at the scene and she was taken emergently to the hospital. Upon admission, she had an initial Glasgow Coma Scale score of 11 with confusion

and combative behavior. She remained hospitalized for 2 months and received intensive, inpatient rehabilitation. Following discharge, she returned to school part-time with the support of her acute rehabilitation team. An updated IEP was developed to take into account Ashley's post TBI presenting symptoms, which were no longer well served by her original IEP recommendations (e.g., redirecting off-topic remarks, providing a visual cue when she interrupted other speakers, and use of assigned supportive peer groups for seatwork).

Ashley's transfer to the school-based team has been challenging as the TBI exacerbated pre-injury symptoms. She does not participate in classroom discussion at all since her return to school; she can be inflexible and intolerant of change (i.e., she does not tolerate disruptions to her schedule, or chaos in crowded areas such as the school cafeteria); nor does she engage with peers in class or in informal settings. She has difficulty retaining information presented in class, and she is unable to relate knowledge with practical applications. For example, she knows how to add simple numbers together on a worksheet, but cannot add two prices together to determine she has enough money to buy a toy in a classroom simulated shopping exercise. Collaboration among the educational team has been only partly successful in supporting Ashley's return to formal integrated learning.

Ashley's social communication impairments (i.e., responding to peers, navigating chaos in settings that appear overwhelming etc.), in addition to her cognitive communication difficulties are impairing her learning success, limiting her ability to have peer acceptance and support, and ability to thrive in a supported classroom. Ashley's parents' goals are to have her gain more acceptance in school by learning functional communication strategies that encourage peers to accept and support her (e.g., simple greetings, turn-taking, acknowledgment that peers have spoken to her) and to develop environmental modifications and behavioral strategies to help facilitate more age-appropriate responses than her current tantrums. Her teachers are requesting support to help her learn skills for organization and memory so that she can be integrated more successfully in the classroom setting rather than working one on one.

The school-based educational team modified Ashley's existing curriculum with updated IEP goals based on results of multidisciplinary testing. Her teacher set up structured work systems and enhanced visual supports (explicit schedules of events, concrete information about what she needs to do) using the TEACCH program methodology. Her classroom supplies were organized into clearly labeled boxes, and a daily communication system for homework, goals, and other objective information was established on the school e-mail system for use with the family. A series of appropriate social communication request supports was developed. She was given laminated cards indicating the class was too noisy or asking get a drink in the hall; a hall pass allowing her, a peer and an adult helper to make transitions through the halls 2 minutes before recess or lunch; and a lunch-buddy request inviting two classmates to join her in a quiet lunch area). A class-wide buddy circle was developed with basic training for her peers and a rotating schedule of daily peer buddies was created. Peer buddies asked her simple personal questions for which possible responses were provided to Ashley in laminated photos.

At a 3-month follow-up school meeting, parents reported Ashley was showing increased enthusiasm to get on the school bus, and some classmates were now initiating

social interactions with her at swimming lessons and when in public with their families. Her teacher reported transitions within the school, both for moving throughout various school locations and moving from one subject area to another, were occurring faster and with fewer disruptions.

Conclusions and Future Directions

Congenital and acquired neurological impairments can impair the typical developmental trajectory of language, cognition, and social communication, leaving children and youth at risk of compromised learning, poor social interaction and reduced participation and quality of life. At this time, the intervention literature is primarily for children and youth with ASD, and much of the evidence is drawn from small case series or small pilot studies, reflective in part of the challenges of conducting intervention research for children with neurological disorders. Overall, there are few adequately powered randomized controlled trials, especially for children with ABI. The evidence to support interventions for language, cognitive communication, and social communication is emerging, however, and the quality of the evidence based on study design and sample size is increasing as the literature evolves. For those with congenital disorders, primarily ASD, there is a fairly large body of evidence to support early speech-language interventions that facilitate reciprocal communication behaviors such as eye contact, turn-taking, vocalization, language learning, and socialization. Parental training has been found a highly effective method of facilitating language and social communication development, and there is also evidence of the effectiveness of peer support. For school-age children, there is less evidence as the literature to date has focused primarily upon infants, toddlers, and adolescents; however, the existing evidence is targeted primarily toward social communication and communication partner training. Interventions specific to this age group are an important focus of future research. For adolescents, the current literature recognizes the importance of collaborative functional goal setting and the addition of metacognitive strategy development and teaching in addition to direct therapies. Overall, there is increasing evidence to support group interventions for social communication and communication partner training.

Emerging technologies offer new opportunities for virtual therapies and remote access to interventions. The ICF provides a framework for the development of interventions designed to target specific impairments but with the overall goals of facilitating function, participation, and engagement in meaningful life roles for children and youth with neurological impairments. Going forward, there is a need for research to examine interventions for children and youth following ABI as well studies involving emerging technologies, especially those that support remote service delivery. Longer-term follow-up is needed to further establish the functional efficacy of interventions that promote participation and support ongoing development, academic and vocational success, and social competence.

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