CHAPTER 7

Communication and Learning Disorders

LEARNING OBJECTIVES

After reading this chapter, you should be able to do the following:

7.1. Describe the key features of children’s communication disorders.
   - Identify the main causes of communication disorders and their evidence-based treatment.

7.2. Differentiate between a specific learning disorder and a specific learning disability.
   - Describe how learning disorders and disabilities are identified in school-age children.
   - Give examples of evidence-based treatments for school-age children with reading, writing, or math disabilities.

7.1 COMMUNICATION DISORDERS

Communication and learning disorders are among the most common, and most overlooked, neurodevelopmental disorders experienced by children (Bishop & Rutter, 2010). Whereas most people are familiar with Down syndrome and autism spectrum disorder (ASD), relatively few people have heard of language disorder or know much about the causes of learning disabilities. Despite their “Cinderella status” among early childhood disorders, approximately 15% of youths have one or more of these conditions. Furthermore, longitudinal studies indicate that these disorders can lead to short- and long-term problems with children’s academic attainment, behavior, and social functioning (Cortiella & Horowitz, 2014).

What Is Language Disorder?

Description

Language refers to communication in which beliefs, knowledge, and skills are experienced, expressed, and shared. It involves the complex manipulation and organization of auditory or visual symbols according to a system of rules that is determined by one’s culture. Language can be spoken, signed, or written. Between 6 and 8 million people in the United States have some form of language impairment that interferes with their ability to communicate with others (Angell, 2009).

Language disorder is diagnosed when children show marked problems in the acquisition and use of language due to deficits in comprehension or production. Children with language disorder have trouble with grammar or sentence structure or have more general problems sharing their thoughts and feelings. By definition, language disorder is not explained by intellectual disability (ID) or a physical disability, such as hearing loss (see Table 7.1; American Psychiatric Association, 2013).
A. Persistent difficulties in the acquisition and use of language across modalities (i.e., spoken, written, sign language) due to deficits in comprehension or production that include the following:

1. Reduced vocabulary (word knowledge and use).
2. Limited sentence structure (ability to put words and word endings together to form sentences based on the rules of grammar and morphology).
3. Impairments in discourse (ability to use vocabulary and connect sentences to explain or describe a topic or series of events or have a conversation).

B. Language abilities are substantially and quantifiably below those expected for age, resulting in functional limitations in effective communication, social participation, academic achievement, or occupational performance, individually or in combination.

C. Onset of symptoms is in the early developmental period.

D. The difficulties are not attributable to hearing or other sensory impairment, motor dysfunction, or another medical or neurological condition and are not better explained by Intellectual Disability or Global Developmental Delay.


The Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) does not specify how language disorder should be assessed and identified. In practice, however, language disorder is typically diagnosed in toddlers and preschool-age children who earn language scores more than 1.25 standard deviations below the mean on standardized language tests (e.g., <80), have nonverbal IQ scores within with the average range (e.g., >85), and otherwise appear healthy. Children with language disorder, therefore, show impairment that is specific to their language skills rather than general intellectual impairments or global developmental delay (GDD).

Children with language disorder can show problems with receptive language, expressive language, or both aspects of communication. Receptive language is the ability to listen to and understand communication. One test of receptive language is the Peabody Picture Vocabulary Test, Fourth Edition. On this test, the psychologist presents four pictures to the child and asks her to point to the picture that shows a specific word or idea. The test assesses receptive vocabulary because the child indicates her understanding by pointing, not by speaking or writing. In contrast, expressive language refers to the ability to share beliefs, knowledge, and skills with others. One test of expressive language is the Expressive One-Word Picture Vocabulary Test, Fourth Edition. On this test, the psychologist presents a picture to the child and asks her to name it. This test assesses expressive vocabulary because the child must recognize the picture and state its name (Shipley & McAfee, 2015).

Language disorder is characterized by overall delays in language acquisition or skills. The diagnosis serves as a “red flag,” which warns professionals to monitor the child’s language development and, if necessary, to intervene early to prevent more serious language deficits. Typically, professionals specify the type of language problem the child displays: (a) late language emergence or (b) specific language impairment (SLI).

Late Language Emergence

Late language emergence is a type of language disorder characterized by significant delays in receptive or expressive language. It is typically diagnosed when children are between 18 and 36 months of age yet show marked delays in understanding language or speaking (see Figure 7.1). For example, a 24-month-old who cannot follow simple directions (e.g., “Pick it up”) or a 36-month-old who cannot combine words to form simple sentences (e.g., “Give me the doll”) might show late language emergence.

Late language emergence is important because it can be an indicator of later, more serious language problems (e.g., SLI) or an early sign of ASD. Therefore, children diagnosed with late language emergence need to be monitored and, if appropriate, provided with early intervention to improve their language skills (MacWhinney & William, 2015). Consider the case of Cody, a boy with language disorder characterized by late language emergence.

Prolonged delays in language acquisition can be an indicator of more pervasive neurodevelopmental problems. Buschmann, Jooss, and Rupp (2008) assessed a large sample of 24-month-old children with late language emergence. Approximately 22% showed at least one other developmental delay. For example, 12% showed borderline significant deficits in nonverbal cognitive functioning, like...
Figure 7.1  Expressive Vocabulary Increases Dramatically in Typically Developing Children

![Graph showing expressive vocabulary increases dramatically in typically developing children.](image)

Source: Based on National Institute on Child Health and Human Development (NICHD, 2010), data.

Note: Most children show a marked increase in words between 18 and 36 months of age. Children with Late Language Emergence do not.

CASE STUDY

LANGUAGE DISORDER (LATE LANGUAGE EMERGENCE)

Cody’s Problems With Language Acquisition

Cody was a physically healthy 26-month-old boy referred to our clinic by his pediatrician because of language delays. Cody’s mother reported that he was only able to speak a few words clearly, such as mama, dada, and cup. He usually communicated by gesturing and crying. A physical exam indicated that Cody was healthy; his head circumference and weight were within normal limits. He showed no problems with vision or hearing. His motor and social skills were also appropriate for a child his age.

A psychologist at our clinic tested Cody’s cognitive functioning and language skills. Although his fluid IQ fell within the average range (101), his verbal IQ score indicated marked delays (75). Cody’s receptive language skills were approximately one standard deviation below his peers. For example, he was able to follow simple one-word commands, but he had difficulty pointing to pictures of common objects when instructed to do so. Cody’s expressive language skills were also delayed. His vocabulary consisted of only about 20 to 25 words, most of which served a function (e.g., up, more, mama). He did not combine words to form simple, two-word sentences.

“I’m not sure if Cody really has a language problem or if he’s just a late bloomer,” said his mother. “I thought I’d just give him a few more months to catch up to the other kids, but his doctor suggested I have him tested right away.”

Cody, 6% showed significant deficits in nonverbal intelligence, and 4% met diagnostic criteria for ASD. Although most children with late language emergence eventually develop language skills similar to their peers, a sizable minority of these children have potentially serious developmental delays that require treatment (Pierce, 2015).

Specific Language Impairment

Although most youths with late language emergence catch up to their peers, 25% to 40% develop more serious problems with language (Kaderavek, 2014). Specific language impairment (SLI) is characterized by marked
deficits in language that are not better explained by ID or another medical or psychiatric condition (MacWhinney & William, 2015).

Children with SLI are usually diagnosed in preschool or kindergarten, when their language skills continue to lag behind those of their peers. Overall, their language is short, simplistic, and filled with errors characteristic of much younger children. Older children with SLI make the same linguistic errors, in roughly the same sequence, as much younger children without language problems. For example, a 7- or 8-year-old child with SLI speaks like a typically developing 3- or 4-year-old preschooler (Cupples, 2011). Consider the case of Bernadette, a girl with language disorder characterized by SLI.

Children with SLI typically show problems in four domains of language: (1) phonology, (2) morphology, (3) grammar, and (4) semantics (Brookshire & McNeil, 2014). Phonology refers to the sounds of a language and the rules for combining these sounds. English has 42 basic sounds, or phonemes. As children acquire language, they typically make certain errors in phonological processing and articulation. For example, it is common for 3-year-old children to say “ephant” for elephant or “sghetti” for spaghetti. However, children with SLI often continue to make these characteristic phonological errors into their early school years.

Children with SLI often show a lack of phonemic awareness—that is, the ability to hear, identify, and manipulate these sounds. For example, separating the spoken word “cat” into three distinct phonemes, /k/, /a/, and /t/, requires phonemic awareness. Children with SLI show problems with phonemic awareness in their language when they transpose, substitute, or mispronounce word sounds. For example, they may say “ting” instead of thing, “tu” instead of zoo, and “dub” instead of job. As we will see, a lack of phonemic awareness underlies both communication and learning disorders.

Morphology refers to the study of word structures—quite literally, how words are built from phonemes (Pindzola, Plexico, & Haynes, 2015). A morpheme is the smallest unit of language that has meaning. Some morphemes

### CASE STUDY

#### LANGUAGE DISORDER (SPECIFIC LANGUAGE IMPAIRMENT)

**Bernadette’s Problems With Expression**

Bernadette was a 5-year-old girl referred to our clinic by her parents because of deficits in expressive language. She had a history of late language emergence. She did not begin talking until 24 months of age and only began speaking in short two- or three-word sentences the previous year. Her pediatrician initially suspected that Bernadette had ID; however, her nonverbal intelligence and adaptive functioning were within the average range for a girl her age. Indeed, Bernadette was a friendly, outgoing girl whose main limitation was her difficulty expressing herself.

The speech–language pathologist at our clinic showed Bernadette a series of pictures and asked her to tell a story with them. The exchange went as follows:

**Therapist:** Here’s the first picture. Tell me what’s going on.
**Bernadette:** (Pointing to the girl in the picture.) Who her?
**Therapist:** Her name is Sally.
**Bernadette:** Sally. Her going shopping. Sally hold . . . (long pause) bag and . . . (pause)
**Therapist:** What is she holding?
**Bernadette:** I don’t know.
**Therapist:** OK. Let’s try the next picture. What’s going on here?
**Bernadette:** Her go into house. Sally. Her eat with mom.
**Therapist:** What did they eat?
**Bernadette:** Her eat apple. Her eat . . . (pause) . . . I don’t know.
**Therapist:** It looks like they ate an apple and some grapes.
**Bernadette:** (Smiles.) Yeah.

“She often can’t remember the names of objects,” Bernadette’s mother reported. “There might be a problem with her memory.” The therapist replied, “That is possible. I’ll need to assess her more thoroughly to be sure. But I think her main difficulty is expressive language. Luckily, there are some things you and I can do to help Bernadette express herself better.”
are “free”—that is, they carry meaning on their own as whole words (e.g., tie, walk, dog). Other morphemes are “bound”—that is, they carry meaning only when combined with other morphemes, as in the case of prefixes or suffixes (un– as in “untie”), endings (–ed as in “walked”), or plurals (–s as in “dogs”).

Typically developing children follow a relatively consistent pattern in their mastery of morphemes. For example, the use of the –ing ending (e.g., swimming) and certain prepositions (e.g., in the box) usually develop first. Later, children begin to master the plural –s ending (e.g., hats), the possessive –s ending (e.g., Mommy’s hat), and the uncontractible copula “be” (e.g., She is my mom. I am her son.) Some of the last morphemes that children master include the past tense –ed ending (e.g., walked), the first-person singular –s ending (e.g., The bird chirps), and the uncontractible auxiliary “be” followed by a verb (e.g., She is playing. I was running).

Children with SLI show marked deficits in their mastery of morphemes, especially the morphemes that are typically learned later in development (see Table 7.2). For example, many youths with SLI omit past-tense endings; they may say, “I walk to school” instead of “I walked to school.” Another common error is to omit the third person singular –s ending: “My friend walk with me” instead of “My friend walks with me.” A third common error is difficulty with conjugations involving be, such as “Mommy bes nice” instead of “Mommy is nice.” Although these errors are developmentally normative in 2- and 3-year-old children, children with SLI continue to make these errors in preschool and kindergarten (Pindzola et al., 2015).

**Grammar** describes the rules that govern the use of morphemes and the order of words (syntax) in a sentence. Children with SLI often make serious grammatical errors. For example, they might say “Me go there” instead of “I went there” or “Why he like me?” instead of “Why does he like me?” They may also not appreciate differences in word order. For example, they may have difficulty using puppets to act out the sentence “The dog is chased by the boy” because they are not sure who is chasing whom (Kaderavek, 2014).

**Semantics** refers to the meaning of language. Semantics can refer to the meaning of individual words (lexical semantics) or sentences (sentential semantics). Word meaning is important because it allows children to verbally represent their world, understand others, and convey their thoughts with precision. Children with SLI often show delays in word acquisition and word knowledge. Whereas most 2-year-old children have vocabularies of approximately 200 words, 2-year-olds later diagnosed with SLI typically know only 20 (Owens, 2013).

Children with SLI typically have semantic skills similar to those of much younger children. For example, preschoolers with SLI often show errors of overextension and

### Table 7.2 Morphological and Grammatical Errors Often Shown by Children With Specific Language Impairment

<table>
<thead>
<tr>
<th>Error</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular past tense (–ed)</td>
<td>He push him. (He pushed him.)</td>
</tr>
<tr>
<td>Present possessive verb –ing</td>
<td>Cat eat him food. (The cat is eating his food.)</td>
</tr>
<tr>
<td>Plural /s/</td>
<td>Me got two toy. (I have two toys.)</td>
</tr>
<tr>
<td>Possessive ‘s</td>
<td>That mommy hat. (That is Mommy’s hat.)</td>
</tr>
<tr>
<td>Simple pronoun errors</td>
<td>He running. (She is running.)</td>
</tr>
<tr>
<td>Pronoun case markings</td>
<td>Her do it. (She can do it.)</td>
</tr>
<tr>
<td>Omitted copula be verb</td>
<td>The bear big. (The bear is big.)</td>
</tr>
<tr>
<td>Errors in copula be verb</td>
<td>Me happy today. (I am happy today.)</td>
</tr>
<tr>
<td>Omitted articles (e.g., a, the)</td>
<td>Give me drink. (Give me a drink.)</td>
</tr>
<tr>
<td>Omitted prepositions in and on</td>
<td>Daddy, put table my paper. (Daddy, put my paper on the table.)</td>
</tr>
<tr>
<td>Omitted auxiliary verbs (e.g., is, do, can)</td>
<td>Janie do it. (Janie can do it.)</td>
</tr>
<tr>
<td>Overuse of vague demonstratives (e.g., this, that, these, those)</td>
<td>This mine! (This toy is mine.)</td>
</tr>
<tr>
<td>Third person singular verbs</td>
<td>Mommy teach me. (Mommy teaches me.)</td>
</tr>
<tr>
<td>wh questions</td>
<td>What we can make? What can we make?</td>
</tr>
<tr>
<td>Embedded clauses with wh questions</td>
<td>What do you think what Janie broke? (What do you think that she broke?)</td>
</tr>
</tbody>
</table>

*Source:* Based on Kaderavek (2011).
underextension similar to 2- and 3-year-olds. Overextension is inappropriately generalizing a word (e.g., calling all adult men “daddy”) whereas underextension is failing to generalize a word (e.g., using the word “cat” to refer only to the family’s pet and not to other cats). Children with SLI may also have difficulty with pronouns (e.g., mixing up he/she or him/her). They almost always have underdeveloped vocabularies and experience trouble expressing themselves with precision. Like Bernadette, they may appear to have word retrieval problems, use words incorrectly, invent novel words that have no meaning (e.g., neologisms), or rely on vague, simplistic words (e.g., thing, this, stuff; Cupples, 2011).

Causes

Genes and Brain Structure

Language impairments are greatly influenced by genetics. Heritability estimates for language disorder range between .50 and .75. Whereas the prevalence of language disorder is approximately 7% in the general population, the prevalence increases to 40% for children with at least one family member with the disorder. Furthermore, when the siblings of children with language disorder do not meet criteria for the disorder, they often show subtle difficulties with phonemic awareness and grammar. Altogether, these data suggest a common set of genes that predispose youth toward language problems. The greater the genetic similarity, the greater the risk for language impairment (Kornilov et al., 2016).

Some studies have found brain abnormalities in children with language disorder (Hedge & Maul, 2006). These studies have focused on the region surrounding the lateral sulcus. The lateral sulcus, also known as the sylvian fissure, is a large gyrus (groove) in the left hemisphere of the brain (see Image 7.1). In this area are several brain regions responsible for language, including Broca’s area, Wernicke’s area, and the primary auditory cortex. Most right-handed children show a normal enlargement of this area—that is, this area of the left hemisphere, which is specialized for language, is larger than the corresponding area in the right hemisphere. However, many children with language disorder do not show this typical asymmetry. Instead, both hemispheres may be of equal size, suggesting a lack of linguistic specialization.

Unfortunately, there is not a direct relationship between abnormality of the lateral sulcus and language disorder. Many children with language disorder do not show this lack of asymmetry, and many children with no language impairments show this abnormality. Therefore, this structural difference cannot explain all cases of language disorder.

Auditory Perception Problems

Auditory perception is the ability to identify and differentiate sounds. It can be measured by asking children to detect differences between two tones with different pitch or two phonemes with slightly different sounds (e.g., the /th/ and /d/ sounds). Auditory perception is important because children must detect subtle differences between phonemes in order to develop phonemic awareness. Typically developing children gradually acquire the ability to differentiate subtle differences in auditory information over the first years of life. However, children with language disorder do not. Delays in auditory perception may lead to problems in both speech and language. For example, a child who does not differentiate the /l/ and /r/ sounds may have difficulty accurately producing these sounds (e.g., the word ring sounds like “ling”). Furthermore, a child who does not differentiate the word sing from the word sings may not produce the plural /-s/ ending when speaking (Weismer, 2008).

Deficits in Rapid Temporal Processing

Rapid temporal processing is the ability to quickly and accurately process sensory information. Rapid temporal processing is assessed by asking children to discriminate between stimuli presented quickly. For example, children might be asked to discriminate between two computer-generated sounds (e.g., /ba/ and /pa/) or two multisyllabic words that are presented in rapid succession. When stimuli are presented slowly, all children perform well. However, when stimuli are presented rapidly, children with language disorder perform much worse than their peers without language impairments.

Rapid temporal processing is important when auditory information is presented briefly or in rapid succession, such as when a parent speaks quickly to a child. In order for a child to develop phonemic awareness, to learn the names of objects and to understand sentences, she must be able to encode this auditory information quickly. However, children who have deficits in rapid temporal processing take in and process less fine-grained auditory
Delays in Short-Term Memory

Phonological short-term memory is the ability to hold auditory material in memory for short periods of time. It is measured by asking children to remember long strings of nonsense syllables, such as “perplisteronk” or “blonterstap.” Phonological short-term memory is important, because the ability to learn and accurately reproduce words depends on this skill.

Problems with phonological short-term memory can lead to morphological and grammatical errors. For example, a child who has difficulty remembering auditory information may omit a past-tense or plural ending when completing a sentence (e.g., “Yesterday, I walk[ed] to school; Today, John ride[s] his bike.”) Similarly, children with phonological short-term memory deficits may have underdeveloped vocabularies or show problems understanding sentences. For example, they may have trouble determining whether “The boy chased the dog” and “The dog was chased by the boy” have the same meaning (Gathercole & Baddeley, 2014).

Impoverished Parent–Child Communication

A great deal of research has focused on the verbal interactions between children with language disorder and their parents. Overall, studies have shown that the quality of these interactions is impoverished, compared to the verbal exchanges between parents and typically developing children (Hedge & Maul, 2006). On average, the parents of children with language disorder do the following:

- Interact with their children less often
- Ask their children fewer questions
- Use shorter and less complex sentences
- Show less variation in their language toward their children
- Respond less often to their children’s utterances

It is unknown whether these parenting behaviors are a cause or consequence of language disorder. It is possible that impoverished parent–child communication contributes to children’s language delays. Alternatively, recent data suggest that the parents of children with language disorder may use less complex language in response to their children’s communication problems (Blackwell, Harding, Babayigit, & Roulstone, 2015).

Evidence-Based Treatments

The treatment of language disorder is tailored to the needs of the child. Some children, such as those with late language emergence, need help expanding their expressive vocabularies and combining words to form sentences. Other children, such as those with SLI, need to correct morphological and grammatical errors in their language, such as problems using the past tense or the omission of articles and prepositions. Treatment, therefore, capitalizes on children’s linguistic strengths to overcome or compensate their weaknesses (Roth & Worthington, 2015).

Discrete Trial Training to Increase Language Production

Individual Words. The expressive vocabularies of many young children with language disorder lag far behind their typically developing peers. A primary goal of therapy is to increase these children’s expressive vocabularies, capacity for multiword utterances, and overall language production.

For children with limited expressive language, discrete trial training may be used. As we have seen, discrete trial training is an individually administered instructional approach used to teach specific behaviors in a planned, controlled, and systematic manner. Skills are taught, one at a time, using a series of repeated trials. Each trial has three parts: (1) the presentation of the stimulus, (2) the child’s action, and (3) reinforcement for engaging in the desired action.

First, the therapist presents the target word. For example, the therapist might want to teach a child to say “cookie.” The therapist might present a cookie to the child and ask, “What is this?” If the child does not respond to the therapist’s question, the therapist will prompt the child by saying, “This is a cookie. Say ‘cookie.’” The goal is for the child to produce the desired verbal response so that the therapist can reinforce it.

Second, the therapist watches for the child to respond correctly. In this case, the child replays “cookie” with or without the therapist’s prompt. If the child answers incorrectly, the therapist corrects the child, saying, “No, this is a cookie. Say ‘cookie.’” Then, the therapist waits for the correct response.

Third, the therapist provides positive reinforcement, contingent on the child’s production of the correct utterance. For example, the therapist might reinforce the child’s reply of “cookie” by smiling, saying “Good. This is a cookie,” and giving the child a bite.

Each trial is repeated multiple times until the child correctly produces the desired behavior with minimal prompting. Then, a new behavior is introduced which usually builds upon previously acquired skills.

Requests and Comments. Discrete trial training can also be used to help children combine words into phrases and simple sentences. One important type of phrase that children learn to use is mands, or requests. Mands are important because they allow children to obtain objects, information, or privileges. Mands are also fairly easy to teach because they specify their own reinforcers. For
example, a 2-year-old who says “Give drink” can be given a sip of his favorite juice to reinforce his request.

Initially, therapists use discrete trial training to teach simple mands. For example, the therapist might produce a cup of juice and prompt the child’s request by saying “You want a drink. Say, ‘Give me a drink.’” The therapist would continue to prompt the child until the child produces the request. Then, the therapist would reinforce the mand. Trials would be repeated until the child makes the request with little prompting. Eventually, all prompting would be decreased (or faded) until the child requests on his own.

Children can also be taught to use tacts—that is, comments and descriptions. Tacts allow children to combine nouns and verbs to describe their experiences and surroundings. Examples of tacts include the following:

- Descriptions of objects (e.g., The dog is black and white)
- Descriptions of parts of objects (e.g., The dog has two ears and a nose)
- Descriptions of the function of objects (e.g., His nose is for smelling)
- Descriptions of actions (e.g., The dog runs fast)
- Action sequences (e.g., He runs outside. Then, he gets his ball)
- Expression of feelings (e.g., He likes to play).

To teach a child to use tacts, a therapist might show her client a picture of a dog and say, “Here is a picture of my dog. I want you to tell me about him. You may tell me what he looks like, about the parts of his body, or anything else. For example, say, ‘He is black and white.’” The therapist would then praise the child’s response and continue with a second trial, saying, “Very good. The dog is black and white. Tell me more about how he looks. Say, ‘He has big ears.’” Over the course of several sessions, the therapist would gradually fade her prompts so the child can describe objects on his own.

**Questions.** Therapists also teach children with limited expressive vocabularies to ask questions. Questions are important because they allow children to gather information about their surroundings and expand their semantic knowledge. The therapist structures a situation that encourages the child to ask a question. Then, the therapist models the question and reinforces the child’s attempts to ask the question.

For example, the therapist might present a magnifying glass to the child, saying, “Look what I have. You don’t know what this is. Ask me, ‘What is it?’” When the child responds correctly, the therapist reinforces his question, saying, “Great! You asked a good question. It is a magnifying glass. You see with it. Let’s try it.”

The therapist might introduce other objects, gradually fading her verbal prompt until the child can ask questions independently. The therapist might use other approaches to teach who, when, where, and why questions (see Table 7.3). In each case, the therapist initially relies heavily on verbal prompts. Later, the therapist fades the prompts as the child begins to produce questions independently.

**Complex Sentences.** Older children with language disorder usually have difficulty forming complex sentences. For example, they often have trouble generating compound sentences (e.g., “Orville climbed aboard the airplane and Wilbur started the engine”), dependent clauses (e.g., “After the engine had started, Wilbur gave his brother the signal to start”), and embedded clauses (e.g., “The airplane, which was made of wood and fabric, went into the air”).

### Table 7.3 Discrete Trial Training to Teach Children to Ask Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Who</strong></td>
<td>If you don’t know someone, you ask a question that starts with who. [Holds up a picture of a boy.] Look at this picture. You don’t know this boy. Ask me, “Who is that boy?”</td>
</tr>
<tr>
<td><strong>What</strong></td>
<td>If you want to know something, you ask a question that starts with what. [Shows a picture of two children playing chess.] Look at this picture. You don’t know what the children are doing. Ask me, “What are they doing?”</td>
</tr>
<tr>
<td><strong>When</strong></td>
<td>When you want to know when something will happen, you ask a question that starts with the word when. Let’s pretend that your mother tells you that your grandma is going to visit. You don’t know when. Ask, “When is grandma going to visit?”</td>
</tr>
<tr>
<td><strong>Where</strong></td>
<td>When you can’t find someone or something, you ask a question that starts with where. Let’s pretend that you want to put on your shoes to go outside, but you can’t find them. Ask, “Where are my shoes?”</td>
</tr>
<tr>
<td><strong>Why</strong></td>
<td>When you don’t understand something, you ask a question that starts with why. Let’s pretend that your mother gives you a toy car for your birthday, but the car doesn’t work. Ask, “Why doesn’t the car work?”</td>
</tr>
<tr>
<td><strong>How</strong></td>
<td>If you don’t know the way to do something, you ask a question that starts with how. Here is a new game that you’ve never played before. Ask, “How do we play the game?”</td>
</tr>
</tbody>
</table>

**Source:** Based on Hegde and Maul (2006).
Therapists can encourage children to use longer and more elaborate sentences using discrete trial training. Specifically, therapists systematically model, prompt, and reinforce complex sentence structures.

- Here is a picture of two men. We can tell about these men in one big sentence. Say, “One man is tall and the other is short.”
- Here is a picture of a happy girl. She just won a race. Let’s make one sentence telling why the girl is happy. Say, “The girl is happy because she won a race.”
- Here is a picture of two dogs. The dog with the red collar is dirty. Let’s make one sentence telling which dog is dirty. Say, “The dog, with the red collar, is dirty.”

The therapist gradually fades these prompts until the child can produce complex sentences independently.

**Conversational Recast Training to Correct Language Errors**

Children with language disorder often show specific deficits in morphology and grammar. For example, children may have difficulty using the *to be* form, omit the plural /s/, or leave off the –ed ending of the past tense. Therapists need to target these deficits by modeling, reinforcing, and practicing appropriate language skills. A commonly used technique to achieve these goals is conversational recast training (Cleave, Becker, Curran, Van Horne, & Fey, 2015).

In **conversational recast training**, the therapist structures the child’s environment in ways that are likely to elicit the desired verbal behavior. Then, the therapist prompts the child to practice the desired language skill, each time correcting mistakes and reinforcing appropriate language use with eye contact, smiles, attention, and verbal praise. The following Research to Practice section provides one example of this intervention.

Ample practice is critical to the success of conversational recast training. Mistakes must be corrected immediately and proper use of the desired language skills must be reinforced to maintain its use over time.

**Milieu Training to Generalize Skills**

Although discrete trial training is very effective at introducing and reinforcing language skills, therapists must...
rely on other strategies to help generalize these skills to children’s homes and schools. **Milieu training** is a treatment approach that uses behavioral principles in contexts that approximate children’s real-life environments and experiences. **Milieu** simply means the physical setting in which events typically occur. A young child’s milieu might include her home, preschool, day care, and family outings (e.g., shopping, going to the playground). In milieu training, children practice language skills in natural contexts (Wright & Kaiser, 2016).

Milieu training relies chiefly on contingency management. The therapist observes the child engage in everyday tasks, such as coloring, eating, and playing with toys, and looks for situations in which the child might be able to practice language skills. When such situations arise, the therapist prompts the child to practice the language skill, models the skill (if necessary), and reinforces the child’s attempts to use the skill.

The **mand-model technique** is commonly used in milieu training. The therapist observes the child approach a desired object, such as a toy car, and immediately prompts (mands) the child to ask for the object (e.g., “Tell me what you want.”). If necessary, the therapist models the correct statement (e.g., “Say, ‘I want the car.’”), and reinforces the child’s request (e.g., “Good. I’m glad you told me what you wanted. Here, take it.”).

Another strategy is to use the **delay technique**. This technique is similar to the mand-model approach, but the therapist waits, with an expectant facial expression, for the child to ask for the desired object. The goal of the delay technique is for the child to request the object without the therapist asking “What do you want?” or providing a similar verbal prompt. The delay strategy is designed to increase independent verbal output.

A third strategy is **incidental teaching**. In this technique, the therapist simply waits for the child to initiate a topic and then prompts the child to elaborate on that topic. After elaboration, the therapist reinforces the child’s verbal output. For example, the child might ask, “Where daddy?” The therapist would capitalize on the child’s question and respond, “You want to know where daddy is. Say, ‘Where is daddy?’” When the child asks correctly, the therapist provides reinforcement, saying, “Very good! You asked a good question. Let’s find him” (Kaderavek, 2014).

**Review:**

- Language disorder is characterized by persistent difficulties with the acquisition or use of language that include (a) reduced vocabulary, (b) limited sentence structure, or (c) impairments in discourse. Two broad types are late language emergence and SLI.
- Language disorder is heritable and associated with deficits in auditory processing, rapid temporal processing, and short-term memory. It is unclear if impoverished parent–child communication is a cause or consequence of children’s language problems.
- Evidence-based treatments include discrete trial training to increase vocabulary, conversational recast training to correct language errors, and milieu training to generalize skills to home and school.

### What Is Speech Sound Disorder?

**Description**

Speech is produced when young children learn to modulate their voice to produce specific, discernible sounds that have meaning in a particular language. Speech is complex; it depends on the maturation of the central nervous system; cognitive development; and coordination of head, neck, mouth, chest, and diaphragm muscles. Over the first five years of life, most children transition from unintelligible voice sounds, to idiosyncratic utterances that only their parents understand, to clear and fluid word production. However, 3% to 5% of first-grade students show speech problems that interfere with their ability to communicate (Stemple & Fry, 2010).

**Speech sound disorder** (SSD) is diagnosed when children are unable to produce the expected speech sounds appropriate for their age (see Table 7.4). Children with

<table>
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<th>Table 7.4 Diagnostic Criteria for Speech Sound Disorder (SSD)</th>
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<td><strong>A.</strong> Persistent difficulty with speech sound production that interferes with speech intelligibility or prevents verbal communication of messages.</td>
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<tr>
<td><strong>B.</strong> The disturbance causes limitations in effective communication that interfere with social participation, academic achievement, or occupational performance, individually or in any combination.</td>
</tr>
<tr>
<td><strong>C.</strong> Onset of symptoms is in the early developmental period.</td>
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<td><strong>D.</strong> The difficulties are not attributable to congenital or acquired conditions, such as cerebral palsy, cleft palate, deafness or hearing loss, traumatic brain injury, or other medical or neurological conditions.</td>
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**Source:** Reprinted with permission from the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (Copyright 2013). American Psychiatric Association.
SSD omit, substitute, distort, add, or otherwise incorrectly produce sounds in such a manner that others have difficulty understanding their speech (American Psychiatric Association, 2013). Five sound production problems are common among children with SSD:

- Omission errors occur when children leave off phonemes, usually at the beginning or end of words. For example, children may say “at” for “cat” or “ba” for “ball.”
- Substitution errors occur when children replace one phoneme with another. For example, they may say “wed” instead of “red” or “thoup” instead of “soup.”
- Sound distortions occur when a phoneme is not produced correctly, usually resulting in a “slushy” sound. Children with SSD most frequently distort the /r/, /l/, /z/, /sh/, and /ch/ sounds. Sylvester the Cat displays distortions when he says “thuffering thuccotash.”
- Addition errors occur when children include an extra phoneme, usually the short /u/ sound, into words. For example, children may say “farog” instead of “frog” or “salow” instead of “slow.”
- A lisp is a specific and relatively common speech error that usually results in indistinct /s/, /sh/, and /ch/ sounds. Central lisps occur when the tongue is allowed to protrude beyond the front teeth (e.g., “thun” instead of “sun”). Lateral lisps occur when air is allowed to pass between the tongue and the molars, resulting in a slushy /s/ sound.

Some children show more pervasive problems with speech sound production, beyond simple articulation. Furthermore, their speech errors follow a pattern that reflects underlying problems with phonology. For example, these children may consistently add phonemes to words (e.g., “eggi” for “egg”), reverse sounds (e.g., “peek” for “peak”), or substitute phonemes like /th/ and /z/, making his speech very hard to understand.

**CASE STUDY**

**SPEECH SOUND DISORDER**

**Same Disorder, Different Problems**

Amie and Paul were both young children referred to our clinic because of speech difficulties. Both children were diagnosed with SSD, but they displayed different underlying problems.

Amie was a self-conscious kindergartener who was teased at school because of her “baby talk.” Her speech indicated problems with articulation. She had the most difficulty correctly producing the /l/, /r/, /z/, /sh/, and /ch/ phonemes.

*Therapist:* What did you eat for dinner last night?

*Amie:* Yast night? I fink we ate fish and wice. I don’t wike fish. But I weally wiked dethert.

*Therapist:* What was for dessert?

*Amie:* Cake with ithe kweem.

Paul was an outgoing preschooler whose speech problems indicated more pervasive problems with language. He showed a pattern of speech production errors that suggested underlying difficulty with phonology. Paul tended to leave off the last phoneme of certain words and substitute phonemes like /th/ and /z/, making his speech very hard to understand.

*Therapist:* What did you do on Saturday?

*Paul:* We wen to da do. We saw lot of amals.

*Therapist:* Oh, the zoo? Which animals did you like?

*Paul:* The monees, the bi caas. (Pause) And I ga da fee da gos.

*Therapist:* You got to feed the goats? That sounds like fun.

Amie’s prognosis is much better than Paul’s. In some cases, articulation problems will resolve themselves over time. When they persist beyond age 4 or 5 years, they are usually responsive to treatment. Paul’s problems will likely not resolve on their own and may be more resistant to treatment.
“keep”), replace one sound for another (e.g., “hoop” for “soup”), blend or glide sounds (e.g., “yewo” for “yellow”), or delete sounds (e.g., “pu” for “pool”). Unlike most children with SSD, their deficits are caused by phonological processing problems rather than difficulties with articulation. Needless to say, these phonological processing problems make them very difficult to understand. Consider the case of Amie and Paul, two children with SSD but different problems with speech production (see previous page).

Typically developing children often show speech production errors when they are young. For example, many toddlers say wabbit for rabbit, dis for this, pashehti for spaghetti. SSD is only diagnosed when children's errors are developmentally unexpected—that is, when children make significantly more errors (or more severe errors) than might be expected for their age.

Clinicians must be attentive to children's ethnicity and cultural background when diagnosing SSD. SSD is not diagnosed in children who adopt regional dialects. For example, some African American children use phonemes differently than European American children (e.g., lessening of /l/ phoneme, such as “too” for “tool”; reversals, such as “aks” for “ask”). Similarly, SSD is not diagnosed in bilingual children whose speech sound production reflects their first language. For example, Spanish-speaking children may substitute Spanish language phonemes for English phonemes (e.g., “Yulie” for “Julie”) or insert sounds following the rules of Spanish phonology (e.g., “eskate” for “skate”). These cultural differences reflect linguistic variations and not disorders (Hedge, 2008).

SSD is the most common reason young children are referred to speech-language pathologists. Approximately 10% of preschoolers have a communication disorder; as many as 80% of these children have SSD. By first grade, approximately 3.8% of all children meet diagnostic criteria for SSD. Most of these children show articulation problems only; some also show underlying difficulties with phonological processing (Eadie et al., 2015).

**Causes**

Phoneme acquisition follows an ordered sequence from infancy through age 7.5 years. However, typically developing children show a great deal of variability in their speech sound production. Children in the same preschool class may vary in their phonemic production by as much as 3 years. Usually, vowel sounds are mastered by age 3, simple consonants sounds (/p/, /m/, /n/, /k/) by age 5, and consonant clusters and blends by age 7.5. Because of the wide variability among children, SSD is usually not diagnosed until children's speech skills fall more than one standard deviation behind their classmates (Pena-Brooks & Hedge, 2007).

Most explanations for SSD are based on the notion that children's articulation problems reflect a failure to transition from immature speech to more mature speech production. These theories assume that speech is a complex task that takes children several years to master. Very young children imitate speech sounds generated by parents. These children may initially imitate speech sounds using simplistic, yet incorrect, phonemes. For example, a child who initially learns to produce the /s/ sound by thrusting her tongue beyond her front teeth may find this an effective form of communication. Her parents and other family members may understand her and reinforce this habit. This immature speech usually fades as children gain greater cognitive and motor control over their speech production. However, in some cases, simplified or immature phoneme production persists beyond an age at which it is developmentally expected. Although a lisp may be acceptable at age 3, it becomes problematic at age 7 when most peers speak clearly (Waring & Knight, 2013).

More pervasive cases of SSD often reflect underlying phonological processing problems. Some experts believe these children have difficulty perceiving and differentiating phonemes, rather than merely articulating them. The phonological theory of SSD asserts that children develop underlying mental representations for phonemes as they become exposed to language over their first few years. Children who produce speech sounds normally have formed accurate mental representations of these sounds. However, subtle neurological impairments may interfere with the ability of some children to accurately perceive, differentiate, and mentally represent phonemes, thus leading to impairments in speech production (Dodd, 2013).

SSD is heritable. Approximately 35% to 40% of children with SSD have a family member with a history of the disorder. It is likely that this familial association is caused by shared genes. However, because parents and other family members usually model speech production to children, this association may also be partially explained by shared environmental experiences. Indeed, parents with poor articulation often have children with similar articulation deficits. SSD is also highly comorbid with language disorder. As many as 40% to 80% of children with SSD may also have language disorder. It is possible that early deficits in phonological processing underlie children's speech and language problems (Dodd, 2014).

**Evidence-Based Treatments**

The treatment of SSD involves teaching children how to correctly generate speech sounds. The goals of therapy depend on the specific deficits evidenced by the child. For example, one child might need to improve her articulation of the /s/ sound at the beginning of words, another might need to focus on the /s/ sound at the end of words, and a third might need to correct a lateral lisp. In any case, the therapist uses a combination of modeling and reinforcement to teach children how to produce phonemes in a developmentally appropriate manner. Because children with SSD have never acquired the capacity to produce these word sounds correctly, and may habitually use less
complex (and incorrect) sounds, therapy takes considerable effort on the part of therapist and child.

Speech therapy often relies on direct instruction. Therapists break down correct speech into component parts. Then, they model each part and allow the child to practice its correct use. Over time, basic skills build upon each other until the child is able to correctly produce speech sounds in more complex, flexible ways (Dwight, 2006). The following Research to Practice section describes the use of direct instruction to help Angie, a girl with SSD.

Subsequent sessions focus on producing syllables that either begin (i.e., la, le, li, lo, lu) or end (i.e., al, el, il, ol, ul) with the /l/ phoneme. Then, the therapist and child practice naming objects that either begin (e.g., lion), end (e.g., apple), or contain (e.g., balloon) the /l/ phoneme. Still later, sessions focus on blends containing the target phoneme (e.g., clown). Then, words are combined to form phrases, sentences, and stories that the therapist models and the child repeats (see Image 7.2). Finally, the child and therapist practice correct phoneme production during semistructured play. The therapist looks for opportunities to model and reinforce correct sound production and immediately corrects the child's mistakes (Raz, 1995).

Considerable evidence supports the effectiveness of speech therapy in helping young children overcome SSD. Most children show an 80% reduction in speech–sound errors in 20 sessions, especially if skills are practiced at home by parents. Children who show underlying phonological processing problems or language impairments tend to show gains in therapy more slowly, however (Brumbaugh & Smit, 2013).

RESEARCH TO PRACTICE

SPEECH THERAPY FOR SPEECH SOUND DISORDER

Six-year-old Angie incorrectly produced the /l/ sound. First, her therapist must model and reinforce the correct tongue position to produce the /l/ phoneme.

Therapist: (Sitting next to child, facing a mirror.) Look at my tongue. Watch me lift my tongue and put it right behind my front teeth like this. (Demonstrates.) Now you try it. Let’s practice lifting our tongues in front of the mirror five times. Each time we do it correctly, we’ll color in a happy face circle.

The therapist helps the child attain the correct tongue position and praises correct positioning. In another session, the therapist teaches the child to make the /l/ sound with the tongue in the correct position:

Therapist: Today, I’m going to open my mouth and raise my tongue just behind my front teeth like before. But this time, I’m going to make the /l/ sound. Listen: /l/. (Repeats.) Now you try it after me.

Child: wwwlah.

Therapist: That’s not exactly it. See how I smile when I make the /l/ sound with my tongue. Raise your tongue just behind your front teeth like me, smile, and make the /l/ sound like this (smiles): /l/.

Child: /l/.

Therapist: Very good /l/ sound. Let’s practice it again. Each time we do it right, we’ll color a little piece of this picture.

Review:

- SSD is characterized by persistent difficulty with clear and articulate speech production that limits children’s communication. Examples include sound omissions, substitutions, distortions, and lisps.
- Most children with SSD continue to use immature speech production into middle childhood. Some children with the disorder have underlying phonological problems that cause them to mentally represent and process speech sounds incorrectly.
- Direct instruction can be used to systematically introduce, model, and reinforce correct speech production. Most youths show an 80% reduction in errors.

What Is Childhood-Onset Fluency Disorder?

Description

Speech fluency refers to the ease and automaticity of speech. It has several components, including rate (the speed at which people speak), duration (the length of time of individual speech sounds), rhythm (the flow and fluidity of sounds), and sequence (the order of sounds). Fluency is important to speech because it increases the likelihood that listeners will understand speakers’ utterances and respond appropriately (Ratner & Tetnowski, 2014).

Childhood-onset fluency disorder reflects a marked impairment in speech fluency (see Table 7.5). It is commonly called stuttering. Stuttering reflects an underlying problem with speech production rather than a language
Children who stutter know what they want to say but have problems saying it. As a result, their speech is disfluent and difficult to comprehend.

Common disfluencies include sound repetitions (e.g., l-l-l-l... listen to me), broken words (e.g., com—puter), and silent blocking (e.g., problems with word production producing large pauses in speech). Other common problems are sound extensions ("mmmmmmy dog") and visible tension while speaking. Consider Davis, a child who stutters (see next page).

Many typically developing children, especially preschoolers, exhibit problems with speech fluency. However, children who stutter exhibit fluency problems more frequently than their typically developing peers. Childhood-onset fluency disorder is diagnosed only when it is developmentally inappropriate—that is, when the number of disfluencies exceeds the number expected based on the child’s age and gender (Yairy & Seery, 2016).

Approximately 5% of youths have problems with stuttering at some point during childhood. Boys are more likely to stutter than girls. Furthermore, the gender ratio for stuttering increases with age. For example, in preschool, boys outnumber girls approximately 2:1. However, by adolescence, the gender ratio increases to 5:1. This gender disparity is probably due to the fact that girls are more likely to naturally recover from stuttering than boys (Yairy & Seery, 2016).

Stuttering typically emerges between 24 and 48 months of age and rarely emerges after age 6 years. It usually has an abrupt onset in young children. In one large study, 40% of children who stuttered had their symptoms emerge in less than 2 or 3 days. An additional 33% of children showed intermediate speed of onset, with symptoms emerging over the course of 1 or 2 weeks. Only 28% of children showed gradual symptom onset (Yairy & Seery, 2016).
Table 7.5  Diagnostic Criteria for Childhood-Onset Fluency Disorder (Stuttering)

A. Disturbances in the normal fluency and time patterning of speech that are inappropriate for the individual’s age and language skills, persist over time, and are characterized by frequent and marked occurrences of one (or more) of the following:

1. Sound and syllable repetitions
2. Sound prolongations of consonants as well as vowels
3. Broken words (e.g., pauses within a word)
4. Audible or silent blocking (filled or unfilled pauses in speech)
5. Circumlocutions (word substitutions to avoid problematic words)
6. Words pronounced with an excess of physical tension
7. Monosyllabic whole-word repetitions (e.g., "I-I-I-I see him")

B. The disturbance causes anxiety about speaking or limitations in effective communication, social participation, or academic or occupational performance, individually or in any combination.

C. The onset of symptoms is in the early developmental period.

D. The disturbance is not attributable to a speech-motor or sensory deficit, dysfluency associated with neurological insult (e.g., stroke, tumor) or another medical condition and is not better explained by another mental disorder.


CASE STUDY

CHILDHOOD-ONSET FLUENCY DISORDER

Davis’s Stuttering

Four-year-old Davis was referred to our clinic by his pediatrician because of problems with stuttering. His father explained, “It started about two months ago. He’s always been a good talker. He began saying words at 10 months and could speak in sentences by his second birthday. Recently, however, I noticed he’s having more trouble getting the words out.”

His mother added, “At first, Davis just repeated the first syllable of certain words. Then, it occurred more often. Recently, he’s been having trouble beginning his sentences.” The therapist turned to Davis:

Therapist: Davis, do you like the toys I have in my office?
Davis: (Puts down action figure.) Y-y-y-y-es. (Pauses as if he wants to speak.) B-b-b-b-ut I-I-I-ike Thomas the Tank Engine b-b-b-etter.
Therapist: What’s your favorite Thomas train?
Davis: (Pause.) I-I-I-I-ike . . .
Father: (Interrupts). Davis. Try starting again, this time clearly.
Davis: (Frustrated.) I-I-I-I-ike . . .
Mother: Percy’s your favorite, isn’t he?
Davis: Y-y-y-y-es.

His father explained, “That’s pretty typical. He just can’t get the words out. We make him start over to practice speaking correctly. We don’t want him to practice stuttering.” The therapist replied, “If you like, I can show you some other strategies that might work better.”
Most young children who stutter eventually recover. In several longitudinal studies, 65% to 80% of preschool and young school-age children who stutter showed either complete or significant symptom reduction within 4 or 5 years. Recovery is most common among girls, younger children, and youths with a family member who recovered from stuttering as a child. Unfortunately, approximately 20% of children who stutter experience long-term fluency problems that persist into adolescence or adulthood.

Often, older children and adolescents who stutter can engage in certain behaviors that reduce the severity of their symptoms. For example, nearly all children report a dramatic reduction in stuttering when they sing, speak to a pet, talk to themselves, read aloud when no one is else is present, speak in time to the rhythmic swaying of their arm, or read in unison with a large group of students. Other techniques that decrease stuttering for some children include speaking in a singsong manner, speaking in monotone, whispering, acting a part in a play, repeating sentences after someone else, or simply speaking more slowly. It is unclear why these strategies are helpful in reducing stuttering and why some strategies work for some children but not others (Yairi & Seery, 2016).

Causes

We do not yet have a comprehensive explanation for the causes of stuttering. Models based on neurobiology, learning theory, emotional processing, and cognition likely explain some, but not all, instances of stuttering in children. As is the case with most disorders, stuttering is multidetermined.

Genetics and Neurobiology

Stuttering is heritable. On average, 28% of children who stutter have a parent who stuttered as a child, 43% have at least one immediate family member with a history of stuttering, and 71% have at least one extended family member with a history of the disorder. Twin studies support the notion that genes can contribute to stuttering in some children. On average, if one identical twin stutters, the likelihood that the other twin will also stutter is approximately 67% (Yairi & Seery, 2016).

Several studies have indicated possible functional differences in the brains of people who do and do not stutter. When speaking, most people show greater activation of left-hemisphere brain regions responsible for language, especially Broca’s and Wernicke’s areas. However, individuals who stutter often show excessive activity of the right (not left) hemisphere. It is possible that this abnormality in brain functioning explains some instances of stuttering (see Image 7.3). Indeed, at least one study has demonstrated changes in brain activity following therapy for stuttering (De Nil, Kroll, Lafaille, & Houle, 2003).

Unfortunately, there are several limitations to the neurobiological data regarding the causes of stuttering. First, most studies show only small differences in brain structure and functioning between individuals who do and do not stutter, and many studies show no differences whatsoever. Second, the results of studies have been inconsistent; findings often lack replication. Third, very few neuroimaging studies have involved children who stutter, and almost no studies have involved preschoolers—the age group most likely to exhibit the disorder. Because nearly all imaging studies have involved adults, it is unclear whether brain abnormalities are a cause or consequence of stuttering (Yairi & Seery, 2016).

Learning and Emotion

The two-factor theory of stuttering posits that both classical and operant conditioning play roles in the onset and maintenance of stuttering (Brutten & Shoemaker, 1967). Specifically, children begin stuttering when normal speech disfluencies are paired with parental disapproval (e.g., classical conditioning). Children may associate these negative parenting behaviors with disfluent speech and, consequently, develop tension and apprehension when speaking. Later, children’s stuttering is reinforced by the reactions of others (e.g., operant conditioning). For example, parents may give children attention (positive reinforcement) and teachers may excuse children from assignments (negative reinforcement) because of stuttering.

Support for the two-factor theory of stuttering comes from children’s self-reports. Older children and adolescents who stutter report tension and apprehension in speaking situations. Furthermore, parents, teachers, and peers can exacerbate children’s apprehension by interrupting them, scolding them, ridiculing them, or punishing.
them when they exhibit disfluencies. On the other hand, there is little evidence that parents cause their children to stutter. Indeed, most parents respond empathically to their children's speech problems (Jackson, Yaruss, Quesal, Terranova, & Whalen, 2015).

Anxiety can also play a role in stuttering (Messenger, Packman, Onslow, Menzies, & O’Brien, 2015). Young children who stutter may have temperaments that predispose them to anxiety, such as problems with emotion regulation and self-soothing. Adolescents and adults who stutter report higher anxiety levels than individuals who do not stutter. Nearly all older children and adolescents report intense feelings of anxiety, apprehension, and psychological tension associated with speaking. The negative emotions most commonly reported are fear, dread, feeling trapped, embarrassment, shame, humiliation, resentment, and frustration (Yairi & Seery, 2016).

The anticipatory-struggle theory of stuttering suggests that older children and adolescents with speech disfluencies expect speaking to be anxiety-provoking and difficult (Garcia-Barrera & Davidow, 2015). Certain situations tend to elicit the most anxiety: public speaking, answering the telephone, and saying one's own name. Children who stutter experience very low self-efficacy in these situations; they may doubt their ability to speak without mistakes, hesitations, or repetitions. Furthermore, they often report negative thoughts associated with these situations, such as “I won’t be able to speak clearly,” “I’ll make a fool of myself,” or “Other people will think I’m stupid.” These negative automatic thoughts, and the anxiety they elicit, may increase the severity of the individual's stuttering.

It is unlikely, however, that anxiety is sufficient to explain all (or even most) instances of stuttering. Recall that stuttering typically emerges between 24 and 48 months of age. Young children who stutter are largely unaware of their symptoms. Most children who stutter do not report anxiety about public speaking until age 4 or 5 years.

Psycholinguistics

A final explanation for the causes of stuttering comes from the field of psycholinguistics, the study of the psychological and neurocognitive underpinnings of language. Although there are many psycholinguistic theories of stuttering, they are all based on the premise that fluency depends on three processes: (1) conceptualization, (2) formulation, and (3) articulation. First, children must think about what they want to communicate. Next, they must formulate the appropriate mental representations for their message. Formulation involves encoding the appropriate sounds (phonological representations) and word order (grammatical representations) for the message. Finally, they must articulate these representations through manipulation of the mouth, lips, tongue, and vocal cords. Usually, these three processes occur rapidly and outside children's awareness. Most children perform these steps automatically while speaking.

Stuttering occurs when there is a breakdown in one or more of these basic psycholinguistic processes. Most often, breakdowns occur during formulation. Although children who stutter know what they want to say, they may have difficulty planning out the sound sequence needed to say it (i.e., phonological encoding). Consequently, they may be able to utter only the first phoneme or single-syllable word. Alternatively, children may know what they want to say, but be unable to find the correct word or phrase to communicate their message (i.e., grammatical encoding). Consequently, they may show unusual pauses and repetitions as they struggle to generate the proper mental representations for these words.

According to the covert-repair hypothesis, children who stutter show more frequent disruptions in phonological and grammatical encoding than their non-stuttering peers (Buhr, Jones, Conture, & Kelly, 2015). They are also highly sensitive to these disruptions and closely monitor their own speech. When they encounter a problem, they attempt to correct it midspeech. Unfortunately, their covert attempts to repair breakdowns in phonological and grammatical encoding lead to speech disfluencies: They show sound and word repetitions, unusual pauses, and other retrieval problems. Just as traffic stops and starts during road repairs, so, too, does speech stop and start as children attempt to repair disruptions in speech formulation (Yairi & Seery, 2016).

Evidence-Based Treatments

Treatment for Younger Children

Most preschoolers who stutter do not require treatment. As many as 75% of these youths will naturally recover from their disfluencies. Clinicians often recommend waiting several months after the onset of stuttering to see if the problem will spontaneously resolve itself. Although some parents are concerned about delaying treatment, longitudinal data indicate that a brief delay does not affect the severity of the disorder or the efficacy of treatment once it is initiated (Jones, Onslow, Harrison, & Packman, 2000; Kingston, Huber, Onslow, Jones, & Packman, 2003). Treatment is usually warranted if stuttering persists for more than 6 to 12 months, if the child shows other speech or language problems, if the child has a family member who stutters, or if the child's stuttering causes distress or embarrassment (Ratner & Tetnowski, 2014).

Most treatments involve at least one of the following three components: (1) modifying children's speech motor patterns, (2) increasing fluency and decreasing stuttering through operant conditioning, and (3) supporting parents (Ratner & Guitar, 2006).

First, therapists must modify children's speech motor behaviors—behaviors that increase the likelihood that children will pause, repeat, or otherwise linguistically stumble when producing speech sounds. Children are systematically trained to (a) use a soft or "easy" voice when...
speaking, (b) speak at a slower rate, and (c) relax muscles of their mouth and throat and control their breathing.

Initially, children might be taught to whisper when speaking. Then, children are asked to utter one-syllable words and to elongate (i.e., draw out) the vowel sounds of these words to increase the likelihood that they will utter them without pauses or repetitions. Later, children might be asked to practice two-syllable compound words (e.g., school bus, hot dog) at a very slow rate of speech (60 words/min), elongating vowel sounds and speaking in a soft voice. Still later, children increase the length of utterances (i.e., phrases and sentences) and gradually increase their volume and rate of speech. All the while, therapists model slow speech, controlled breathing, and soft voice.

Most therapists also rely heavily on operant conditioning to improve children’s speech motor behaviors. In an early experiment, Martin, Kuhl, and Haroldson (1972) asked young children who stuttered to talk with a puppet. The puppet interacted with the children as long as they spoke fluently. However, when the children stuttered, the puppet stopped interacting with the children for 10 seconds. At the end of the study, the children showed significant decreases in stuttering, both in the laboratory and at home.

Parental involvement in treatment is important. Parents often have many questions about the causes of stuttering and the prognosis for their children. Therapists can answer parents’ questions and provide support and reassurance. Therapists can teach parents how to model soft, slow speech at home and reinforce their children’s fluency (Yairi & Seery, 2016).

### Treatment for Older Children

Therapy for older children and adolescents involves three components: (1) identification, (2) modification, and (3) generalization. Identification involves helping children recognize instances of stuttering when they occur. Although older children are aware that they stutter, they may not be aware of the frequency of their stuttering, physical behaviors associated with their stuttering (e.g., facial tension, blinking), and speaking situations that are most likely to elicit stuttering. Initially, therapists might use mirrors or video recordings to help children identify instances of stuttering. Later, therapists and children work to identify situations that elicit stuttering, such as answering the telephone or being called upon in class (Ratner & Tetnowski, 2014).

Next, children begin modifying their speech. The goal of this phase of treatment is similar to the treatment of preschool-age children; children must learn to switch from “hard speech” to relaxed, slow, “easy speech.” Typically, speech modification is taught during the course of conversations between the child and therapist, using a technique called in-block modification. When the child or therapist notices a disfluency (i.e., a “block”), he or she points it out, and the child must correct it.

The third component of treatment is generalization. Children practice their language skills at home and at school. Initially, home and school settings that elicit stuttering might be role-played during sessions. Later, parents and teachers prompt children to use “easy speech” at home and school and reinforce them for their attempts. Children can also develop communication strategies with their teachers to reduce stuttering in the classroom; for example, if the child raises his hand with an open palm, he signals “I know the answer and want to be called.” In contrast, a raised hand with a closed palm might signal, “I know the answer but please don’t call on me right now.”

Therapists will also address the social and emotional consequences of stuttering on older children and adolescents. Two consequences are particularly salient: teasing from peers and anxiety in speaking situations. With respect to teasing, therapists might work with teachers to identify and rectify situations in which the child is most often teased. Because school personnel cannot monitor all situations, therapists often teach children coping strategies to deal with teasing. For example, some children use humor: “I guess you noticed that I stutter . . . .” or “Don’t get too close, or you might catch it too.” Other children need to learn problem-solving skills, such as how to deal with embarrassment or avoid fights with peers.

Although stuttering is more difficult to treat in older children and adolescents than in preschoolers, therapy can be effective. Overall, interventions that involve the identification, modification, and generalization of children’s speech are associated with 85% to 90% reductions in stuttering. These data provide hope to older youths and their families with this problem (Yairi & Seery, 2016).

### Review:

- Childhood-onset fluency disorder (stuttering) is a persistent problem with the normal rate, efficiency, and timing pattern of children’s speech, often characterized by sound or syllable repetitions, broken or blocked words, or tension while speaking. Problems with speech fluency cause anxiety about speaking or interfere with children’s communication.
- Stuttering is heritable and is sometimes acquired through classical conditioning, as children associate speaking with anxiety. Psycholinguistic theories suggest that stuttering is also caused by covert attempts to fix language problems.
- Speech therapies to reduce stuttering emphasize (a) adopting a soft or “easy” voice when speaking, (b) speaking at a slower rate, and (c) relaxing the throat and controlling breathing. Older children can learn mechanisms to cope with anxiety in speaking situations.

### What Is Social (Pragmatic) Communication Disorder?

#### Description and Causes

Some children show no obvious problems with language or speech. Their fluency, phonological processing, morphology, grammar, and semantics are all well developed.
However, they still show marked impairments in their ability to communicate with others. Social (pragmatic) communication disorder is characterized by deficits in pragmatics—that is, the use of language in specific social contexts (see Table 7.6). Children with social communication disorder have an appreciation for the sounds and structure of language, they speak in complete sentences, and their vocabulary may be well developed. However, they lack the ability to communicate with others effectively in social settings (Norbury, 2014).

Children with social communication disorder show deficits in four broad areas of social communication. First, they display deficits in using communication for social purposes. For example, they may have problems greeting others, joining a conversation that is in progress, or sharing information. Second, they have problems switching their communication style to meet the demands of the situation. For example, they may speak the same way with their classmates on the playground as they do with their teacher in the classroom. Third, these youths have marked problems carrying on conversations. They may have problems taking turns, identifying when their conversational partner does not understand them, and rephrasing their statements when they are not understood. Fourth, older children and adolescents often have great difficulty understanding information that is not explicitly stated but is instead communicated based on context. Puns, jokes, idioms, and double meanings often go over their heads (American Psychiatric Association, 2013).

Youths with social communication disorder often experience problems in their peer relationships. For example, these children may not know how to begin a conversation with a peer or follow the subtle rules of taking turns during a conversation. They may also have difficulty maintaining the flow of a conversation without speaking off topic. These children may not pick up on nonverbal cues from others during conversations—cues that might indicate that others don't want to talk about a certain topic or that a particular topic carries a great deal of interest or importance. Consequently, children with social communication disorder may not draw correct inferences from their social interactions or may behave in socially inappropriate ways (Swineford, Thurm, Baird, Wetherby, & Swedo, 2015). Consider Willem, a boy with social communication disorder (see next page).

Children with social communication disorder often show deficits in two areas that are especially noteworthy: (1) narration and (2) conversational repair. Narrative skills are used to relate personal experiences. Children might rely on narrative skills to describe their favorite movie or their week at summer camp. Narratives are stories; they have a beginning, a middle, and an end. Narratives also include effective vocabulary to convey ideas and events, and they relate events in logical order. Unfortunately, children with social communication disorder have problems with narratives.

### Table 7.6 Diagnostic Criteria for Social (Pragmatic) Communication Disorder

<table>
<thead>
<tr>
<th>A. Persistent difficulties in the social use of verbal and nonverbal communication as manifested by all of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Deficits in using communication for social purposes, such as greeting and sharing information, in a manner that is appropriate for the social context.</td>
</tr>
<tr>
<td>2. Impairment of the ability to change communication to match context or the needs of the listener, such as speaking differently in the classroom than on the playground, talking differently to a child than to an adult, and avoiding use of overly formal language.</td>
</tr>
<tr>
<td>3. Difficulties following rules for conversation and storytelling, such as taking turns in conversation, rephrasing when misunderstood, and knowing how to use verbal and nonverbal signals to regulate interaction.</td>
</tr>
<tr>
<td>4. Difficulties understanding what is not explicitly stated (e.g., making inferences) and nonliteral or ambiguous meanings of language (e.g., idioms, humor, metaphors, multiple meanings that depend on the context for interpretation).</td>
</tr>
</tbody>
</table>

| B. The deficits result in functional limitations in effective communication, social participation, social relationships, academic achievement, or occupational performance, individually or in combination. |

| C. The onset of symptoms is in the early developmental period (but deficits may not become fully manifest until social communication demands exceed limited capacities). |

| D. The symptoms are not attributable to another medical or neurological condition or to low abilities in the domains of word structure and grammar, and are not better explained by Intellectual Disability, Global Developmental Delay, Autism Spectrum Disorder, or another mental disorder. |


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**PART II DEVELOPMENTAL DISORDERS AND DISABILITIES**
For example, they may omit important information, use vague or imprecise language because of limited vocabulary, and present information out of chronological order, thus, making their stories difficult to follow.

Children with social communication disorder are also frequently deficient in conversational repair skills. These children fail to recognize and take action when others do not follow their conversations. Conversational repair skills might include repeating or rephrasing information, providing additional information or examples, or giving background information or context. Children with social communication disorder often have difficulty implementing these skills or are altogether unaware that their communication is not understood by others.

Children with social communication disorder, like children with higher-functioning ASD, show problems with social reciprocity and understanding social interactions. They seem to talk at others rather than talk with others and show a lack of awareness for others’ feelings. However, children with social communication disorder do not show repetitive behaviors and restricted interests like people with ASD. If a child meets diagnostic criteria for ASD, he would not be diagnosed with social communication disorder as well.

**Evidence-Based Treatments**

**Initiating and Maintaining Conversations**

Many children with social communication disorder avoid conversations because they lack confidence in their communication skills. Other children are reluctant to engage in social interactions more generally. Unfortunately, such avoidance deprives them of opportunities to practice their social skills and improve their use of language in social situations. Over time, the communication skills of these children decline (Ingersoll & Dvortcsak, 2010).

The therapist’s first job is to teach children to initiate conversations. A critical component of beginning a conversation is to maintain eye contact with the conversational partner. The therapist might give instructions on the importance of eye contact, model appropriate eye contact, prompt its use, and reinforce the child’s attempts to achieve and maintain it.

Second, the therapist must encourage the child to initiate a conversation. To accomplish this goal, the therapist might tempt the child to begin speaking by strategically placing pictures and objects in her office that require the child to ask questions (e.g., What is this toy? How does it work? Will you play it with me?). Alternatively, the therapist might prompt the child to begin a conversation or tell a story by asking him to complete a sentence stem (e.g., Yesterday, I ____. One of my favorite things is ____.) The therapist reinforces all initiations with eye contact and praise, “Oh, I am so happy you told me that. Thanks for sharing it.”

Third, the therapist encourages children to maintain conversations. Some children provide only brief responses to questions whereas others prematurely end conversations. The therapist teaches children to maintain the conversation with prompts, such as “Tell me more?” “What happened next?” and “What did you like best about it?”

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**CASE STUDY**

**SOCIAL (PRAGMATIC) COMMUNICATION DISORDER**

**Willem’s One-Sided Conversation**

The following is a transcript between Willem, a boy with social communication disorder, and his classmate, Mike:

**Willem:** Hey, Mike, what did you get on the last test?

**Mike:** I didn’t do too well. I studied really hard, but only got a C–.

**Willem:** Oh. Well, I got an A. I thought it was pretty easy.

**Mike:** Ah, yeah, good for you. I think my mom and dad are going to be disappointed with me.

**Willem:** I didn’t even study that hard for it.

**Mike:** Yeah, I’m glad you did well. I’m mostly worried that they may not let me go to the basketball game on Tuesday because they’ll want me to study.

**Willem:** Yeah. I love basketball. Did you see the game yesterday on TV?

**Mike:** Ah, no. Sorry, I got to go.
Other children include off-topic information or switch topics abruptly. To encourage children to stay on topic, the therapist might gently interrupt and redirect the child, by saying, “Stop! I liked how we were talking about your trip to the circus. Tell me more about that trip.”

A final component of pragmatics is turn taking. Children must learn the natural reciprocity of language in which both members of the conversational pair exchange verbal information. Children must attend to their conversational partners, avoid interruptions, and respond to social cues to talk. The therapist can teach turn-taking skills through verbal, symbolic, and physical prompts. Verbal prompts might be specifically telling children when to listen and when to speak (e.g., “It’s your turn now”). Symbolic prompts might include gestures (e.g., pointing, motioning) to indicate who is speaking and who is listening. The therapist might even pass a physical prompt, like a microphone, between herself and the child to indicate whose turn it is to speak. The therapist reinforces appropriate turn taking and gradually fades prompts (Ingersoll & Dvortcsak, 2010).

Conversational Repair and Narratives

Children with social communication disorder usually have poor conversational repair skills. Their deficits in conversational repair are understandable for at least three reasons. First, most people, even people without social communication disorder, are very reluctant to interrupt speakers, and ask for more information when they do not understand something. Often, people simply continue the conversation in an attempt to avoid offense or embarrassment. Second, children with social communication disorder often do not understand slang and nonliteral phrases (i.e., figures of speech). Third, children with social communication disorder often have more global deficits in social functioning, making higher-order social communication skills (such as conversational repair) challenging.

One aspect of teaching conversational repair skills is to systematically instruct children how to ask for clarification from speakers. The therapist can teach clarification by deliberately giving ambiguous commands to the child. For example, the therapist might strategically place three toy cars on a table and say, “Please give me the car.” When the child gives the “wrong” car to the therapist, she might respond, “You don’t know which one I want. Ask, ‘Which car do you want?’” Later, the therapist will teach appropriate ways to interrupt the speaker, such as by saying “Excuse me…” and “I’m sorry, but…”

Another aspect of conversational repair skill training is to help children recognize when listeners do not understand them and to take appropriate action. For example, the therapist might show pictures of people who look confused so that children can more easily detect this emotion in others. Then, the therapist might model appropriate ways to ask for more information from speakers. For example, she might pretend not to understand the child and model appropriate responses: “I don’t understand,” “Can you say it differently?” “I don’t know what (X word) means.” Finally, the therapist reinforces conversational repair skills by saying, “Oh, now I get it. Thanks!”

Narrative skills are among the most important, and challenging, aspects of social communication. Narratives are children’s capacity to tell a story that involves a beginning, middle, and end. Stories can be autobiographical (e.g., what I did after school yesterday) or about others (e.g., the plot of the book I finished reading). Good narratives provide descriptive information, avoid extraneous details, convey a main point, and present elements of the story in an organized fashion. Children with social communication disorder have difficulty with narratives. Their stories often leave out important information, present distracting or irrelevant details, lack a “main point,” or present details out of chronological order.

Initially, narrative skills can be introduced, modeled, prompted, and reinforced by using the tell–retell procedure. Specifically, the therapist might tell a familiar story, such as The Three Little Pigs, using the aid of picture prompts. Then, with the help of the pictures and verbal prompts, the therapist asks the child to retell the story. Effective narrative skills are reinforced, whereas errors are quickly corrected (e.g., “Hold on! Did the wolf say anything to the pig before he blew down the house?”).

Later, the therapist encourages the child to practice narrative skills using autobiographical information. For example, the therapist might first model a simple autobiographical narrative: “Each night, before I go to sleep, I get ready for bed. First, I put on my pajamas…” Then, she might encourage the child to recount his own bedtime routine, prompting him if necessary, correcting errors, and reinforcing appropriate narrative skills.

A final technique to teach narrative skills is to use scripts. Scripts are descriptions of social interactions in which people routinely engage. Ordering food at a restaurant, shopping at a grocery store, or visiting the doctor for a checkup are examples of scripts. Scripts can either be written down verbatim, represented using pictures, or improvised. In individual therapy, the therapist and child take turns acting out the parts of the main characters in a script (e.g., the child plays the role of waiter and the therapist plays the role of customer). The therapist asks the child to generate the script by explaining the next sequence of events that should occur (e.g., we sit, then we read the menu, and then we order). Then, therapist and child role-play the events and practice other pragmatic language skills (e.g., eye contact, turn taking, conversational repair). Finally, therapist and child switch roles to reinforce the interactive nature of social communication.

Social Skills Training and Videotaped Modeling

Children with social communication disorder also benefit from social skills training, a behavioral intervention in which frequently used social skills are systematically introduced,
modeled, practiced, and reinforced (Wilczynski, McIntosh, Tullis, Cullen, & Querim, 2016). **Skillstreaming** (McGinnis, 2011a, 2011b) is a popular curriculum in which clinicians can teach skills such as how to begin a conversation, how to ask a question, and how to join a group activity. Each skill is broken down into steps that are modeled and practiced in small groups.

Alternatively, the Program for the Education and Enrichment of Relational Skills (PEERS), is a 16-week group intervention for middle and high school students with social communication deficits. Youths learn skills such as how to find common interests by sharing information with others, how to appropriately use humor, how to make phone calls to friends, and how to be a good host at get-togethers (Laugeson, Gantman, Kapp, Orenski, & Ellingsen, 2015; Laugeson & Park, 2014).

Recent data indicate that social skills training programs are effective in improving children's social communication skills (Durand, 2015; Smith & Bryson, 2015). For example, Thomeer and colleagues (2012) randomly assigned children to either a social skills training summer camp or to a control condition. After 5 weeks of training, children who attended the camp showed improvements in communication, social interactions, and understanding nonliteral language (i.e., idioms) compared to controls (see Figure 7.2).

An especially effective way to demonstrate social skills is through videotaped modeling (Cardon, 2016). Social skills are clearly modeled by therapists, family members, or other children and recorded. Children with social communication deficits can then review these skills outside of therapy using a tablet device or smartphone. Emerging data indicate that videotaped modeling helps generalize children's social skills to home and school settings (Acar, Tekin-Iftar, & Yikmis, 2016; O’Handley, Radley, & Whipple, 2015; Vandermeer, Beamish, Milford, & Lang, 2016).

**Review:**

- Social communication disorder is characterized by persistent difficulties in the use of verbal and nonverbal communication in social contexts (i.e., pragmatics). Features include problems (a) greeting others and sharing information; (b) changing communication style to meet the needs of listeners in different contexts; (c) maintaining conversations or telling stories; or (d) understanding inferences, idioms, metaphors, or humor.
- Youths with social communication disorder show deficits in social communication but they do not display the restrictive, repetitive patterns of behavior seen in children with ASD.
- Treatment involves helping youths initiate and maintain eye contact and conversations, develop conversational repair skills, and improve storytelling abilities. Social skills training, either in group therapy or while watching videotaped models, is also effective in improving pragmatic communication skills.

### 7.2 LEARNING DISABILITIES AND SPECIFIC LEARNING DISORDER

Learning disabilities are serious conditions that can adversely affect children's academic functioning, career...
attainment, and self-concept (Pierce, 2015). Although there is disagreement as to the exact definition of learning disabilities, most experts agree children with learning disabilities have the following characteristics:

- Children with learning disabilities have marked deficits in basic academic skills: reading, math, and/or written expression. These academic problems are due to dysfunction in underlying psychological processes.
- Learning disabilities are heritable. Genes are believed to cause subtle abnormalities in brain structure, functioning, perception, memory, and information processing, which, in turn, interfere with learning.
- If untreated, learning disabilities persist over time. Children with learning disabilities are not simply “slow learners” or “late bloomers.”
- Although children’s intelligence and academic achievement are correlated, learning disabilities are not caused by low intelligence or ID.
- Learning disabilities are also not caused by emotional problems (e.g., test anxiety, depression), socioeconomic deprivation (e.g., malnutrition, poverty), or impoverished educational experiences (e.g., low-quality schools). Although these factors can exacerbate children’s learning problems, they do not cause learning disabilities.

There is currently no consensus regarding the best way to identify children with serious learning problems. Indeed, the definition of learning disabilities varies across disciplines. Professionals who work in clinics, hospitals, and other health care facilities (e.g., clinical psychologists, physicians) tend to adopt the medical definition of learning disabilities outlined in DSM-5. These professionals diagnose children with specific learning disorder. In contrast, professionals who work in educational settings (e.g., school psychologists, special education teachers) tend to rely on the legal definition of learning disabilities outlined in federal and state laws. These professionals typically classify children with “specific learning disabilities” (Lewandowski & Lovett, 2014).

What Is Specific Learning Disorder?

Specific learning disorder is a DSM-5 condition characterized by a current, normative deficit in reading, writing, and/or mathematics (see Table 7.7). Children with specific learning disorder earn reading, writing, and/or math scores well below their peers on standardized measures of academic achievement. “Well below” is usually considered at least 1.5 standard deviations below the mean. Because most achievement tests have a mean of 100 and a standard deviation of 15, a score < 78 might indicate low achievement. These academic skill deficits must be normative, that is, they must be low compared to other children in the general population. Relative deficits in academic skills, such as a lower score in math compared to reading, do not indicate a specific learning disorder (American Psychiatric Association, 2013).

Children with specific learning disorder must meet three other criteria. First, they must have a history of academic problems. In most instances, children’s academic problems emerge during the early elementary or middle school years and significantly affect school performance. In some cases, however, problems begin in early childhood, but youths are able to compensate for these problems in some way. For example, a child with reading problems who has excellent short-term memory might compensate for these problems by memorizing frequently occurring words. His problems may not manifest themselves until later childhood or adolescence, when academic demands (e.g., more complex reading vocabulary) exceed his compensatory strategy.

Second, the deficits shown by people with specific learning disorder must interfere with their academic achievement, work functioning, or everyday life activities. It is not sufficient for children to score low on an achievement test; their academic deficits must also affect their functioning in the real world. For example, children with specific learning disorder might have difficulty meeting educational benchmarks for their grade, adolescents might have trouble maintaining their eligibility to play sports, or young adults may experience problems reading instruction manuals, balancing checkbooks, or writing resumes (Weis, Speridakos, & Ludwig, 2014).

Third, academic deficits shown by children with learning disorder must be “specific” to one or more academic domains—they must not reflect overall low cognitive ability. Children’s overall intellectual functioning should be within normal limits with specific deficits in reading, writing, and/or math. Furthermore, specific learning disorder must not be due to other mental or neurological disorders or sensory impairments, such as vision or hearing problems. Professionals must rule out these other potential causes for low academic achievement, such as anxiety at school, medical problems that might interfere with learning, or problems seeing the blackboard or hearing the teacher. Finally, specific learning disorder must not be attributable to sociodemographic factors, such as a lack of proficiency in English or inadequate instruction in school (American Psychiatric Association, 2013). To illustrate this condition, consider Daniel, a boy with a specific learning disorder in the domain of reading.

When diagnosing specific learning disorder, clinicians specify the area of impairment: reading, written expression, or mathematics. Then, for each area identified, clinicians indicate the nature of the child’s weakness. For example, Daniel might be diagnosed with specific learning disorder with impairment in reading. He seems to have moderate problems reading words accurately and fluently. Some clinicians use the term dyslexia to describe these deficits. In contrast, another child might be able to read words accurately and quickly but he might show...
Table 7.7 Diagnostic Criteria for Specific Learning Disorder

<table>
<thead>
<tr>
<th>A. Difficulties learning and using academic skills, as indicated by the presence of at least one of the following symptoms that have persisted for at least 6 months, despite the provision of interventions that target those difficulties:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inaccurate or slow and effortful word reading (e.g., reads single words aloud incorrectly or slowly and hesitantly, frequently guesses words, has difficulty sounding out words).</td>
</tr>
<tr>
<td>2. Difficulty understanding the meaning of what is read (e.g., may read text accurately but not understand the sequence, relationships, inferences, or deeper meanings of what is read).</td>
</tr>
<tr>
<td>3. Difficulties with spelling (e.g., may add, omit, or substitute vowels or consonants).</td>
</tr>
<tr>
<td>4. Difficulties with written expression (e.g., makes multiple grammatical or punctuation errors within sentences; employs poor paragraph organization; written expression of ideas lack clarity).</td>
</tr>
<tr>
<td>5. Difficulties mastering number sense, number facts, or calculation (e.g., has poor understanding of numbers, their magnitude, and relationships; counts on fingers to add single-digit numbers instead of recalling the math fact as peers do; gets lost in the midst of arithmetic computation and may switch procedures).</td>
</tr>
<tr>
<td>6. Difficulties with mathematical reasoning (e.g., has severe difficulty applying mathematical concepts, facts, or procedures to solve quantitative problems).</td>
</tr>
</tbody>
</table>

| B. The affected academic skills are substantially and quantifiably below those expected for the individual's chronological age, and cause significant interference with academic or occupational performance, or with activities of daily living, as confirmed by individually administered standardized achievement measures and comprehensive clinical assessment. |

| C. The learning difficulties begin during school-age years but may not become fully manifest until the demands for those affected skills exceed the individual's limited capacities (e.g., as in timed tests, reading or writing complex reports for a tight deadline, excessively heavy academic loads). |

| D. The learning difficulties are not better accounted for by Intellectual Disability, uncorrected visual or auditory acuity, other mental or neurological disorders, psychosocial adversity, lack or proficiency in the language of academic instruction, or inadequate educational instruction. |

*Note:* The four diagnostic criteria are to be met based on a clinical synthesis of the individual's history (developmental, medical, family, educational), school reports, and psycho-educational assessment.

Specify all academic domains and subskills that are impaired. When more than one domain is impaired, each one should be coded individually according to the following specifiers:

**Specific Learning Disorder with Impairment in Reading:**
- Word reading accuracy
- Reading rate of fluency
- Reading comprehension

**Specific Learning Disorder with Impairment in Written Expression:**
- Spelling accuracy
- Grammar and punctuation accuracy
- Clarity or organization of written expression

**Specific Learning Disorder with Impairment in Mathematics:**
- Number sense
- Memorization of arithmetic facts
- Accurate fluency calculation
- Accurate math reasoning

*Source:* Reprinted with permission from the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (Copyright 2013). American Psychiatric Association.
CASE STUDY

SPECIFIC LEARNING DISORDER

Waiting to Fail

Daniel was a 9-year-old boy referred to our clinic because of low academic achievement. He began struggling in kindergarten. He had trouble recognizing and writing letters and numbers, answering questions about stories, and following instructions. A medical examination showed that he was healthy. Daniel repeated kindergarten the following year, but his academic problems continued.

In the first grade, Daniel was tested to determine if he had a learning disability. Daniel’s IQ score was 103, indicating average intellectual functioning. His standardized scores on tests of reading (80) and writing (81) were significantly below most of his peers. However, Daniel’s reading, writing, and math test scores were not low enough for him to receive special education services.

At the time of the evaluation, Daniel was attending a regular third-grade classroom. He showed significant trouble in reading. He often confused letters with similar appearances and had trouble differentiating similar-looking words, such as that, this, those, and these. Daniel could not sound out unknown words; instead, he usually guessed at their pronunciation. Daniel also read very slowly.

Daniel hated school. He was especially embarrassed to read out loud in front of the class. He resented the teacher for correcting him when he misread a word. Daniel would often try to avoid schoolwork by averting his eyes in class, volunteering to do chores in the classroom, or charming the teacher. At home, Daniel would whine when his mother asked him to complete his homework.

Daniel explained, “I’m not dumb or lazy. I just have a hard time with reading.” The psychologist at the clinic suggested that Daniel be assessed for a possible learning disability. His mother responded, “Okay. But didn’t they already test him when he was in the first grade and find out that he wasn’t dyslexic? Besides, can’t Ritalin work for these sorts of problems?”

Learning Disabilities

Professionals working in schools tend to use the term specific learning disability, rather than specific learning disorder, to describe children with serious deficits in academic skills (Peacock & Ervin, 2012). The term learning disability was coined by Samuel Kirk (1962) to describe children who showed significant delays in the development of reading, writing, math, or oral language. Kirk suggested that these delays interfered with children’s ability to learn and were likely caused by structural abnormalities of the brain. Kirk differentiated learning disabilities from other psychological conditions that often interfere with learning, such as low intelligence and sensory impairment (Courtad & Bakken, 2011).

Today, the legal definition of a learning disability is provided by the Individuals With Disabilities Education Improvement Act (IDEIA, Public Law 5-17). This definition borrows heavily from Kirk’s original conceptualization:

The term “specific learning disability” refers to a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. The term includes such conditions as perceptual disturbances, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. It does not include a learning problem that is primarily the result of visual, hearing, or motor disabilities, of intellectual disability, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

IDEIA is noteworthy in several ways. First, it applies to all children with disabilities. Although the majority of school-age children receiving special education have specific learning disabilities, IDEIA also applies to children with ID, ASD, and physical/sensory impairments (see Table 7.8). Second, IDEIA entitles all children with disabilities to a “free appropriate public education (FAPE).” Youths with disabilities have a right to receive an education that allows them to learn and achieve their academic potentials. Third, children with disabilities must be taught in the “least restrictive environment”—that is, they should be educated alongside students without disabilities in regular education classrooms whenever possible. Fourth, children with disabilities are entitled to Individualized

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epilepsy, or leukemia. Other health impairments include chronic or acute health conditions. Other health impairments are the most common types of disabling problems, such as a heart condition, asthma, sickle cell anemia, hemophilia, or leukemia. 

Table 7.8  Percent of Children With Disabilities in U.S. Schools

<table>
<thead>
<tr>
<th>Disability</th>
<th>Percentage of All Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Disability</td>
<td>13.1</td>
</tr>
<tr>
<td>Learning disability</td>
<td>4.9</td>
</tr>
<tr>
<td>Speech/language impairment</td>
<td>2.9</td>
</tr>
<tr>
<td>Other health impairments</td>
<td>1.4</td>
</tr>
<tr>
<td>Intellectual disability</td>
<td>0.9</td>
</tr>
<tr>
<td>Emotional disturbance</td>
<td>0.8</td>
</tr>
<tr>
<td>Autism</td>
<td>0.8</td>
</tr>
<tr>
<td>Developmental delay</td>
<td>0.7</td>
</tr>
<tr>
<td>Multiple disabilities</td>
<td>0.3</td>
</tr>
<tr>
<td>Hearing impairments</td>
<td>0.2</td>
</tr>
<tr>
<td>Visual impairments</td>
<td>0.1</td>
</tr>
<tr>
<td>Orthopedic impairments</td>
<td>0.1</td>
</tr>
<tr>
<td>Traumatic brain injury</td>
<td>0.1</td>
</tr>
</tbody>
</table>


Note: Learning disabilities and speech/language impairments (i.e., communication disorders in DSM-5) are the most common types of disabling conditions. Other health impairments include chronic or acute health problems, such as a heart condition, asthma, sickle cell anemia, hemophilia, epilepsy, or leukemia.

Education Programs (IEPs) that specify what services will be provided to them to help them achieve. Finally, IDEIA entitles parents to take an active role in planning and implementing their children’s education (Walter, 2015).

Review:

- Specific learning disorder is a DSM-5 diagnosis characterized by difficulties learning or using reading, math, or writing skills. These academic skill deficits are significantly low, compared to other people of the same age, and cause impairment in school or other activities.
- Specific learning disability is a legal term that reflects problems in the basic psychological processes involved in using spoken or written language. These processing problems cause impairment in reading, math, spelling, writing, or oral language.
- The academic problems shown by children with learning disorders or disabilities are not due to sensory impairments, impoverished educational experiences, socioeconomic disadvantage, or children’s cultural or linguistic background.

How Are Learning Disabilities Identified in Children?

Response to Intervention

Most school personnel identify learning disabilities using response to intervention (RTI). RTI gets its name because children are identified with learning disabilities when they fail to respond to scientific, research-based educational interventions. Children who are provided with high-quality, evidence-based reading, math, and writing instruction, but who fail to show academic progress, may be classified with learning disabilities using the RTI approach (Reschly & Coolong-Chaffin, 2016).

School systems that use RTI usually rely on a three-tier system to identify children with learning disabilities (Jimerson, Burns, & VanDerHeyden, 2016; see Figure 7.3). Tier I is characterized by universal or “primary preventative” screenings all children in a class are evaluated to assess their acquisition of basic academic skills. Typically, screenings are brief and administered periodically over the course of the academic year. Furthermore, screening often relies on curriculum-based assessment. Curriculum-based assessment involves measuring children’s progress toward academic benchmarks established by the teacher or school district. Rather than comparing children’s scores to a norm group (like standardized achievement testing), children are evaluated based on whether they are meeting these learning goals.

For example, many school districts use the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) to identify children with delays in word reading (Smolkowski & Cummings, 2016). The DIBELS consists of a series of very brief tests that require students in early elementary school to read words or short passages. Testing takes only a few minutes and is repeated across the school year to monitor students’ reading acquisition. Children’s performance on the DIBELS is compared to other students in their class and evaluated based on the school district’s learning objectives.

Approximately 85% of all children show adequate progress in reading, writing, and math. However, the remaining 15% who lag behind their peers or fall short of the district’s standards are considered “nonresponsive” to treatment and progress to Tier II. This tier is called secondary prevention because interventions in this tier are administered to children who show academic delays but have not yet been identified with learning disabilities. Children in Tier II typically receive supplemental, small-group instruction in the academic domain in which they show delays. For example, children struggling with reading might receive regular reading instruction in the classroom and additional, small-group instruction several times per week. Reschly and Bergstrom (2009) recommend that Tier II interventions last 10 to 20 weeks. In practice, the frequency and duration of group interventions range considerably, from weekly sessions lasting a few months to daily sessions lasting most of the academic year (McKenzie, 2009). After
small-group instruction, schools reevaluate children’s need for continued services in Tier II. Children who meet learning benchmarks may return to Tier I, students who show some improvement may remain in Tier II, and children who do not respond to group intervention may progress to Tier III (Reschly & Bergstrom, 2009).

Between 5% and 10% of school-age children continue to show academic deficits even when provided with supplemental group instruction. These youths may progress to Tier III of RTI (Jimerson et al., 2016). The services delivered to children in Tier III vary from school to school. In most instances, Tier III involves individualized instruction or one-on-one tutoring, targeting children’s academic deficit. Some experts regard Tier III as “special education” whereas others believe that children should only be placed in special education if they fail to show progress in Tier III (Clemens, Keller-Margulis, Scholten, & Yoon, 2016). To see the three-tier system at work, consider the case of Rafe and Ricky.

The chief benefit of RTI is that it allows school personnel to identify and help children with learning disabilities at an earlier age (Yssledyke, Burns, Scholin, & Parker, 2010). Children with potential learning problems can be identified based on classroom observations, and primary and secondary prevention strategies can be implemented immediately. Early identification and remediation might also decrease the number of children referred to special education. Because RTI uses a tiered approach to identification and treatment, only children who fail to respond to lower level interventions are referred for more intensive (and costly) special education services (Walter, 2015).

**Comprehensive Assessment**

Comprehensive assessment is an alternative approach to learning disability identification (Flanagan, Fiorello, & Ortiz, 2010; Flanagan, Ortiz, & Alfonso, 2013). It involves integrating classroom observations of academic performance with norm-referenced testing that includes measures of academic achievement, intellectual ability, and cognitive processing. Advocates of comprehensive assessment point out that children can fail to respond to evidence-based academic instruction for many reasons—only one of which is a learning disability (Hale et al., 2010). Alternative reasons might include low intellectual functioning, attention problems, anxiety or mood disorders, low motivation, poor parental involvement or support,
**CASE STUDY**

**RAFE, RICKY, AND RTI**

Rafe and Ricky are 7-year-old boys in the same first-grade class. Both boys had problems with letter recognition and basic word reading in kindergarten and have continued to lag behind their peers this year as well. Periodic screenings conducted by their teacher indicated that they could read only about 8 to 10 words/minute, compared with their classmates who read 20 to 25 words/minute on average. Because the boys were not making adequate progress with regular classroom instruction, they progressed to Tier II of their school’s RTI program. Tier II consisted of regular reading class and supplemental small-group instruction, designed to improve the boys’ ability to sound out words. Their group met approximately 20 minutes each day for 20 weeks.

Figure 7.2(a) shows Rafe’s progress. The dark line shows the school’s benchmark criterion for first graders; that is, it shows how many words a first-grade child should be able to read at each point in the school year. Rafe’s reading specialist set the goal (light line) that he should be able to read three more words/minute each week over the course of the intervention. As the dotted line shows, Rafe was able to meet his goals and catch up to his peers. Because he responded to Tier II intervention, it was discontinued, and he continued to receive only regular reading instruction with his class.

Figure 7.2(b) shows Ricky’s progress. Although Ricky and Rafe had the same goals, Ricky did not respond to the group-based intervention (dotted line). Ricky’s parents, teacher, and reading specialist decided that Ricky should receive Tier III services, which consisted of individual reading instruction for the remainder of the academic year. Their goal is to help Ricky catch up to his classmates before transitioning to the second grade.

![Figure 7.2](image)

*Source: Based on Reschly and Bergstrom (2009).*

linguistic or cultural differences, health or nutritional problems, or other difficulties stemming from social-cultural disadvantage (Tannock, 2013). Although all children with learning disabilities have academic delays, all children with academic delays do not necessarily have learning disabilities. Comprehensive assessment permits clinicians to differentiate learning disabilities caused by underlying cognitive processing problems from low achievement caused by these other factors (Mascolo, Alfonso, & Flanagan, 2014).
The first part of the comprehensive model capitalizes on the strengths of RTI. Children who show delays in academic skills compared to their peers (Tier I) are provided with additional group-based instruction (Tier II). If children continue to lag behind their classmates, they may receive individualized instruction and practice (Tier III). If children continue to show deficits despite individual instruction, they might have a learning disability. Determination is based on the following four criteria (see Figure 7.4):

1. The child shows a **normative deficit in academic skills**. According to DSM-5, the child’s reading, math, or writing achievement score is <85 (lowest 16th percentile).

2. The child shows a **cognitive processing problem** that is related to his or her academic skill deficit. For example, cognitive testing might show that a child with poor reading fluency displays underlying problems with processing speed. Alternatively, a child with poor math calculation skills might have underlying deficits in working memory.

3. The child does not have generally low intelligence. Although the child shows specific cognitive processing problems, his or her intellectual functioning is intact. For example, a child with reading disability might have underlying problems with processing speed. However, his verbal IQ should be within normal limits and most of his other cognitive processing scores should fall into the average range. An otherwise normal cognitive profile allows the clinician to differentiate children with learning disabilities from children who experience learning problems because of low intelligence.

4. **Alternative explanations for the child’s academic deficit are ruled out**. For example, the clinician must determine that the child’s achievement deficit is not due to language differences or problems with acculturation, socioeconomic disadvantage, test anxiety, or sensory deficits.

Children who meet criteria for learning disabilities according to the comprehensive model may be referred for high-intensity, individualized instruction to help them overcome their academic deficits. More importantly, the results of comprehensive assessment provide information to school personnel that might help them tailor interventions to suit children’s cognitive strengths and weaknesses (Flanagan & Harrison, 2012).

**Review:**
- Learning disabilities are usually identified in school-age children using RTI, a three-tiered system in which

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**Figure 7.4** Comprehensive Assessment of Learning Disabilities in Children

- **Intact Cognitive Ability**
  - Despite specific academic and cognitive processing problems, the child’s cognitive functioning is otherwise normal.

- **Academic Deficit**
  - Child shows an academic deficit not responsive to instruction.

- **Cognitive Processing Problem**
  - Child shows cognitive processing problems related to the academic deficit.

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**Source:** Based on Flanagan and colleagues (2010).

**Note:** Children with learning disabilities show (a) an academic skill deficit, (b) underlying cognitive processing problems associated with that academic deficit, and (c) otherwise normal cognitive functioning (IQ). Furthermore, alternative explanations for the child’s academic problem (e.g., cultural or economic disadvantage) must be ruled out.
children receive progressively more intense, individual services to help them acquire academic skills. Failure to respond to these interventions may indicate a disability.

- RTI relies on curriculum-based assessment, the measurement of children’s academic progress toward standards or benchmarks.
- In comprehensive assessment, children are diagnosed with a learning disability when they show (a) normative deficits in academic skills, (b) underlying cognitive processing problems that might explain these deficits, and (c) otherwise average intelligence. Furthermore, alternative causes for their achievement problems must be ruled out.

How Common Are Learning Disabilities?

Prevalence

Approximately 5% of children have been classified with learning disabilities and are receiving special education services in US schools (Cortiella & Horowitz, 2014). This percentage has remained relatively stable for the past decade. This percentage likely underestimates the actual number of children with learning disabilities because not all youths receive a formal disability classification and receive services. An alternative way to estimate prevalence is to ask parents if their child has even been diagnosed with a learning disability, either by school officials or by private practitioners. Results of the National Health Interview Survey (NHIS), a very large epidemiological study, revealed that 7.5% of parents report that their child has a learning disability (Centers for Disease Control and Prevention, 2016b).

Reading disability is the most common learning disability; as many as 80% of children with diagnosed learning disabilities have reading problems. The prevalence of writing disabilities (8%–15%) and math disabilities (5%–8%) is much lower. Many children with learning disabilities experience problems in two or more academic domains. For example, roughly half of all youths with math-related problems also show difficulty reading. Furthermore, children with both math and reading problems show greater impairment in each of these areas than do children with math or reading problems alone (Cortiella & Horowitz, 2014).

Gender, Ethnicity, and Culture

Studies examining gender differences in the prevalence of learning disabilities have yielded mixed results. Most data indicate that boys are more likely than girls to be classified with a learning disability and receive special education services. For example, data from the NHIS (Centers for Disease Control and Prevention, 2016b) indicated that approximately 9% of boys and 5.9% of girls have been identified with a learning disability. Boys may be more likely to receive learning disability classification because they also tend to show more disruptive behavior than girls. Their disruptive behavior may increase the likelihood that they will be referred for testing and, consequently, receive special education.

Ethnically diverse children in the United States are more likely to be classified with learning disabilities than non-Latino, White children. For example, Shifrer, Muller, and Callahan (2011) found that African American, Latino, and American Indian children were approximately 1.5 times more likely than non-Latino, White children to be diagnosed with learning disabilities. According to the researchers, these differences are largely attributable to socioeconomic status (SES). Low family income consistently predicted a child’s likelihood of disability classification; furthermore, when the researchers controlled for SES, differences in the prevalence of learning disabilities across ethnicities disappeared. The researchers hypothesized that low family income, low parental education, and barriers to high-quality schools, nutrition, and health care place children at risk for learning disabilities (see Figure 7.5).

Children whose primary language is not English are not more likely than native English speakers to be diagnosed with learning disabilities (Shifrer et al., 2011). However, children who do not gain proficiency in English by the time they begin school or children who are placed in an English as a second language class in school are at increased likelihood of learning disability classification. This increased risk is not explained by ethnicity or SES. The researchers suggest that school personnel may misinterpret these children’s difficulty with English as evidence of a learning disability. These findings speak to the importance of being sensitive to children’s native language and cultural background when assessing their academic skills (Lewandowski & Lovett, 2014).

Review:

- Between 5% and 7.5% of school-age children have been identified as having a learning disability. Reading disabilities account for approximately 80% of youths with these conditions.
- Boys are more likely than girls to be identified with a learning disability.
- Children from minority backgrounds are more likely to be identified with a learning disability than non-Latino, White youths. These differences in identification are partially attributable to SES.

What Causes Reading Disabilities?

Basic Reading Problems

Reading is a complex task that children do not acquire naturally. As children learn to read, they progress along a continuum of reading skills. First, children learn to recognize individual letters by their names and sounds. For example, preschool-age children learn to recognize the letter “s” from a list of printed letters, to name the letter “s,” and to tell a parent that the “s” makes the /s/ sound. Letter
recognition is essential to the development of all other reading skills.

After letter recognition, children must develop phoneme awareness. First, children must learn to isolate phonemes (i.e., the first sound in “car” is /c/), segment phonemes (e.g., there are three sounds in “shop”: /sh/ /o/ /p/), blend phonemes (e.g., the sounds /s/ /t/ /r/ /ee/ /t/ make “street”), and manipulate phonemes (e.g., “car” with a /f/ instead of a /c/ is “far”). Later, they are able to use these phonemic skills to phonetically sound out new words (e.g., the letters C-A-T spell /c/ /a/ /t/ or “cat”). Most children need systematic instruction to develop phoneme awareness. Indeed, a considerable percentage of time in preschool and kindergarten is devoted to learning phoneme awareness and developing phonics skills (Samms-Vaughn, 2006).

Children with adequate phoneme awareness are able to engage in **phonemic mediation**—that is, the ability to sound out novel words. Consider the following sentence: *Cat has a snack* (see Image 7.4). A beginning reader might know the first three words in the sentence but be unfamiliar with the word *snack*. He might use phonics skills to sound out the word by translating each letter into its corresponding phoneme: /s/ /a/ /n/ /a/ /c/ /k/. Then, he examines whether the resulting combination of phonemes corresponds to his existing spoken vocabulary. For example, he might think to himself, “The word sounds like *snack*. I know what a *snack* is. The word *snack* makes sense in the sentence, so the word must be *snack*.”

Most children with reading disabilities have marked deficits in phoneme awareness (Johnson, Humphrey, Mellard, Woods, & Swanson, 2010). Consequently, they have difficulty sounding out novel words. Instead, they may try to infer words based on their appearance, other words in the sentence, or contextual cues (e.g., pictures). In the sentence, *Cat has a snack*, a young child with a reading disability might guess at the meaning of the word *snack* based on its length or beginning letter. Then, he might use pictures to test whether his inference is correct. For example, a child might incorrectly read the sentence as *Cat has a sack* because he sees a picture of the cat holding a bag of candy.

Brain abnormalities may underlie children’s problems with basic reading. Three areas of the brain are important to reading (see Image 7.5). The first area is the left occipitotemporal cortex, located near the back of the brain near our visual processing area. Functional MRI (fMRI) studies indicate that this region helps us recognize familiar printed words (i.e., common “sight” words). It is likely that this brain region is especially involved in our ability to read rapidly and accurately. Damage to this region renders people unable to recognize familiar words. Instead, people with damage to this brain region must sound out...
CHAPTER 7  COMMUNICATION AND LEARNING DISORDERS

even simple, frequently occurring words. Their reading is slow and laborious (Kovelman et al., 2012).

The second brain region is a portion of the left temporoparietal cortex known as Wernicke's area. This brain region is responsible for sounding out words. Individuals with damage to this brain region can read common words quickly and automatically, but struggle with unfamiliar words.

The final brain region is a portion of the left inferior frontal lobe known as Broca's area. This region helps us understand a word's meaning and its association with other words in the sentence. Individuals with damage to this brain area are often able to read common words and sound out novel words, but have poor reading comprehension.

Children with reading problems often show abnormal functioning of the left inferior frontal and left temporoparietal cortices (i.e., Broca's and Wernicke's areas). Instead of relying on these regions in the left hemisphere, children with reading disabilities often use portions of their right hemispheres—regions responsible for processing visual information. Interestingly, older children with reading disabilities show greater reliance on right hemisphere brain regions than younger children with the disorder. These findings indicate that older children with reading disabilities may learn to compensate for their poor phonics skills by memorizing words based on their appearance or relying on contextual cues. Although these strategies can be effective for early readers, they are inadequate to read complex material and to read with high comprehension (Kovelman et al., 2012).

Surprisingly, children with reading disabilities who receive instruction in phonics show a significant increase in activity in the left frontal and temporoparietal areas. In several studies, 2 to 8 months of phonics instruction caused significant increases in left hemisphere activity. After instruction, the brain activity and reading skills of children with reading disabilities were similar to those of typically developing readers. Phonics instruction may normalize brain activity among children with reading disabilities, helping these children process words like their classmates (Aylward, Bender, Graves, & Roberts, 2003; Shaywitz et al., 2004).

Reading Fluency and Comprehension Problems

Reading fluency refers to the ability to read rapidly, accurately, and with proper expression. Fluent readers recognize words quickly, attend to important words in sentences more than unimportant words, and emphasize critical words so that sentences make sense.

Children become fluent readers through extensive practice. Initially, children must sound out almost all words in order to gain familiarity with the irregularities of the English language. Over time, children begin to recognize frequently occurring words on sight. Consequently, their speed and accuracy increases. As children accumulate reading experience, they encounter more novel words, which gradually become familiar “sight” words. Practice allows children to make reading automatic—that is, practice lets children “turn low-frequency words into high-frequency words” (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001, p. 40).
Reading comprehension refers to children’s ability to read text for meaning, to remember information from the text, and to use information to solve problems or to share with others. Reading comprehension is an active process in which children construct meaning from what they read. Reading comprehension, therefore, depends on the interaction between the reader and the text. The reader’s understanding of the text will depend on her basic reading skills, reading fluency, and prior knowledge.

Children with reading fluency and comprehension problems often have histories of poor phoneme awareness. Many of these children never developed the basic reading skills necessary to sound out novel words. Consequently, their exposure to novel words and practice with reading is limited. Problems reading novel words often lead to an overall reduction in the rate of reading (i.e., fluency) and accuracy with which children can answer questions about the passages they read (i.e., comprehension).

Reading fluency and comprehension problems are also associated with specific cognitive processing deficits (Johnson et al., 2010). Processing speed refers to a child’s cognitive efficiency—that is, her ability to quickly and accurately perform relatively simple tasks without expending a high degree of effort. Children with above-average processing speed can perform simple cognitive tasks automatically and, therefore, can devote cognitive resources to high-level thinking and reasoning. Because these children can read quickly and accurately, they can spend more energy thinking about the meaning of the text. Children with below-average processing speed find cognitive tasks slow and effortful; consequently, they have fewer resources available for higher order mental activity. Often, these children read slowly and spend a great deal of energy sounding out words; as a result, they have less energy to spend on comprehension.

Working memory is the ability to simultaneously hold and manipulate multiple pieces of information in short-term memory to solve problems. Verbal working memory is a specific kind of working memory for verbal information (e.g., words, sentences). Children with above-average verbal working memory can keep verbal information in short-term memory long enough so that it can be used to solve immediate problems. When reading, these children can keep details about the early part of a sentence or paragraph in mind while simultaneously reading the later part of a sentence. Their verbal working memory permits greater reading comprehension. Children with below-average verbal working memories have difficulty maintaining and manipulating information in short-term memory. When reading, these children may forget important information presented earlier in the text and, consequently, show poor comprehension (Swanson & Stomel, 2012).

Finally, rapid automatized naming (RAN) refers to the ability to recall the names of a series of familiar items as quickly as possible (Denckla & Rudel, 1976). In everyday life, RAN might be measured by counting the number of songs on your smartphone that you can name in one minute. In clinical settings, RAN is measured by counting the number of items in a certain category that children can name while working against a time limit (e.g., “Name as many foods as possible in one minute”). It can also be assessed by presenting an array of pictures, colors, letters, or numbers in random order and asking children to name each stimulus in the array while working against a time limit.

Experts are not certain why RAN is important to reading. It is possible that RAN depends on both verbal working memory (e.g., the recall of words) and processing speed (e.g., the automaticity of processing), which are, themselves, important to language. Whatever the reason, considerable research has shown that children’s capacity for RAN predicts their reading achievement. Furthermore, deficits in RAN are associated with reading disabilities (Norton & Wolf, 2012).

Children with reading disability can be differentiated into three groups based on the nature of their reading problems and underlying cognitive processing deficits (O’Brien, Wolf, & Lovett, 2012). Wolf and Bowers (1999) developed the double-deficit model to explain these differences. Some children show problems with word reading. These children often have deficits in phonological processing. In early elementary school, they may rely on sight words and context cues to read. However, by middle school, these children experience problems with word reading and reading comprehension because of the greater frequency of novel words (e.g., chlorophyll, diffusion, photosynthesis). Their deficits in phonemic mediation catch up to them.

A second group of children shows few problems with word reading or phonemic awareness but does display poor reading fluency. These children often have underlying deficits in processing speed, verbal working memory, and/or RAN. They can read words accurately, but their reading is slow and laborious. These children may also have poor reading comprehension skills because of their slow reading speed and working memory deficits. They often have difficulty remembering information from the beginning of the passage by the time they reach the end of the passage.

A third, small group of children shows impairments in both basic reading skills and reading fluency. These children with double-deficits show the greatest level of reading problems overall (Frijters et al., 2011).

Review:

- Children with basic reading problems often display poor phonemic awareness, which interferes with their ability to decode unfamiliar words. Underactivity of the left hemisphere language areas of the brain are associated with these deficits.
- Youths with reading fluency and comprehension problems often have underlying deficits in processing speed, working memory, or RAN.
- The double-deficit model indicates that children can have problems with (a) basic word reading, (b) reading fluency and comprehension, or (c) both. Youths with double deficits are most resistant to treatment.

PART II DEVELOPMENTAL DISORDERS AND DISABILITIES
What Treatments Are Effective for Children With Reading Disabilities?

Basic Reading

Empirical studies confirm the importance of systematic instruction in phoneme awareness and phonics to treat problems with word reading (see Table 7.9). Explicitly teaching children to recognize and manipulate phonemes has a large and direct effect on their phoneme awareness skills. Explicit training in phoneme awareness is also associated with significant gains in reading and spelling. Similarly, children who receive systematic instruction in phonics show significantly greater gains in reading than children who do not receive phonics instruction. Phonics programs that encourage children to convert letters (graphemes) into sounds (phonemes) and combine or blend sounds into recognizable words are associated with the greatest improvement in reading. Systematic phonics instruction is most effective when it is administered individually or in small groups and when it is initiated before second grade. Phonics-based reading instruction is also associated with gains in children's reading comprehension (Adams & Carnine, 2003; Carlson & Francis, 2002; National Reading Panel, 2000).

Reading Fluency

Reading fluency depends on practice; therefore, interventions designed to increase reading fluency provide children with ample exposure to text and frequent feedback regarding accuracy. One evidence-based approach is guided oral reading. In guided oral reading, the child reads and rereads a text aloud until she becomes proficient. Teachers or peers listen to the child, provide assistance sounding out words, and correct reading errors. Sometimes, children read along with audiotapes, videos, or computer programs.

A variant of guided oral reading is digitally assisted reading, in which children read text on a tablet or computer as a voice models proper pronunciation, speed, and inflection. For example, Literacy by Design offers “echo reading” in which children can read a story while a digital narrator demonstrates proper reading accuracy, speed, and inflection (see Image 7.6; Coyne, Pisha, Dalton, Zeph, & Smith, 2012).

Children who participate in these interventions show increased reading accuracy, speed, and comprehension compared to children who do not receive treatment. Furthermore, these interventions are effective for typically developing readers and children with reading disabilities (National Reading Panel, 2000).

What about children who struggle with reading fluency despite ample practice? Interventions for these children target underlying deficits in cognitive processing such as working memory and RAN. Wolf, Miller, and Donnelly (2000) have developed a program to improve the reading fluency of children with these deficits. Their intervention is called retrieval, automaticity, vocabulary, elaboration, and orthography (RAVE-O), an intensive program designed to improve children's ability to automatically decode, identify, and understand words (Wolf, Gottwald, & Orkin, 2009).

To help children read words more quickly, and with less effort, teachers emphasize certain “core words” that form the basis of their reading vocabulary (Wolf, Barzillai, et al., 2009). These words are organized in groups based on similar rhymes. For example, “hat,” “mat,” and “cat” share the /at/ rhyme. Children learn to recognize related core words each week as well as common rhyme patterns. They also begin to recognize words quickly based on their beginnings and endings (e.g., _-at_).

Teachers try to improve children's word recognition by improving their reading vocabularies. One method to increase children's semantic knowledge is to use image cards to help children learn and recall frequently encountered words quickly and easily. Image cards contain pictorial representations of common words designed to help children with memory deficits recall them. Multiple meanings for each word might be displayed on the card, to help children

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**Table 7.9 Using Direct Instruction to Teach Reading**

<table>
<thead>
<tr>
<th>Step 1: The teacher explicitly states the goals for the lesson.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Today, we are going to learn how to read words that contain the letters “st” and make the sound /st/_.</strong> By the end of the lesson, you will be able to read words that have /st/ in them.</td>
</tr>
<tr>
<td>Step 2: The teacher breaks down material into small steps, giving students the chance to practice each step.</td>
</tr>
<tr>
<td><strong>Here are the letters “st.” What are the letters?</strong> (Child answers “st.”) <strong>They make the /st/ sound. What sound do they make?</strong> (Child answers /st/.)</td>
</tr>
<tr>
<td>Step 3: Teacher provides clear and detailed instructions.</td>
</tr>
<tr>
<td><strong>Let's practice some words that start with /st/_. All of these words begin with the /st/ sound.</strong> (Teacher provides examples.)</td>
</tr>
<tr>
<td>Step 4: Teacher provides guidance during initial practice.</td>
</tr>
<tr>
<td><strong>Start with this word.</strong> (Teacher points to each part of the word as child reads it.)</td>
</tr>
<tr>
<td>Step 5: Teacher provides systematic feedback and corrects child's mistakes immediately.</td>
</tr>
<tr>
<td><strong>Now read this word.</strong> (Child incorrectly reads the word “stem.”) <strong>Good. Now this one.</strong> (Child correctly reads the word “stem.”) <strong>No. The word is “stem.” Read it again with me._</strong></td>
</tr>
<tr>
<td>Step 6: Teacher gives additional practice, either during seatwork, homework, or during the next lesson.</td>
</tr>
<tr>
<td><strong>During the last lesson, we learned about words that begin with /st/<em>. Today, we're going to review and practice more /st/ words.</em></strong></td>
</tr>
</tbody>
</table>
Appreciate the flexibility of language. For example, the word "jam" might be shown as "a topping for toast" and as "a child in trouble."

A final component of treatment involves improving children’s word recall strategies. Recall that children with RAN deficits have difficulty retrieving words. One technique to improve word recall is the detective game. Children are taught to be “word detectives” who retrieve words that might be “on the tip of their tongues.”

The efficacy of RAVE-O was investigated in a randomized controlled study of 279 children with reading disabilities (Morris et al., 2012). Youths were randomly assigned to one of four conditions: (1) traditional phonemic awareness and word identification skills training, (2) RAVE-O, (3) phonemic awareness training plus study skills training, or (4) controls. All interventions were conducted 5 days per week for 70 sessions. At the end of treatment, children in the three active treatment groups showed significantly more improvement in word reading than children in the control group. More importantly, children who participated in RAVE-O showed the greatest improvement in reading fluency and comprehension.

Reading Comprehension

Children with reading disability will not develop adequate reading comprehension on their own. Reading comprehension skills must be systematically introduced and modeled in the classroom. Children who are provided with systematic training in reading comprehension show significant improvements compared to youths who do not receive explicit instruction. Systematic instruction is associated with increases in children’s memory for information, speed of reading, understanding, and ability to apply information to answer questions or solve problems (National Reading Panel, 2000; Therrien, Wickstrom, & Jones, 2006).

Many children with reading disabilities have deficits in story grammar (Mason & Hagaman, 2012). Story grammar refers to knowledge of the components and structure of stories, such as their characters, setting, conclusion or resolution, and tone or emotion. Children with reading disability are often unaware of many of these aspects of story grammar and recall fewer of them than typically developing children. Furthermore, they exhibit deficits in story grammar regardless of whether they are listening to or reading stories.

Interventions teach children to recognize and retain information about story grammar (Mason & Hagaman, 2012). For example, story mapping is a technique suitable for younger readers. As children read stories aloud, the teacher emphasizes aspects of story grammar when they occur. Then, she represents each aspect with a picture to aid children’s recall (e.g., straw, sticks, and bricks to appreciate the flexibility of language. For example, the word “jam” might be shown as “a topping for toast” and as “a child in trouble.”

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Reading Comprehension

Children with reading disability will not develop adequate reading comprehension on their own. Reading comprehension skills must be systematically introduced and modeled in the classroom. Children who are provided with systematic training in reading comprehension show significant improvements compared to youths who do not receive explicit instruction. Systematic instruction is associated with increases in children’s memory for information, speed of reading, understanding, and ability to apply information to answer questions or solve problems (National Reading Panel, 2000; Therrien, Wickstrom, & Jones, 2006).

Many children with reading disabilities have deficits in story grammar (Mason & Hagaman, 2012). Story grammar refers to knowledge of the components and structure of stories, such as their characters, setting, conclusion or resolution, and tone or emotion. Children with reading disability are often unaware of many of these aspects of story grammar and recall fewer of them than typically developing children. Furthermore, they exhibit deficits in story grammar regardless of whether they are listening to or reading stories.

Interventions teach children to recognize and retain information about story grammar (Mason & Hagaman, 2012). For example, story mapping is a technique suitable for younger readers. As children read stories aloud, the teacher emphasizes aspects of story grammar when they occur. Then, she represents each aspect with a picture to aid children’s recall (e.g., straw, sticks, and bricks to appreciate the flexibility of language. For example, the word “jam” might be shown as “a topping for toast” and as “a child in trouble.”

A final component of treatment involves improving children’s word recall strategies. Recall that children with RAN deficits have difficulty retrieving words. One technique to improve word recall is the detective game. Children are taught to be “word detectives” who retrieve words that might be “on the tip of their tongues.”

The efficacy of RAVE-O was investigated in a randomized controlled study of 279 children with reading disabilities (Morris et al., 2012). Youths were randomly assigned to one of four conditions: (1) traditional phonemic awareness and word identification skills training, (2) RAVE-O, (3) phonemic awareness training plus study skills training, or (4) controls. All interventions were conducted 5 days per week for 70 sessions. At the end of treatment, children in the three active treatment groups showed significantly more improvement in word reading than children in the control group. More importantly, children who participated in RAVE-O showed the greatest improvement in reading fluency and comprehension.

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represent events in *The Three Little Pigs*). With practice, children learn to recognize aspects of story grammar independently and complete their own story maps. Another technique, appropriate for older children, is self-questioning. Although skillful readers naturally ask questions about story grammar while reading a narrative, poor readers need to be taught this skill. In self-questioning, children are initially prompted by teachers to ask questions about purpose, characters, plot, and resolution while they are reading. With practice, children begin to ask (and answer) these questions independently.

Children with reading disabilities also struggle with nonfiction. Text that conveys facts and information tends to use relatively unfamiliar structure (e.g., lists, compare-and-contrasts), adopts complex vocabulary, and assumes prior knowledge, which children might lack (Mason & Hagaman, 2012). To understand nonfiction writing, children need to be taught to break down and reorganize the text, using text enhancements. **Text enhancements** are visual aids or routines that assist students in identifying, organizing, understanding, and recalling important information (see Image 7.7). Some of the most effective text enhancements are graphic organizers (i.e., diagrams, figures, or timelines to make abstract ideas concrete), cognitive maps (i.e., arrows, flowcharts, or lines that show relationships between ideas), mnemonics (i.e., memory aids like HOMES to help you recall the Great Lakes), and computer-assisted instruction (i.e., embedded digital media such as hyperlinks or videos). Youth with learning disabilities who use text enhancements show moderate improvements in reading comprehension (Berkeley, Scruggs, & Mastropieri, 2010; Kellems et al., 2016).

**Review:**

- Children with reading fluency or comprehension problems caused by poor word reading skills may benefit from phonics-based instruction.
- Guided oral reading, digitally assisted reading, and the RAVE-O program are effective at increasing the rate and accuracy of children’s reading.
- Interventions to improve reading comprehension for fiction often focus on teaching story grammar—that is, the components and structure of stories. Interventions for nonfiction often involve text enhancements, such as diagrams, flowcharts, or mnemonics.

### What Causes Disabilities in Written Expression?

Like reading, writing is a complex task that takes years to master. For most children, the writing process involves three steps: planning, translating, and reviewing (Hayes & Flower, 1980). **Planning** involves determining the purpose of the writing, generating a main topic and supporting ideas, and organizing these ideas so that they make sense. **Translating** involves converting ideas into text. It depends on children’s phonemic awareness, their knowledge of vocabulary and spelling, and the mechanics of writing (e.g., how they hold a pencil, typing skills). **Reviewing** involves rereading their stories, identifying mistakes, and making changes.

Children with writing disabilities spend less time on all three tasks than their typically developing classmates. First, children with writing disabilities spend little time planning and organizing. Consequently, their writing becomes a stream of consciousness in which ideas are disjointed and arguments are difficult to follow. Second, children with writing disabilities make frequent spelling errors and have poor handwriting. Although these problems may seem minor, they hinder the writing process. Third, children with writing disabilities seldom review their work. When they do edit, their changes tend to be superficial (e.g., correcting a spelling or punctuation

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**Image 7.7** A timeline is one example of a text enhancement that can help children with reading comprehension. This fifth-grader’s timeline shows events leading up to the American Revolution.
error) rather than focus on the coherence and quality of the composition.

Children with and without writing disability differ greatly in the quality of their writing. Specifically, they differ in six areas (Graham, Harris, & Chambers, 2016; MacArthur, 2016; MacArthur, Philippakos, & Graham, 2016)

- **Productivity.** Children with writing disability simply write fewer words than their typically developing classmates. On average, their compositions are one-third shorter than those of children with average writing skills. Their lack of productivity is seen in both narrative and expository writing.

- **Lexical diversity.** Lexical diversity is typically assessed by counting the number of different root words in a composition. Children with writing disability write fewer words and use language that is less varied and more redundant.

- **Grammar.** Grammatical errors are the most noticeable and common problem shown by children with writing disability. They often omit essential parts of a sentence, have difficulty with subject–verb agreement, or mistakenly use pronouns and contractions (e.g., their vs. they’re).

- **Sentence complexity.** Children with writing disability use less descriptive sentences than their peers. Sentence complexity is typically assessed by determining the average length of main clauses and dependent clauses in the child’s writing. Consider the following lines of text:
  - I followed the rabbit all day. It ran into its hole.
  - I followed the rabbit all day. It ran into its hole.

  Although both lines have the same meaning, the first is more complex.

- **Spelling accuracy.** Children with writing disability often make spelling errors. Children with underlying phonological processing problems and reading disability often make dysphonic spelling errors—that is, there is little relationship between the sound of their words and the way they spell them. For example, a young child with adequate phonemic processing might spell “telephone” as “telafone.” However, a child without adequate phonemic processing might spell the word “telephone,” which does not correspond to the sound of the word. Dysphonic spelling errors make children’s compositions extremely difficult to read.

- **Story content.** Children with writing disability also receive lower ratings for overall story content than do their typically developing classmates. Specifically, they have difficulty (a) relating experiences or presenting information in a clear and focused manner, (b) structuring their writing in such a way that their main idea is clear and supported, (c) using an appropriate tone of voice and degree of formality for the purpose of the writing and the audience, and (d) adopting writing conventions such as punctuation and capitalization.

**What Treatments Are Effective for Children With Disabilities in Written Expression?**

Children with writing disability need systematic instruction, ample practice, and frequent feedback (MacArthur, Philippakos, Graham, & Harris, 2012; Mather & Wendling, 2011). One of the most effective methods of teaching writing skills is the **Self-regulated strategy development (SRSD)**. SRSD is based on the notion that poor writers lack effective strategies for planning, implementing, and evaluating their work.

Teachers introduce, model, and reinforce writing strategies, give specific feedback regarding the quality of children’s writing, and offer ample opportunities to practice and improve their writing over time (Harris & Graham, 2016).

The SRSD model consists of a series of stages that children learn to implement, practice, and evaluate (Harris et al., 2012; Reid, Harris, Graham, & Rock, 2012):

1. **Develop and activate background knowledge:** The teacher explains or models any skills or information needed to complete the writing assignment. For example, if the assignment involves autobiographical writing, the teacher might explain the term autobiograph and provide a short example of an autobiographical narrative.

2. **Discuss the strategy:** The teacher suggests a specific strategy for completing the writing task.

3. **Model the strategy:** The teacher presents each step in the strategy, emphasizing why it is important. The teacher “thinks aloud,” explaining her thought process behind each step. Modeling is extremely important because it makes normally covert processes overt and accessible to students.

4. **Memorize the strategy:** Students memorize each step in the strategy through repetition and variation. The more practice they receive, the easier they will recall the strategy when necessary.

5. **Support the strategy:** Teachers use scaffolding to make sure students are successful implementing the strategy. Initially, teachers offer a great deal of assistance. As students become more familiar with the strategy, teachers reduce their level of support until students can implement it independently.

6. **Independent performance:** The teacher continues to monitor students’ use of the strategy and help them modify it, when necessary, to suit different writing assignments.
The specific strategies used in the SRSD model vary depending on the writing task (Common Core State Standards, 2016). For example, when teaching narrative writing (i.e., storytelling), teachers might introduce the POWER strategy: planning, organizing, writing, editing, revising. First, the student plans her story. What is the purpose of the story? What background information or knowledge do I need to write it? Second, the student organizes her thoughts before writing. She completes a worksheet that prompts her to identify the main characters, the setting, the problem, and the resolution. Third, the teacher models the writing process using the think-aloud technique. The teacher shows how he uses the students’ ideas to create sentences and why the order of events is important to a story’s coherence. Fourth, the student edits her own writing. She reads her story, stars portions that she likes, and marks sections that need improvement. She also receives feedback from classmates. Fifth, the teacher models ways to revise the story to make it better. The student ultimately decides which changes she will make based on feedback from the teacher and peers (Harris, Graham, & Adkins, 2015).

Another strategy, DEFENDS (i.e., decide, examine, form, expose, note, drive, search) is useful in expository writing, when children must defend a thesis statement. Using the SRSD approach, the teacher introduces models, and supports each step in the strategy. First, the child decides on an exact position (e.g., Geckos make the best pets for fourth-grade boys). Second, he examines possible reasons for his position, perhaps by generating them on his own or consulting other people or books (e.g., They are interesting to feed). Third, the student forms a list of points that explains each reason (e.g., They eat live crickets and mealworms. They shake their tails before attacking their prey. Their food crunches in their mouths). Fourth, the child is ready to begin writing. He exposes his position in the first sentence of the essay. Fifth, he notes each reason for his position and supporting points. Sixth, the student drives home his main idea in the final sentence. Finally, he searches for mistakes and makes necessary corrections.

Overall, children with and without disabilities who use SRSD show improvement in grammar, length, and quality of their writing (see Figure 7.6). Furthermore, the benefits of SRSD are maintained over time and generalize to other writing assignments. For example, children who are initially taught to write essays also improve in writing book reports and short stories. The benefits of SRSD are attributed to the fact that teachers systematically introduce and model planning and reviewing strategies and encourage students to actively participate in the writing process (Graham, McKeown, Kiuhara, & Harris, 2012).

Review:

- SRSD involves introducing, modeling, and reinforcing strategies for improving written expression.
- Children are explicitly taught steps to plan, implement, and evaluate the quality of their written expression, and they are given frequent feedback as they practice their writing skills.

**What Causes Math Disabilities?**

**Delays in Number Sense**

Some experts have argued that children are biologically predisposed to understand and process mathematics information. Infants may have inherent number sense—that is, they may be aware that a group of stimuli can be understood in terms of their quantity (Geary, 2010). For example, Karen Wynn (1992) demonstrated that 5-month-old infants could differentiate between a correct numerical expression (1 + 1 = 2) and an incorrect expression (1 + 1 = 1). Similarly, Starkey and Cooper (1980) showed that 4- through 7-month-old infants could differentiate groups of dots presented in different numbered clusters. More recent research has shown that young infants can also discriminate between sounds of different numbers (Lipton & Spelke, 2003), and older infants can order sets of items from largest in number to smallest (e.g., A > B > C; Xu & Spelke, 2000). By the time most children begin school, their ability to discriminate small quantities is greatly refined. Six-year-olds can easily tell that a basket containing 25 pieces of candy has more candy than another basket containing only 20 pieces of candy. By late childhood, this capacity for numerosity is similar to that of adults (Geary, 2013).

Number sense permits the development of all other math abilities (Geary, 2010). It allows very young children to subitize—that is, to estimate the number of objects in a small group, rapidly and accurately, without counting them. For example, young children can quickly differentiate between a plate with three cookies and a plate with five cookies. Number sense also allows them to mentally represent quantities. For example, young children learn the correspondence between Arabic numerals and discrete quantities (e.g., 3 = ⬜⬜⬜). About the same time, children also begin to mentally represent quantities along a number line. Young children easily understand that numbers are positioned in ordinal fashion—that is, first, second, third, and so on. Over time, children also learn that the intervals between numbers are equal. The capacity to mentally represent quantities permits basic math calculation in early elementary school, like addition and subtraction.

Children with mathematics disabilities tend to show delays in the development of number sense. The **Number Sets Test** (see Figure 7.7) is a brief test of number sense that consists of a series of numerals (e.g., 1, 3) or groups of objects (e.g., ⬜⬜⬜⬜⬜) that children must group to...
**Figure 7.6** Effects of SRSD on Children's Writing

![Bar chart showing the effects of SRSD on various writing outcomes](chart.png)

**Source:** Based on Graham and Harris (2003).

**Note:** Children who participate in SRSD show improvements in four areas of writing compared to youths who receive traditional writing instruction. SRSD is associated with improvements in both typical readers and children with learning disabilities.

**Figure 7.7** The Numbers Sets Test

![Image of the Numbers Sets Test](image.png)

**Source:** Based on Geary and colleagues (2011).

**Note:** This test can be used to predict mathematics disorder in young children. Children with mathematics disorder are 3 years behind their typically developing classmates in their capacity for numerosity.
Children can use subitizing, counting, or a combination of both strategies to group the stimuli as fast and as accurately as possible. Typically developing children show improvement on this test from first through fourth grade. However, children with mathematics disabilities perform more slowly and make more errors than their classmates. On average, they lag approximately three years behind their peers (Geary, Bailey, & Hoard, 2009). Furthermore, children’s performance on the Number Sets Test at the beginning of first grade (before most children even know how to add and subtract) predicts their likelihood of developing mathematics disability by the time they reach third grade. In fact, first graders’ scores on the Number Sets Test predict later math skills better than their intelligence, memory, and baseline knowledge of math!

### Counting and Calculation Errors

Children’s ability to count develops between the ages of 2 and 5. Young children obey certain principles of counting that follow a fixed sequence (Gelman & Gallistel, 1978).

- **One-to-one correspondence**: One number is assigned to each object.
- **Stable order**: Numbers are counted in a specific order.
- **Cardinality**: The last number stated reflects the quantity of the items counted.
- **Abstraction**: Objects of any kind can be grouped and counted.
- **Order irrelevance**: Objects can be counted in any order.

Preschoolers later diagnosed with mathematics disability make two types of counting errors not often shown by their classmates (Geary, Hoard, & Bailey, 2011; Geary, Hoard, Nugent, & Bailey, 2012). To study these errors, researchers ask children to help a puppet learn to count objects. On some counts, the puppet deliberately makes mistakes. The researchers record whether the child detects the mistake and corrects the puppet. First, children with mathematics disability often become confused when counting occurs from right to left, rather than in the typical left-to-right order. They do not seem to understand the principle of order irrelevance. Second, they often fail to detect errors when the puppet double-counts the first object in the row (e.g., the puppet points to the first object and counts “one, two” and then points to the second object and counts “three”). It seems that these children have difficulty remembering one-to-one correspondence.

Beginning in elementary school, children’s math skills become more complex, as children transition from counting to arithmetic. Addition depends greatly on children’s counting abilities. For example, young children use fairly
immature strategies to add numbers. Initially, they might count on their fingers to solve addition problems. Later, addition is performed verbally or mentally. Young children also use less efficient strategies to add. For example, very young children use the **counting-all strategy**; when asked to add 7 + 4, they first count from 1 to 7 and then count four more numbers until they arrive at the correct answer. In contrast, older children use the **counting-on strategy**; they begin with the larger number (i.e., 7) and then count four more digits until they arrive at the answer. Similar shortcuts are used for subtraction and other mathematical operations (Augustyniak, Murphy, & Phillips, 2006).

With experience, children learn to store math facts in long-term memory. For example, children begin to use **direct retrieval** to recall that 7 + 6 = 13; they no longer need to count to arrive at the correct answer. Alternatively, they may use a process called **decomposition** to solve the same problem; they might break up the problem into smaller components that are more easily remembered. For example, children might directly recall that 6 + 6 = 12 and then add one to this partial sum to obtain the correct answer. Direct retrieval and decomposition permit more rapid and automatic math computation. Children can direct their attention to conceptualizing arithmetic problems rather than to counting. Direct retrieval and decomposition also free short-term memory, allowing children to perform more complex calculations in their heads (Geary, 2011).

Children with math disabilities show deficits in math calculation skills. They calculate more slowly and make more errors than their typically developing classmates (see Figure 7.8). Several studies indicate that memory deficits underlie many of their difficulties with math calculations (Geary et al., 2011). Specifically, these children have trouble remembering math facts (Geary et al., 2012). Whereas most fourth graders can effortlessly recall 4 + 5 = 9, children with mathematics disability often need to count to recall the correct answer. Consequently, they spend greater cognitive resources performing basic calculations and fewer resources conceptualizing the problem itself (Andersson, 2010).

Youths with mathematics disabilities also have difficulty remembering math procedures. For example, when presented with a problem such as 41 – 29 = ?, children with disabilities may forget how to “borrow” and, consequently, they provide an incorrect answer (Temple & Sherwood, 2002).

Because of their difficulty retrieving math facts and procedures from long-term memory, children with mathematics disabilities often rely on immature strategies to solve math problems. For example, many first graders count on their fingers to solve addition problems. However, children with mathematics disabilities often continue to rely on this immature tactic into the third and fourth grades. Furthermore, when young children with disabilities count, they often count all digits rather than rely on more advanced “add-on” strategy. These immature strategies result in slow, error-prone calculations (Swanson, 2015; Swanson, Lussier, & Oroco, 2015).

### Deficits in Math Reasoning

By late childhood, children begin to develop more complex math problem-solving skills. These skills include the ability to solve story problems, to interpret charts and graphs, and to perform mathematical operations with complex sets of numbers (i.e., borrowing, long division, fractions).

Children’s ability to solve higher order math problems depends on their capacity for working memory (Toll, van der Ven, Kroebergen, & van Luit, 2011). Many children with mathematics disabilities have problems with verbal or phonological working memory. Some children have reading disabilities that interfere with their ability to comprehend math story problems. Other children have difficulty with auditory working memory, attention, and concentration; they are unable to hold mathematical information in short-term memory long enough to process it and arrive at the correct answer. For example, they may forget important bits of information at the beginning of story problems, become distracted by extraneous information, or transpose digits when converting a story problem to a math calculation (Toll et al., 2011).

Other children with mathematics disorder have problems with visual–spatial working memory. Poor visual–spatial working memory can lead to difficulty interpreting charts and graphs. Many complex math calculations, like adding three-digit numbers or performing long division, also depend on visual–spatial skills. Deficits in visual–spatial working memory can cause children to misalign numbers, leading them to use the wrong digits for their calculations (Geary et al., 2015).

### Review:

- Deficits in number sense that persist into first grade predict math disabilities.
- Youths later diagnosed with math disabilities often show characteristic mistakes in counting and math calculation skills. They often rely on immature strategies to perform math computations.
- Some youths have deficits in math reasoning because of poor verbal working memory, which causes them to forget important information in story problems. Other children have deficits in visual–spatial working memory, which leads to mistakes interpreting graphs and figures.

### What Treatments Are Effective for Children With Math Disabilities?

Clinicians generally rely on one of three methods for math instruction: (1) direct instruction, (2) self-instruction, or (3) mediated/assisted instruction (Steedly, Dragoo, Arafeh,
& Luke, 2008; see Table 7.10). **Direct instruction** in mathematics, like direct instruction for other skills, involves the systematic presentation of math calculation and problem-solving strategies. The teacher introduces and demonstrates the skill following a carefully designed script. Then, the skill is broken down into specific steps, which children perform. Teachers provide help and feedback regarding children's performance, correcting children's mistakes. Gradually, assistance is faded as children gain mastery of the skill. Children are given repeated opportunities to practice the skill and extend it to new problems. Direct instruction tends to be most effective in improving basic math computation skills in younger children.

**Self-instruction** is a second method to improve children's math skills. In self-instruction, teachers systematically present a series of verbal prompts that children can use to solve math problems. Teachers model the use of these prompts as they complete problems. Then, children are encouraged to use the prompts when solving their own problems, while the teacher monitors their use. Initially, teachers provide careful assistance to children in using the prompts. Eventually, assistance is faded until children can use the prompts to solve problems on their own. Self-instruction tends to be most effective for higher order math problem-solving.

Teachers who use **mediated or assisted instruction** begin with the child's understanding of the mathematical problem. Then, they offer assistance and guidance to help the child solve the problem correctly. Mediated or assisted instruction does not involve the use of a

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**Table 7.10 Three Methods for Teaching Mathematics Skills**

<table>
<thead>
<tr>
<th>Problem: Anne had 9 apples. She gave 4 apples to her friend. How many apples does Anne have left?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Instruction</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
| Step A  
Read the problem with me. *Teacher reads the problem.*  
What kind of problem is it? *Answer: Subtraction* |
| Step B  
Good. It's subtraction. Is the big number given? *Answer: yes* |
| Step C  
Let's read the problem again. *Teacher reads the problem again.*  
Is 9 the big number or the small number? *Answer: The big number.*  
What kind of number is 4? *Answer: the small number.* |
| Step D  
Good. Now let's take 9 and subtract 4. Watch me. Nine minus four is five.  
Now you say "Nine minus four is five." *Child repeats.*  
Good. What is the answer? *Answer: Five* |
| Step E  
Good. Now let's read the next problem. |

**Self-Instruction**<sup>b</sup>

Teacher introduces and demonstrates the following steps to solve story problems. Teacher encourages children to use the steps (first aloud, then silently) as she monitors.

- **What are you asked?**  
  *How many apples does Anne have left?*
- **What numbers do you have?**  
  *9 and 4*
- **What number(s) do you need to know?**  
  *How many left?*
- **What must you do?**  
  *Subtract, 9 – 4*
- **What is the answer?**  
  *5*
- **Check your answer.**  
  *4 + 5 = 9, so it checks out!*

**Mediated/Assisted Instruction**<sup>c</sup>

Teacher provides a structured sequence of hints to help the child complete the problem. Hints become gradually more specific and content-related until the child is able to arrive at the correct answer.
script (as direct instruction) or a series of prompts (as
self-instruction). Instead, the teacher offers increasingly
detailed hints until the child is able to complete the
problem successfully. In this way, children are encour-
aged to derive their own way of solving problems, rather
than rely on a formal set of rules.

Meta-analyses support the use of all three strategies
for children with and without math disabilities (Gersten
et al., 2009). Children with disabilities who receive direct
instruction or self-instruction show large improvements
in calculation and reasoning skills compared to controls.
Mediated or assisted instruction is associated with moder-
ate improvement in math reasoning, especially for older
children and adolescents.

Review:
- Three effective treatments for math disabilities are
direct instruction, self-instruction, and mediated or
assisted instruction. These strategies also improve math
skills in youths without disabilities.
- Direct and self-instruction are most effective with
younger children whereas mediated or assisted instruc-
tion is recommended for older children.

KEY TERMS

Anticipatory-struggle theory of stuttering: A theory used to
explain stuttering; suggests that children expect speaking to
be anxiety-provoking; these cognitions interfere with speech
production

Auditory perception: The ability to accurately identify and dif-
f erentiate sounds

Childhood-onset fluency disorder: A DSM-5 disorder charac-
terized by a persistent problem with the normal rate, efficiency,
and timing pattern of speech; causes anxiety and/or interferes
with communication

Comprehensive assessment: A method of learning disability
assessment in which children are classified when they show
(a) normative deficits in academic skills, (b) underlying cogni-
tive processing problems that might explain these deficits, and
(c) otherwise average intelligence

Conversational recast training: A therapy for SLI, the ther-
pist structures the child's environment to elicit verbal behavior;
then, the therapist prompts the child to practice the behavior,
correcting mistakes and reinforcing appropriate use

Conversational repair skills: Techniques used to help listen-
ers regain an understanding of information conveyed during
discourse; examples include providing additional background
information or context

Covert-repair hypothesis: An explanation for stuttering; chil-
dren who stutter show frequent disruptions in language for-
mulation; their stuttering occurs when they try to correct these
formulations while speaking

Curriculum-based assessment: A technique use in schools to
measure children's academic progress in terms of their ability
to reach academic goals or "benchmarks"

Decomposition: A technique used to solve math calculation
problems in which the problem is broken into smaller steps
that are more easily recalled and performed. In math calcula-
tion, to break up complex problems into smaller components
which are more easily remembered or solved
Digitally assisted reading: A technique to improve fluency using technology; children read text on a tablet or computer as a voice models fluent reading.

Direct instruction: The systematic introduction, modeling, practice, and reinforcement of appropriate skills.

Direct retrieval: In math calculation, the immediate recall of math facts (e.g., \(3 \times 3 = 9\)).

Double-deficit model: A model that indicates that children can have problems with (a) basic word reading, (b) reading fluency and comprehension, or (c) both.

Dyslexia: A term used by some clinicians to refer to deficits in basic word reading and reading fluency.

Expressive language: The ability to share beliefs, knowledge, and skills with others.

Guided oral reading: A technique to improve fluency in which children read aloud and teachers provide assistance and feedback regarding mistakes.

Grammar: The rules that govern the use of morphemes and the order of words (syntax) in a sentence.

Immature speech: Developmentally less sophisticated speech production that might be adaptive at early ages but is considered inarticulate and maladaptive at later ages.

Individuals With Disabilities Education Improvement Act (IDEIA): A federal law that entitles children with disabilities to free, appropriate public education.

Language: Spoken, signed, or written communication in which beliefs, knowledge, and skills are experienced, expressed, or shared; involves the manipulation and organization of auditory or visual symbols according to a system of rules that is determined by one’s culture.

Language disorder: A DSM-5 disorder characterized by persistent difficulties with the acquisition or use of language that include (a) reduced vocabulary, (b) limited sentence structure, or (c) impairments in discourse.

Late language emergence: A subtype of language disorder characterized by significant delays in receptive or expressive language; usually identified between 18 and 36 months.

Lateral sulcus: Also known as the sylvian fissure, a large gyrus (groove) in the left hemisphere of the brain; near important areas for language.

Mands: A term used by speech-language therapists to refer to requests.

Mediated or assisted instruction: A technique to improve math reasoning in which teachers help students comprehend math problems and offer assistance as children work through the problems themselves.

Milieu training: A treatment for SLI; uses behavioral techniques to encourage children’s language use in real-life environments and experiences.

Morphology: The structure of words; usually the combination of several phonemes; can be fixed or free.

Narrative skills: Communication skills used to tell stories or relate personal experiences; often deficient in youths with social communication disorder.

Number sense: An early awareness that a group of stimuli can be understood in terms of their quantity.

Number Sets Test: A test of number sense in which children must match numerals or objects with a target number; predicts math disabilities in young children.

Phonemic awareness: The ability to hear, identify, and manipulate these phonemes (i.e., the sounds of a language).

Phonemic mediation: The ability to use phonemic awareness and phonics skills to sound out novel words.

Phonological short-term memory: The ability to hold auditory material in memory for short periods of time.

Phonological theory of SSD: Asserts that children develop SSD when they develop incorrect mental representations for phonemes during the first few years of life.

Phonology: The sounds of a language and the rules for combining these sounds.

Processing speed: The ability to quickly and accurately perform relatively simple cognitive tasks without expending a high degree of effort.

Psycholinguistics: The study of the psychological and neurocognitive underpinnings of language.

Rapid automatized naming (RAN): The ability to recall the names of a series of familiar items as quickly as possible.

Rapid temporal processing: The ability to quickly and accurately process sensory information.

RAVE-O: A program to improve reading fluency; involves instruction in retrieval, automaticity, vocabulary, elaboration, and orthography.

Reading comprehension: The ability to read text for meaning, to remember information from the text, and to use information to solve problems or share with others.

Reading fluency: The ability to read rapidly, accurately, and with proper expression.

Receptive language: The ability to listen to and understand communication.

Response to intervention (RTI): A method of learning disability identification in which children are classified when they persistently fail to respond to scientific, research-based educational interventions.

Scripts: Detailed descriptions of social interactions in which people routinely engage; can be used to practice social communication skills.

Self-instruction (in mathematics): Teachers systematically present a series of verbal steps or “prompts” that children can use to solve math problems by themselves.
Self-regulated strategy development (SRSD): A technique to improve written expression; involves introducing, modeling, and reinforcing writing strategies for specific types of assignments

Semantics: The meaning of individual words (lexical) or sentences (sentential) in a sentence

Social (pragmatic) communication disorder: A DSM-5 disorder characterized by persistent difficulties in the use of verbal and nonverbal communication in social contexts; interferes with communication and/or social functioning

Specific language impairment (SLI): A subtype of language disorder characterized by significant deficits in morphology, syntax, and/or grammar that are not better explained by ID or another medical or mental disorder

Speech: The modulation of one's voice to produce specific, discernible sounds that have meaning in a particular language

Speech fluency: The ease and automaticity of speech; includes rate, duration, rhythm, and sequence

Speech sound disorder (SSD): A DSM-5 disorder characterized by persistent difficulty with clear and articulate speech production; include sound omissions, substitutions, distortions, and lisps

Skillstreaming: A social skills training program that systematically introduces, models, practices, and reinforces social skills; useful in teaching social communication

Specific learning disability: A legal term usually used in educational settings to describe problems in the basic psychological processes involved in spoken or written language; causes impairment in reading, math, spelling, writing, or oral language

Specific learning disorder: A DSM-5 disorder characterized by difficulties learning or using reading, math, or writing skills; emerges in childhood or adolescence; skill deficits are significantly low, compared to other people of the same age, and cause impairment in school or daily activities

Story grammar: Knowledge of the components and structure of stories (e.g., characters, setting, plot); often deficient in children with poor reading comprehension

Tacts: A term used by speech-language therapists to refer to a comment or description

Text enhancements: Visual aids or routines that assist students in identifying, organizing, understanding, and recalling important information; important to nonfiction reading comprehension

Two-factor theory of stuttering: Posits that stuttering arises because of classical conditioning and is maintained through operant conditioning

Working memory: The ability to simultaneously hold and manipulate multiple pieces of information in short-term memory to solve problems

CRITICAL THINKING EXERCISES

1. Tom and Kelly are parents of a 2-year-old girl with late language emergence. At 24 months, their daughter is able to say only a handful of words and communicates mostly through gestures. Tom and Kelly are wondering if their daughter will eventually catch up to other children her age or if her language delays are a sign of a more serious problem. How might you respond to their concerns? What other information might you need?

2. Children's language problems are sometimes associated with impoverished parent–child interactions. Why can't we conclude that the quality of parent–child interactions causes these language problems?

3. Some adults try to help children who stutter by encouraging them to “relax” during conversations. Why isn't this strategy usually effective? What might be a more effective intervention for older children and adolescents who stutter?

4. Why aren't children who meet diagnostic criteria for ASD also diagnosed with social communication disorder? How might these two disorders be differentiated?

5. Children from low-SES families are at disproportionate risk for being classified with a learning disability. How might school psychologists and other professionals avoid misdiagnosing these children?

TEST YOURSELF AND EXTEND YOUR LEARNING

Videos, flash cards, and links to online resources for this chapter are available to students online. Teachers also have access to PowerPoint slides to guide lectures, case studies to prompt classroom discussions, and exam questions. Visit www.abnormalchildpsychology.org.