PHONOLOGICAL TREATMENT
of
SPEECH SOUND DISORDERS
IN CHILDREN

A Practical Guide

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their physical form. The final objective is improving children's ability to communicate in daily interactions and, therefore, specific functional activities in natural contexts are a component of some phonological methodologies.

Workbook Content and Layout

In this workbook, you will find practical guidelines for the implementation of phonological treatment methods in your daily work as a clinician. To this end, Chapter 2 includes information regarding assessment and analysis, including easy-to-use data sheets that are demonstrated in the chapters that follow. Each of the next eight sections (Chapters 3 to 10) provides a clear explanation of a phonological intervention method, using case studies to illustrate its application in a step-by-step progression. The approaches included in this book are: Chapter 3: Minimal Pair Therapy, Chapter 4: Multiple Oppositions, Chapter 5: Maximal Oppositions, Chapter 6: Complexity Approaches, Chapter 7: Phonotactic Therapy, Chapter 8: Core Vocabulary Approach, Chapter 9: Cycles Approach, and Chapter 10: Phonological/Phonemic Awareness. The chapters devoted to a specific intervention method contain:

1. A brief overview of the therapy method;

2. Examples of supporting research;

3. Target selection procedures;

4. Sample goals and data collection strategies;

5. Treatment guidelines;

6. Group therapy ideas.

The final chapter of this book includes case studies that illustrate the application of the intervention methods presented. Short video clips demonstrating the therapy methods selected for each case study are available online at http://www.pluralpublishing.com/publication/ptssd. Below you will find a brief description of each method included in this workbook.

Summary of Treatment Approaches

There are many therapies to choose from that effectively address phonological deficits. In fact, Baker and McLeod (2011a) identified 46 different intervention approaches and seven target selection options for treatment of phonological disorders in a narrative review of 134 studies published between 1979 and 2009. In this workbook, we have selected eight of these to review, based upon factors including supporting evidence and available resources for implementation. Some of the approaches included in this book represent comprehensive therapeutic protocols (e.g., cycles approach, multiple oppositions), while others primarily describe a specific target selection strategy (e.g., complexity

approach, phonotactic therapy). All are designed to remediate phonological difficulties, yet do not necessarily exclude the principles which govern a traditional sound-by-sound approach. Many of these therapies, as are noted in later chapters, first use aspects of traditional articulation therapy. There is not a dichotomy between articulation and phonological treatment, but rather both work together to optimally aid children with speech sound disorders. Here are brief summaries of the eight intervention methods.

Minimal pair therapy is the original contrastive therapy using pairs of words that differ by only one phoneme (a minimal word pair). Targets are typically based on the specific error pattern demonstrated by the child. Thus, the intended sound and the error production are set in opposition to each other. For example, if the child produced /f/ as /p/ then minimal pairs such as "fan" and "pan" could be used. If the child produces "fan" and "pan" as /pæn/ then the semantic consequences of misproductions are highlighted. The goal is an increase in the use of contrastive phonemes and word shapes for the purpose of functional communication (Barlow & Gierut, 2002).

Multiple oppositions therapy is a variation of minimal pair therapy that incorporates larger treatment sets. Rather than targeting one contrast pair at a time, a whole family of homonyms is targeted simultaneously. Thus, if the child uses /t/ for /k, ʃ, tʃ, and st/, minimal word pairs contrasting each of these phonemes would be created. An example would be using the words "top," "cop," "shop," "chop," and "stop" as a contrastive word set during intervention activities. Each child's unique phonological system is first analyzed to identify phonemic collapses, and then targets are developed to systematically increase contrasts and reduce homonymy across the child's phonological system (Williams, 2010).

Maximal oppositions therapy uses pairs of words with two phonemes that represent maximal distinctions in their production. Optimal targets incorporate contrasts across many distinctive or descriptive features (i.e., place, manner, voicing), and at least one major class feature (i.e., sonorant, consonantal, vocalic). A variation, known as Treatment of the Empty Set, creates word pairs representing two unknown sounds (i.e., not able to be produced by the child), instead of one known sound (i.e., produced by the child), and one unknown sound. These adjustments to target selection have been shown to produce broader, more system-wide change in children's phonological systems (Gierut, 1989, 1992).

The **complexity approach** is actually a target-based approach. Therefore, the foundation consists of how targets are selected, and not a specific treatment protocol. It is unique in that it targets sounds that are more "complex." More complex sounds are those (1) that are excluded from the child's inventory, (2) that are not stimulable, (3) imply production of other classes of sounds, and (4) that are later-developing. These categories create the priority for target selection. In addition, specific consonant clusters could alternatively be chosen as targets. Consonant clusters are chosen based on sonority (specific loudness differences between the elements of the cluster), the lack of stimulability of the individual cluster elements, and the productional difficulty of the specific elements. It appears that by targeting word pairs that contain complex phonemic elements, more generalization occurs in the child's phonological system (Gierut, 2001).

Phonotactic therapy emphasizes word shapes as important structures for creating contrast in a child's developing phonological system. This approach to target selec-

tion allows clinicians to simultaneously expand a child's phonotactic inventory, sound inventory, and vocabulary. Phonotactics looks at the rules governing how syllables and words are constructed. It includes rules about how consonants may combine to form clusters, how consonants and vowels may combine to form syllables, and how syllables may join together in words, including their stress patterns. Phonotactic intervention expands both the syllable and word structure possibilities of the child while also introducing new phonemes within these structures. It represents a practical option for children who demonstrate restricted word shape inventories, or who exhibit whole word error patterns (Velleman, 2002, 2016).

Core vocabulary is a whole-word approach for children who demonstrate an inconsistent speech disorder. Inconsistency is characterized by the unpredictable use of different phonemes when saying the same word repeatedly. Children with an inconsistent speech disorder may indeed produce the same word differently each time they say it. These children appear to need a unique type of treatment procedure (Dodd, Holm, Crosbie, & McIntosh, 2010). The core vocabulary chapter is structured to first give specific guidelines for diagnosing an inconsistent speech disorder. Treatment is based on stabilizing the productions of a core set of vocabulary items that are very functional for the specific child. If consistency of productions can be attained, these children are able to transition to other types of goal-directed phonological treatment protocols.

The **cycles phonological remediation approach** targets a broad age-range of children with severe-to-profound expressive speech sound disorders. It was developed to facilitate the acquisition of intelligible speech in "cycles," periods of time where one specific pattern is targeted. The cycles phonological remediation approach has a detailed way to select targets, structure therapy, and move from cycle-to-cycle of patterns. In contrast to other mentioned approaches, cycles training targets specific preselected words in such a way that 100% accuracy is obtained in production-practice drills. Thus, it is critical that the child be "stimulable" and capable of producing the pattern with "assists," such as tactile cues or amplification. According to the authors, the concept that sets this approach apart from others is that it appears that children make progress in a relatively short time (Hodson & Paden, 1991).

The last treatment chapter describes using **phonological/phonemic awareness** strategies as a portion of treatment for speech sound disorders. First, this chapter briefly summarizes the very complex interdependency between phonological/phonemic awareness, speech sound disorders, and learning to read and write. It defines key terms, such as phonological versus phonemic awareness, and gives examples of the types of tasks that are considered within each area (Gillon, 2018). These tasks are also defined according to broad-based developmental parameters. For example, certain skills are considered very early, such as segmenting the individual words in a sentence (how many words are in "I am at home"), while others typically occur later developmentally, such as phoneme manipulation ("What would the word "team" be if you reversed the "t" and the "m"?). The second portion of the chapter attempts to show how phonological/phonemic awareness activities could be directly connected to treatment for speech sound disorders.

Table 1–1 provides a brief description of the characteristics of each approach. You may use this chart as a quick guide for identification of therapies that may be appropriate for a particular child. References for this table are extensively provided within each of

Table 1–1. Summary of Phonological Treatment Options

Type of Phonological Treatment	Approximate Age Range, Severity	Characteristics of Disorder
Minimal Pair Therapy e.g., Barlow & Gierut, 2002	3+ years of age. Mild to mild-moderate phonological disorder.	Does the child have one or only a few speech sound errors that involve a lack of contrast?
Multiple Oppositions e.g., Williams, 2010	Research supports 3 to 6½ years of age, most with moderate or severe speech sound disorders.	Does the child demonstrate a high number of phonemic collapses? A high degree of homonymy?
Maximal Oppositions e.g., Gierut, 1989, 1992	Research supports 3;6 to 5+ years of age. At least six sounds excluded from inventory and extensive "gaps" in their phonemic inventory.	Does the child demonstrate multiple speech sound errors across a variety of sound classes? Could maximal oppositions be found that would reflect the child's phonological system needs?
Complexity Approaches e.g., Gierut, 2001	3 to 7 years of age with a moderate to severe speech sound disorder.	Does the child's phonological system need overall change? Does targeting later sounds to achieve earlier ones seem to be warranted?
Phonotactic Therapy e.g., Velleman, 2001, 2016	Age not specified. Moderate, severe, or profound speech sound disorder.	Does the child have difficulties with early syllable or word shapes?
Core Vocabulary e.g., Dodd, Holm, Crosbie, & McIntosh, 2010	3 to 11 years of age, however, the most progress was made with children around 3 years old.	Does the child demonstrate an inconsistent speech sound disorder?
Cycles Phonological Remediation Approach e.g., Hodson & Paden, 1991	Research supports 2;9 to 7 years of age. Children should demonstrate a severe phonological disorder.	Is the child unintelligible?
Phonological/Phonemic Awareness Training e.g. Gillon, 2018	From 3 to 9 years of age. Children should have skills that test below the norm range.	Are skills low?

the chapters. We encourage clinicians to use the information provided in this workbook within the context of an evidence-based framework for clinical decision making, which includes consideration of current research and client values, as well as your own clinical expertise (please see Baker & McLeod, 2011b for an excellent tutorial on evidence-based practice (EBP) and speech sound disorders). We hope this workbook will inspire you to implement new strategies to achieve optimal outcomes with the children you serve.

CASE STUDIES

Overview

This chapter contains four case studies. Each of these children has been diagnosed with a speech sound disorder. The following sections outline their diagnostic information, provide detailed inventory material, and briefly discuss the reasoning for the phonological treatment method chosen. The accompanying website demonstrates small portions of therapy with these children, using four of the phonological treatment methods that have been previously described.

Case Study #1: Elias

Elias is a 7;4-year-old boy who is in second grade. He has received speech therapy for the past three years due to a speech sound disorder. Although he has made significant progress, he continues to produce some sounds in error. His classroom teacher reports that Elias is an excellent student and that his reading and spelling skills are above grade level. According to his parents, Elias has many friends and is enthusiastic about interacting with familiar peers and adults. However, he has recently become self-conscious about his speech in new settings and is reluctant to speak in front of groups. Refer to Table 11–1 for a summary of Elias' most recent assessment results.

Test Results

According to standardized assessment, Elias demonstrates expressive and receptive language skills in the average range for his age. His voice, fluency, and pragmatics are all typical. No difficulties were observed with the structure or function of his oral mechanism, and he passed a hearing screening.

Results of a standardized speech assessment indicated that Elias' sound production skills are significantly below average for his age. His speech is typically intelligible to familiar listeners. Table 11–2 presents a summary of Elias' sound inventory, with substitutions noted.

Elias is able to produce all early developing sounds. He is unable to produce some later sounds, including [θ, ð, tʃ, dʒ, ɹ, and l]. During stimulability probing, Elias produced close approximations of all sounds, with the exception of [θ, ð]. In fact, he exhibited noticeable frustration when trying to produce these interdental fricatives. Elias demonstrated the ability to consistently differentiate between minimal pairs containing the

Table 11–1. Elias (7 years 4 months): Summary of Assessment Results

Area Assessed	Assessment Tool	Measurements/Observations
Receptive Vocabulary	The Peabody Picture Vocabulary Test: Fourth Edition–PPVT-4 (Dunn & Dunn, 2007)	Standard Score of 114. Considered average, within one standard deviation of mean (Mean of 100, SD of 15).
Expressive Vocabulary	The Expressive Vocabulary Test: Second Edition–EVT-2 (Williams, 2007)	Standard Score of 110. Considered average, within one standard deviation of mean (Mean of 100, SD of 15).
Language Development	Clinical Evaluation of Language Fundamentals: Fifth Edition–CELF-5 (Wiig, Secord, & Semel, 2013)	Receptive Language Index of 111. Expressive Language Index of 107. Both scores are considered to be in the average range (Mean of 100, SD of 15).
Speech Production: Standardized One-Word Test	Goldman-Fristoe Test of Articulation–GFTA-3 (Goldman & Fristoe, 2015)	Standard Score of 48. More than two standard deviations below the mean.
Speech Production: Spontaneous Speech Sample	Sample of connected speech was gathered during classroom interaction with other students.	Elias speech intelligibility was high with familiar listeners. Unfamiliar adults and peers sometimes misunderstood him.
Speech Production Consistency	Informal analysis of single word articulation test and speech sample.	Elias' speech sound errors were consistent. No formal testing was warranted.
Hearing Function	Pure-tone audiometric screening at 500, 1000, 2000, and 4000 Hz.	Elias responded bilaterally to pure tones presented at 20 dB. Passed hearing screening.
Oral Structure and Function	Speech-Motor Assessment Screening Form (Bauman-Waengler, 2020).	Oral structure was unremarkable. Function of the articulators appeared to be within the normal range.
Fluency	Informal observation during speech sample.	No dysfluencies were noted.
Voice	Informal observation during speech sample.	Elias' voice quality and pitch were perceived to be appropriate.
Behavioral Observation	Informal observation, parent report.	Elias initiates communicative interactions with peers and adults. However, he is reluctant to speak in front of groups or read aloud in class.
Pragmatics	Informal observation, parent report.	Observations indicate age-appropriate functioning.
Academics	Summary by second grade teacher.	Above average performance in classroom spelling and reading tasks.

Table 11–2. Inventory and Stimulability for Elias (age 7 years, 4 months)

Early Sounds	I	M	F	Stimulable	Later Sounds	I	M	F	Stimulable
Stops					**Fricatives**				
p	✓	✓	✓		f	✓	✓	✓	
b	✓	✓	✓		v	✓	✓	✓	
t	✓	✓	✓		s	✓	✓	✓	
d	✓	✓	✓		z	✓	✓	✓	
k	✓	✓	✓		θ	t	t	t	No
g	✓	✓	✓		ð	d	d	d	No
Nasals					ʃ	✓	✓	✓	
m	✓	✓	✓		**Liquids**				
n	✓	✓	✓		ɹ	w	w	ə	Yes
ŋ	-----	✓	✓		l	w	w	ə	Yes
Glides					**Affricates**				
w	✓	✓	-----		tʃ	t	t	ts	Yes
j	✓	✓	-----		dʒ	d	d	dz	Yes
Fricative									
h	✓	✓	-----						

Consonant Clusters: All elements of clusters are maintained; that is, two consonant clusters are all produced with two consonants and three consonant clusters are produced with three consonants. All clusters were produced accurately, with the exception of clusters containing /l, ɹ, θ/. Clusters with /l/ and /ɹ/ were produced with /w/ (e.g., [bw] for /bl/ and [tw] for /tɹ/) and /θɹ/ was produced as [tw].

sounds he produced in error, contrasted with the sound he used as a substitution (e.g., tin/thin, doe/though, tease/cheese, dam/jam, wing/ring, wake/lake).

Minimal pair therapy and maximal opposition therapy were identified as possible options for Elias, based upon his sound inventory and careful consideration of relevant factors (Table 11–3).

Elias demonstrates sound errors that involve a loss of contrast, including the collapses in the initial position of [ɹ, l] → [w] , [θ, tʃ] → [t], and [ð, dʒ] → [d]. Both minimal pair and maximal opposition therapy may effectively increase the use of contrastive sounds. Research has shown that for children with six or more sounds in error, like Elias, maximal oppositions may be a more efficient route to system-wide change than traditional minimal pair intervention (e.g., Gierut, 1992; see Chapter 5). Maximal

Table 11–3. Checklist for Phonological Treatment Options: Elias (age 7 years, 4 months)

Type of Phonological Treatment	Approximate Age Range, Severity	Characteristics of Disorder	Case Study #1: Elias
Minimal Pair	3+ years of age. Mild to mild-moderate phonological disorder.	Does the child have one or only a few speech sound errors that involve a lack of contrast?	Yes, Elias has error sounds that involve a lack of contrast. The initial collapses noted are [ɹ, l] → [w] and [θ, tʃ] → [t] while [ð, dʒ] → [d].
Multiple Oppositions	Research supports 3 to 6½ years of age, most with moderate or severe speech sound disorders.	Does the child demonstrate a high number of phonemic collapses? A high degree of homonymy?	No, homonymy is not present to a high degree. The collapses noted (above) involve only two phonemes rather than an extensive collapse.
Maximal Oppositions	Research supports 3;6 to 5+ years of age. At least 6 sounds excluded from inventory and extensive "gaps" in their phonemic inventory.	Does the child demonstrate multiple speech sound errors across a variety of sound classes? Could maximal oppositions be found that would reflect the child's phonological system needs?	Yes, 6 sounds are excluded from Elias' inventory, across several sound classes (liquid, fricative, affricate). Maximal oppositions such as /f/ versus /ɹ/ or /m/ versus /tʃ/ would address Elias' needs.
Complexity Approaches	3 to 7 years of age with a moderate to severe speech sound disorder.	Does the child's phonological system need overall change? Does targeting later sounds to achieve earlier ones seem to be warranted?	No, Elias is able to produce all earlier developing sounds. In addition, his production of consonant clusters is only impacted by difficulty with liquids and /θ/.
Phonotactic Therapy	Younger children, approximately 2;6 to 3;6 years of age.	Does the child have difficulties with early syllable shapes?	No
Core Vocabulary	3 to 11 years of age; however, the most progress was made with children around 3 years old.	Does the child demonstrate an inconsistent speech sound disorder?	No
Cycles Phonological Remediation Approach	Research supports 2;9 to 7 years of age. Children should demonstrate a severe phonological disorder.	Is the child unintelligible?	No, intelligibility is impacted, but he is not unintelligible.

Table 11–3. *continued*

Type of Phonological Treatment	Approximate Age Range, Severity	Characteristics of Disorder	Case Study #1: Elias
Phonological/ Phonemic Awareness Training	From 3 to 9 years of age. Children should have skills that test below the norm range.	Are skills low?	No, Elias demonstrates above grade level reading and spelling skills, per teacher report.

oppositions specifically targets singleton consonants in the initial position of words, which are an area of need for Elias. In addition, minimal pair therapy includes a speech perception phase, whereas maximal oppositions therapy does not. Elias demonstrated that he is already able to discriminate between his target and error sounds, and thus this phase of remediation would not be necessary. For these reasons, maximal oppositions therapy was chosen as the best choice for Elias at this time.

Selecting a Target

Identification of Unknown Sounds

As described in Chapter 5, p. 129, the first step in target selection for maximal oppositions is to identify the child's known and unknown sounds. Reviewing Elias' sound inventory, presented in Table 11–1, the following lists can be compiled:

Elias' known initial consonant phonemes: /p, b, t, d, k, g, m, n, w, j, h, f, v, s, z, ʃ/

Elias' unknown initial consonant phonemes: /θ, ð, ɹ, l, tʃ, dʒ/

A sound pair was then chosen that represented maximal oppositions, by referencing Table 5–10 on page 140. Target selection for maximal oppositions begins with an unknown sound. In Elias' case, /ɹ/ was picked as the next phoneme for intervention, due to its high frequency of occurrence in American English. Table 5–10 lists the following sound pairs that contain maximal oppositions for /ɹ/: /ɹ/ versus /p/, /ɹ/ versus /k/, /ɹ/ versus /h/, /ɹ/ versus /f/, /ɹ/ versus /s/, and /ɹ/ versus /θ/. The first four options include one unknown sound and one known sound for Elias, and would therefore constitute maximal opposition pairs. The final duo, /ɹ/ versus /θ/, is composed of two unknown sounds, and would thus meet the criteria for Elias as a target for treatment of the empty set. This last option was considered, but eliminated due to the frustration exhibited by Elias when attempting to produce /θ/. The sound pair of /ɹ/ versus /f/ was chosen in the end because Elias had recently learned to produce /f/ contrastively and might benefit from the additional practice on this sound. Minimal pair words were then generated using /ɹ/ and /f/ in the initial position of words, using Appendix 5–1 p. 150 as a resource. Real words were selected as stimuli for Elias, although the use of nonsense words was also considered. Table 11–4 presents a summary of Elias' target selection.

Table 11–4. Elias (age 7 years, 4 months) Maximal Opposition Minimal Pair Target Selection

Unknown Sound	Known Sound	Descriptive Feature Difference(s)	Major Class Feature Difference(s)	Sample Pairs: Nonhomonymous
/ɹ/	/f/	1) PLACE: palatal vs. labiodental 2) MANNER: liquid vs. fricative 3) VOICE: voiced vs. voiceless	YES +sonorant versus –sonorant +vocalic versus –vocalic	row & foe rat & fat right & fight rig & fig roam & foam

Navigating the Video

Elias appears in Video #1 participating in the two phases of maximal opposition therapy. During the first stage of intervention, the imitation phase, Elias is required to produce each word in direct imitation of an adult model. The clinician is seen reviewing the physical production of each sound target, including direct instruction on placement and the use of hand cues. Although the inclusion of phonetic teaching is not a component of the maximal opposition approach, some research has demonstrated that the inclusion of articulatory cueing in minimal pair therapy may result in more rapid progress (e.g., Saben & Ingham, 1991). Elias is next seen participating in the spontaneous phase of intervention. The clinician and Elias participate in a game of *Go Fish*, which requires Elias to spontaneously produce the target contrasts during an interactive exchange.

Case Study #2: Cameron

Cameron is a 5;1-year-old boy who will begin kindergarten in a few months. His preschool teacher referred him for a speech and language evaluation when he was just over three years old. Results of the initial assessment indicated that Cameron demonstrated a severe speech sound disorder, characterized by extensive phonemic collapses. He used the phonemes /b/ and /d/ as substitutes for most other sounds, resulting in widespread homonymy. His speech intelligibility was very low, even among family members. Cameron has made significant progress over the past two years, which is reflected in his most recent evaluations results, presented below (Table 11–5).

Test Results

Standardized assessment results indicate that Cameron's expressive and receptive language skills are in the average range for his age (within one standard deviation of the mean). His voice, fluency, and oral-motor skills are typical. In addition, his pragmatics were observed to be appropriate and he passed a hearing screening. On a phonological awareness assessment, Cameron performed in the below-average range in all areas,