The Cycles Phonological Remediation Approach

Raúl F. Prezas and Barbara Williams Hodson

ABSTRACT

The cycles approach has evolved based on more than 30 years of clinical practice and research. It was designed explicitly for children with highly unintelligible speech but also has been used to treat clients with special etiologies (e.g., children with the label of childhood apraxia of speech [CAS]). Rather than following a traditional phoneme-oriented model (e.g., 85% criterion for mastery of each sound), practitioners identify phonological patterns (e.g., /s/ clusters) that are deficient, but stimulable, and present them in a cyclical fashion to expedite intelligibility gains. This chapter provides information regarding implementing the cycles approach and discusses theoretical underpinnings, selection of optimal target patterns, and evidence-based practices.

INTRODUCTION

The cycles approach was designed to facilitate the development of intelligible speech patterns in children with severe-to-profound expressive phonological impairments (intelligibility percentage typically less than 20%). A cycle (i.e., period of time, typically 10–15 weeks) is completed after each of the phonological patterns (e.g., /s/ clusters, velars) that need to be targeted during a cycle has been facilitated. In addition, each phoneme per pattern (e.g., postvocalic /k/, prevocalic /k/ [for velars]) has been presented for approximately 60 minutes per cycle. The duration of each cycle depends on two major factors: 1) the number of deficient patterns a child needs to target and 2) the number of deficient sounds in each pattern that are stimulable (i.e., consonants that are not being produced by the child but that can be imitated or produced with assistance; Hodson, 2007a). Stimulable sounds are a central tenet in the cycles approach because children have been found to demonstrate greater gains when stimulable (rather than nonstimulable) sounds are targeted (e.g., Rvachew & Nowak, 2001). Nonstimulable sounds (e.g., velars) are stimulable during each session but not targeted until the child can produce the sound. Practicing nonstimulable sounds is counterproductive because practicing an error sound reinforces the inaccurate kinesthetic image.
TARGET POPULATIONS

Primary Populations

The cycles approach has evolved from formulating and testing clinical research hypotheses while working with several hundred children between the ages of 2½ and 14 years (Hodson, 2007a). It was designed primarily for children with multiple speech errors and highly unintelligible speech who have major phonological deviations (e.g., cluster reduction). This population includes children who have been labeled as having CAS (Hodson & Paden, 1983, 1991; Velleman, 2003). Speech-language pathologists (SLP) generally have classified children with highly unintelligible speech differently from school-age children with mild speech disorders and minimal intelligibility concerns (e.g., Pascoe, Stackhouse, & Wells, 2006). Although a phoneme-oriented approach is adequate for children with mild speech disorders who demonstrate only a few misarticulations (e.g., lisps, substitutions of /f/ for /th/), children with severe-to-profound speech sound disorders (SSD) are ideal candidates for the cycles approach (Hodson, 2007a) in which the critical need is to expedite intelligibility gains so that children can be intelligible in time to succeed in school (see Critical Age Hypothesis in Bishop & Adams, 1990).

Secondary Populations

One of the key strengths of the cycles approach is its adaptability. This approach has been effectively modified for group treatment (e.g., Montgomery & Bonderman, 1989). The cycles approach also has been adapted for children with various etiological factors. Implementation of the cycles approach, for example, has been successful for children with recurrent otitis media, the most common etiological factor reported in case histories of children with severe SSD (Churchill, Hodson, Jones, & Novak, 1988). This intervention approach also has been used successfully for children with cochlear implants (Hodson, 2001), children with repaired cleft palate (Hodson, Chin, Redmond, & Simpson, 1983), children with mild-to-moderate (Gordon-Brauman, Hodson, & Wynne, 1992) and severe hearing losses (Garrett, 1986), and individuals with cognitive delays (e.g., Berman, 2001).

It is important to mention that phonological intervention procedures may need modification for children with additional etiological factors. Children with severe-to-profound hearing losses, for example, often require targeting suprasegmental aspects (e.g., phrasing, intonation) and morphophonological rules (e.g., pronunciations of ed) in addition to specific phonological pattern targets (e.g., /s/ clusters) in treatment (Hodson, 2007a). Cycle durations for children with cognitive delays typically are double in length (i.e., phonemes per pattern targeted for 2 hours, rather than 1 hour). Moreover, 3 or more years may be required before comparable intelligibility gains are observed by children with lower cognitive abilities (Hodson, 2007a).

ASSESSMENT METHODS FOR DETERMINING INTERVENTION RELEVANCE

Speech intelligibility is an important prognostic indicator in the diagnostic process of children with potential speech sound disorders (SSD). As such, the primary goal of the evaluation is the determination of an individual child's phonological system. Five major
Cycles Phonological Remediation Approach

...a goal of the diagnostic process for phonological assessment include determining: (1) a child's phonological strengths and weaknesses, (2) the severity level, (3) stimulability information, (4) an optimal direction for intervention, and (5) baseline measures in order to document change following intervention (Prezas & Hudson, 2007).

The primary method for assessing children with potential SSD involves the elicitation of single words by naming pictures (e.g., Goldman Fristoe Test of Articulation-2 [GFTA-2]; Goldman & Fristoe, 2000) or objects (Hudson Assessment of Phonological Patterns, Third Edition [HAPP-3]; Hudson, 2004). Another widely used method for assessing speech sounds is to obtain a continuous speech sample and compute a percentage of consonants correct (PCC; Shriberg & Kwiatkowski, 1982). Although some assessments are pattern-oriented and designed for children with highly unintelligible speech who require phonological intervention (e.g., HAPP-3), most assessment measures are phoneme-oriented and are more appropriate for children with mild SSD who demonstrate only a few misarticulations.

Children with highly unintelligible speech often have extensive omissions and many substitutions (Hudson, 2007a). With most assessments (e.g., GFTA-2, PCC), omissions, substitutions, and distortions are not differentiated in the overall scoring process (Prezas & Hudson, 2007). In most assessment tools, distortions, for example, are given the same weight as omissions in the final score, regardless of the fact that omissions have a more adverse effect on intelligibility. Consequently, children with very different phonological systems often receive the same scores on these assessments. Posttreatment gains, therefore, may not be measured appropriately for a highly unintelligible child who has, through the course of treatment, replaced omissions with substitutions or distortions (e.g., Velleman, 2005). In addition, distortions (e.g., lisps) can occur with all children across the severity continuum of SSD (i.e., mild, moderate, severe, profound), but their impact on intelligibility is much less than deviations such as omissions. It is critical, therefore, that differentiations be made among substitutions, omissions, and distortions in the scoring process through the use of assessments that differentiate deviation types in final scores (e.g., HAPP-3).

THEORETICAL BASIS

Dominant Theoretical Rationale for the Intervention Approach

Several theoretical frameworks and models have contributed to the development of the cycles approach. This approach is based on developmental phonology theories (e.g., Brown & Goldstein, 1986; Stampe, 1972), cognitive psychology principles (e.g., Hunt, 1981; Vygotsky, 1962), phonological acquisition research (e.g., Dyson & Paden, 1983; Grunwell, 1977; Hudson & Paden, 1981; Porter & Hudson, 2001; Preissner, Hudson, & Paden, 1988), and ongoing clinical phonology research (Hudson, 2007a). Gestural phonology, which aligns most closely with the cycles approach, is a theory in which phonological representation serves as a foundation for speech perception and speech production physical constraints (Brown & Goldstein, 1986; Kent, 1997). The term gesture refers to a class of articulatory movements. One of the important tenets of gestural phonology is that it includes implications/applications for metaphonological awareness and literacy, as well as for phonological production. According to Mody, literacy acquisition appears to be related to the "integration of recurrent gestural patterns into segmental units" (2003,
Incorporating metphonological skill enhancement tasks along with production practice tasks during intervention is a core component of the cycles approach.

**Underlying Concepts for the Cycles Phonological Remediation Approach**

Seven underlying concepts and recommendations serve as the basis for intervention decision making when implementing a cycles approach and are summarized in Table 6.1.

1. **Much of what is known regarding phonological acquisition comes from research on typically developing children.** Such children do not learn phonemes "one at a time" (e.g., /l/) to a specific criterion (e.g., 90%; Dyson & Paden, 1983; Hodson, 2007a). Instead, as David Ingram pointed out in his 1976 book, *Phonological Disability in Children*, phonological acquisition is a gradual process (emphasis added). Typically developing children continually explore and experiment with their speech sounds and learn to acquire the correct productions over time. The cycles approach more closely approximates how typical phonological development occurs (Ingram, 1976). Rather than aiming for a specific criterion of mastery for individual phonemes, it is recommended that practitioners introduce carefully selected targets and present them in a cyclical manner, recy-

<table>
<thead>
<tr>
<th>Underlying concept</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>1. Phonological acquisition is a gradual process (Ingram, 1976).</td>
<td>Allow children to practice phonological patterns (a carefully designed sequence) of primary targets that are stimulable early in treatment.</td>
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<tr>
<td>2. Children with normal hearing typically acquire the adult sound system primarily by listening (Van Riper, 1939).</td>
<td>Incorporate slight amplification with targets at the beginning and ending of each treatment session and also as needed when a child is experiencing a great deal of difficulty producing a particular target/word.</td>
</tr>
<tr>
<td>3. Children associate kinesthetic and auditory sensations as they acquire new patterns, enabling later self-monitoring (Fairbanks, 1954).</td>
<td>Production practice in treatment should be structured in a way that promotes successful responses, rather than a charting of errors, which allows reinforcement of incorrect kinesthetic images.</td>
</tr>
<tr>
<td>4. Phonetic environment can facilitate (or inhibit) correct sound productions (Kent, 1982).</td>
<td>Choose production-practice words wisely so that children will experience greater success during treatment sessions (e.g., avoid using a word with an alveolar consonant in it when the child demonstrates extensive velar fronting).</td>
</tr>
<tr>
<td>5. Children are actively involved in their treatment.</td>
<td>Create an enjoyable, spontaneous atmosphere for children filled with experiential play production-practice activities (e.g., bowling).</td>
</tr>
<tr>
<td>6. Children tend to generalize new speech production skills to other targets (McReynolds &amp; Bennett, 1972).</td>
<td>Target /s/ clusters before singleton stridents for two major reasons: 1) Highly unintelligible children tend to say <em>sun</em> initially when asked to say <em>sun</em>. 2) The English language is &quot;loaded&quot; with <em>s/</em> consonant sequences. Success in producing /s/ clusters increases intelligibility substantially and also leads to productions of other stridents (e.g., /z/).</td>
</tr>
<tr>
<td>7. An optimal match facilitates a child's learning (Hunt, 1961).</td>
<td>Identify optimal target patterns based on phonological assessment results and choose targets for treatment that are stimulable so that a child can be challenged but also successful and not continue practicing the error production, which would reinforce the inaccurate kinesthetic image.</td>
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</tbody>
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Cycles Phonological Remediation Approach

Prezas and Hudson

talent tasks along with production-practice activities of the cycles approach.

The phonological patterns (a carefully selected set of targets that are stimulus-induced) are utilized with targets at the beginning of treatment session and also as needed throughout the entire treatment. Treatment should be structured in a way as to reinforce correct responses, rather than a charting approach or enforcement of incorrect kinesthetic responses.

Words wisely so that children will learn during treatment sessions (e.g., /t/ or /n/). Avoid repetitive phonemes that are not targeted (e.g., /e/).

A conducive atmosphere for children to participate in production-practice activities.

Children tend to generalize new speech production skills to other targets (McReynolds & Bennett, 1972). In most cases, it is not necessary to target every deficient sound. What is necessary, however, is to choose target phonemes/patterns that will trigger the most extensive generalization. Targeting /s/ clusters before singleton stridents, for example, is recommended. Most preschool children generalize to other singleton stridents after /s/ clusters begin to emerge in conversation.

In order to facilitate a child’s learning, it is critical to identify the optimal “match” (Hunt, 1961) and “zone of proximal development” (Vygotsky, 1962) based on phonological assessment results. It is important to determine at what level the child’s phonological system is breaking down so that intervention can be initiated one step above the child’s current level of functioning. This allows the child to be optimally challenged and yet experience immediate success.
Levels of Consequences Being Addressed

The enhancement of phonological patterns and metaphonological skills leads to rapid gains in productions of appropriate phonological patterns, which, in turn, helps young children become intelligible by the “critical age” (Bishop & Adams, 1990). Children who are still highly unintelligible when they begin school typically have excessive difficulties acquiring reading and spelling skills, leading to a downward spiral referred to as “Matthew Effects” (Stanovich, 1986). Thus, the cycles approach targets functional limitations (Body Function) and promotes Activities and Participation in society (World Health Organization, 2001).

Target Areas of Intervention

Multiple domains are introduced in a cycles approach. Although speech output is the primary concern, the cycles approach includes other factors related to auditory awareness, speech perception, language, and literacy. The purpose of production practice during intervention is not to establish a motor pattern of speech, but rather to develop new accurate kinesthetic images and provide a means for integrative rehearsal. During this process, the development of auditory awareness is a critical element. In most cases, unintelligible children do not seem to hear their own errors. If, for example, an adult repeats a word that a child with highly unintelligible speech said, the child will usually respond to the adult’s production by saying “no” and then repeat the word with the identical error (Berk & Brown, 1960).

The cycles approach integrates auditory stimulation with slight amplification (upon the introduction of the target pattern and also whenever needed in each treatment session). Auditory stimulation is used to enhance speech perception and is particularly important during the first few cycles. Pragmatically appropriate activities are recommended whenever possible (e.g., camera used for the production practice word smile). These activities also may include vocabulary words from a child’s classroom list, as well as stories from the student’s classroom (which ties into collaboration). In addition, the cycles approach includes a metaphonological awareness component (Hodson, 1994b; Hodson & Strattman, 2004). Children with highly unintelligible speech often have concomitant difficulties in metaphonological awareness and literacy (Bird, Bishop & Freeman, 1995; Clarke-Klein & Hodson, 1995; Larrivee & Catts, 1999; Raitano, Pennington, Tunick, Boada, & Shriber, 2004; Rvachew & Grawberg, 2006; Rvachew, Ohberg, Grawburg, & Heyding, 2003). Metaphonological awareness activities (e.g., rhyming, syllable segmentation) are built into the cycles approach and are incorporated for a few minutes during each session. These activities function as a means to assist children in developing primary literacy skills (e.g., targeting underlying representation deficiencies; Mody, 2003; Stackhouse, 1997). Moreover, a metaphonological awareness assessment instrument (see Hodson, Scherz, & Strattman, 2002) often is administered to help identify any areas that may need facilitation.

EMPIRICAL BASIS

The efficacy of a modified cycles approach has been investigated by researchers who have implemented a group design (e.g., Almost & Rosenbaum, 1998). In addition, documentation of the effectiveness of the cycles approach exists in a number of refereed/peer-reviewed
training and remediation of phonological skills leads to rapid improvements in speech production, which, in turn, helps young children to develop more appropriate language patterns (Bishop & Adams, 1990). Children who have had difficulty learning to read typically have excessive difficulties with phonological awareness and, as a result, develop a downward spiral referred to as “phonological slippage.” (World Health Organization, 1982).

Although speech output is the primary concern for caregivers and teachers, there is evidence that children who have difficulties with phonological awareness also have difficulties in auditory awareness and language perception. These difficulties are related to other aspects of production practice during speech and, in turn, lead to reduced speech accuracy and a lack of expressive rehearsal. During this process, the child is encouraged to repeat the word with the identical error patterns.

Practicing the word with slight amplification (upon request) is needed in each treatment session. Perception and is particularly important. Permutation activities are recommended (e.g., practice word *smile*). These activities include an oral classroom list, as well as stories (e.g., *sun*). In addition, the cycles approach (Hodson, 1994b; Hodson & Blachowicz, in press) often have concomitant difficulties in phonological awareness (Bishop & Freeman, 1995; Blachowicz, Raitano, Pennington, Tschirich, Bishop & Raitano, 1992). Bishop & Freeman, 1995; Blachowicz, Raitano, Pennington, Tschirich, Bishop & Raitano, 1992). Bishop & Freeman, 1995; Blachowicz, Raitano, Pennington, Tschirich, Bishop & Raitano, 1992). Bishop & Freeman, 1995; Blachowicz, Raitano, Pennington, Tschirich, Bishop & Raitano, 1992).

Ravachow, Raffata, and Martin (1999) examined stimulability and speech perception skills in the treatment of phonological disorders in children. In the first study, 10 children received nine group treatment sessions targeting three phonological processes using the cycles approach. Treatment progress was not observed for sounds that were nonstimulable before treatment. Given stimulability, treatment progress was greater for sounds that were well perceived before treatment in contrast with sounds that were poorly perceived before treatment. In the second study, 13 children received a modified cycles approach. In the modified version, each child received three brief, individual treatment sessions followed by six group treatment sessions. Phonetic placement was used to facilitate stimulability of target sounds. Perception of target sounds was treated using the Speech Assessment and Interactive Learning System (SAILS; AAAZ Innovations, Inc.). In the second study, good progress was observed for most target phonemes, including those that were nonstimulable or poorly perceived before treatment. The researchers determined that increased speech perception is needed for sounds that are nonstimulable. Moreover, nonstimulable sounds often emerge after treatment using stimulable sounds (i.e., children tend to generalize sounds [McReynolds & Bennett, 1972]).

In an independent review of a number of studies involving the cycles approach, Baker, Carrigg, and Linch (2007) concluded that there seems to be evidence to support the efficacy of cycles. They noted the need for more studies comparing phonological intervention approaches.

**Efficacy Studies**

In a randomized controlled intervention study, Almost and Rosenbaum (1998) assigned 26 children who had received a phonological assessment rating of severe (based on Hodson, 1986) either to an immediate intervention group or to a controlled/delayed group. The first group received 4 months of intervention followed by 4 months of no intervention; the second group did not receive intervention the first 4 months, but then, received 4 months of treatment. Four to six phonological patterns based on individual systems were presented in a modified cycles format (Hodson & Paden, 1991). At the end of the first 4 months, the first group received significantly higher scores than the delayed group on three measures (Assessment of Phonological Processes—Revised [Hodson, 1986]; Goldman-Fristoe Test of Articulation [Goldman & Fristoe, 1969]; and PCC [Shriberg & Kwiatkowski, 1982]). Scores of the first group continued to be significantly better at the end of 8 months.

**Studies of Effectiveness**

There have been a number of published, refereed/peer-reviewed case studies providing pre- and postintervention data (Gordon-Bramman, Hodson, & Wynne, 1992; Hodson, 1983, 1994a, 1998, 2005, 2007a; Hodson et al., 1983; Hodson, Nonomura, & Zappia, 1989; Hodson & Paden, 1983, 1991). The case studies presented in this section highlight not only the
clinical application of the cycles approach, but also the variety of populations that benefit from the approach. Although case studies do not provide efficacy evidence, they do yield a measure of feasibility and also often provide an impetus for large-scale efficacy studies (Fey, 2004).

Two case studies have been published in refereed journals of the American Speech-Language-Hearing Association (ASHA). Hodson et al. (1983) reported treatment and results for a child with a repaired cleft palate. Gordon-Brannan et al. (1992) detailed treatment and results for a child with an unusual hearing loss. A report of a 3-year-old with highly unintelligible speech and possible CAS was published in an ASHA Monograph (Hodson, 1994a), and another report of a child with similar issues was published in an ASHA continuing education Master Clinician series (Hodson, 2005). In addition, a case study was published in Topics in Language Disorders (Hodson, 1983) and another study involving a child with more global issues and some literacy concerns was published in Seminars in Speech and Language (Hodson et al., 1989). Moreover, Hodson and Paden published a total of 10 case reports for clients with highly unintelligible speech between the ages of 3 and 14 years in their 1983 and 1991 editions of Targeting Intelligible Speech: A Phonological Approach to Remediation.

Studies of Feasibility

One of the strengths of the cycles approach is its efficiency (Hodson, 1982, 1997; Hodson & Paden, 1991). Many preschool children have required less than 1 year (1 hour per week) of phonological intervention to become intelligible (Hodson, 2007a).

Summary of Levels of Evidence

Two efficacy investigations and several peer-reviewed case studies noted previously provide evidence for the use of the cycles approach with children who have highly unintelligible speech. In addition, the cycles approach has been found to be feasible in individual and group treatment settings, as well as with children with other impairments (e.g., cleft palate). Researchers of a randomized controlled intervention study reported significant results with the use of the cycles approach. Other researchers of one efficacious study reported that stimulable, rather than nonstimulable, sounds were easier to produce (Rychowch & Nowak, 2001). Pre- and postintervention data, as well as treatmnet outcomes, are reported in case study results. Table 6.2 lists major studies involving the cycles approach.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia</td>
<td>Meta-analysis of &gt; 1 randomized controlled trial</td>
<td>Almost &amp; Rosenbaum (1998)</td>
</tr>
<tr>
<td>Ib</td>
<td>Randomized controlled study</td>
<td>Tyler, Edwards, &amp; Saxman (1987)</td>
</tr>
<tr>
<td>Ila</td>
<td>Controlled study without randomization</td>
<td>Gordon-Brannan et al. (1992); Hodson, 1983, 1994a, 2005; Hodson et al. (1983); Hodson et al. (1989)</td>
</tr>
<tr>
<td>Iib</td>
<td>Quasi-experimental study</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Nonexperimental studies (i.e., correlational and case studies)</td>
<td></td>
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</table>

Adapted from the Scottish Intercollegiate Guidelines Network (http://www.sign.ac.uk).
Cycles Phonological Remediation Approach

PRACTICAL REQUIREMENTS

The cycles approach begins with target patterns that are lacking in the child's speech but that are stimulable. The majority of sounds/patterns of a child's phonological inventory that are in error are presented in a carefully planned succession to represent one cycle of treatment (e.g., /s/ clusters before singleton /s/ and liquids at the end of each cycle). Deficient phonological patterns from prior cycles are recycled as many times as needed until the targeted patterns begin to emerge in the child's spontaneous conversational utterances. In addition, the complexity of production-practice words increases with subsequent cycles to ensure an optimal match for treatment targets (Hunt, 1961). Table 6.3 provides the format for the cycles approach, which has been used in university clinics and has been modified and used effectively in schools, clinics, and hospitals.

One of the advantages of the cycles approach is that it can be modified to work in group (e.g., Montgomery & Bondener, 1989) as well as individual sessions. Practitioners in various clinical settings (e.g., schools) have used cycles with a great deal of success (personal communications). Moreover, a homework component is incorporated in which caregivers (or paraprofessionals) actively participate in a 2-minutes-per-day home program.

Nature of Sessions

In the cycles approach, phonological patterns are presented and recycled as needed. Each phoneme (e.g., final /k/) within a pattern (e.g., velars) is targeted for 60 minutes a week (i.e., one 60-minute session, two 30-minute sessions, or three 20-minute sessions per week). Patterns are recycled as needed until they emerge in conversation. Children with highly unintelligible speech are usually seen individually but can be paired with another child when appropriate. Group sessions are appropriate after children progress from severe/profound levels of severity to mild/moderate levels.

Another part of the cycles approach includes a focused auditory input cycle that is used for children younger than 3 years for the initial cycle. These sessions are typically 30-45 minutes long. Target patterns are identified (e.g., final consonants), and a phoneme

Table 6.3. Session-structure model for the cycles approach

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Review production-practice words from prior session.</td>
</tr>
<tr>
<td>2.</td>
<td>Provide auditory stimulation (with slight amplification).</td>
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<tr>
<td>3.</td>
<td>Have child name prospective picture word cards to determine appropriateness of each for production practice.</td>
</tr>
<tr>
<td>4.</td>
<td>Incorporate motivational experiential play production-practice activities.</td>
</tr>
<tr>
<td>5.</td>
<td>Probe for stimulability to determine next session's target.</td>
</tr>
<tr>
<td>6.</td>
<td>Include metaphonological awareness activities (e.g., a folder with a four-line rhyme, syllable segmentation). a. Clinician reads rhyme to child, and child takes rhyme folder home (parents read rhyme to child pausing after a few readings for the child to fill in the rhyme word). b. The amount of intervention session time devoted to enhancing metaphonological awareness skills often is increased during the final cycles.</td>
</tr>
<tr>
<td>7.</td>
<td>Repeat listening activity at the end of the session (with slight amplification).</td>
</tr>
<tr>
<td>8.</td>
<td>Incorporate a home program in which caregivers (or paraprofessionals) participate in 2-minutes-per-day home (or school) activities. The week's listening list is read to the child each day, and the child is asked to name the picture cards that contain the week's production-practice words.</td>
</tr>
</tbody>
</table>

within the pattern (e.g., final /p/) is presented/facilitated for a session via activities/materials containing the target (e.g., up, hop, cup). The child participates in parallel play activities but is not required to say anything during these sessions. After this focused auditory input cycle, the child moves into a regular cycle involving production practice.

Personnel

The goal of any treatment approach for children with highly unintelligible speech should be to expedite intelligibility gains in an optimal and efficient manner and to develop accurate underlying phonological representations. Speech sounds/patterns that are in error must first be identified through assessment, then followed by careful selection of targets and production practice words for treatment. The systematic process of speech assessment and phonological remediation should be implemented by a certified SLP.

The cycles approach is relatively easy to implement. One of the important components of the cycles approach is the home program. Caregivers can contribute greatly to a child's overall success with treatment (e.g., reading the listening list and having the child name the carefully selected production-practice words at home). In some cases, the home program can be implemented each day in a school setting by a member of the school staff (e.g., paraprofessional).

Dosage

It is recommended that each target phoneme within a target pattern be presented for 60 minutes a week. Children in our university phonology clinics participate in 1-hour sessions once a week. School clinicians who use shorter sessions present the target phoneme an equivalent amount of time (e.g., three 20-minute sessions or two 30-minute sessions). The goal in the cycles approach is 100% accuracy for all target productions so that the child can develop a new accurate kinesthetic image. Typically, the child must say the target (but not necessarily the whole word) correctly before taking a turn in an activity.

Typically, three or four cycles (requiring approximately 30–40 hours of an SLP's contact time) are required for children with severe expressive phonological impairments to become intelligible. The longest amount of treatment time (on record) required for clients with extremely disordered phonological systems (within normal limits cognitively, neurologically, and auditorily) to become intelligible (not perfect) has been 66 contact hours over a period of approximately 2 years (Hodson, 2007a).

**KEY COMPONENTS**

The ordering of phonological patterns within cycles is based on developmental and clinical phonology research findings and on each individual child’s phonological abilities (Hodson, 2007a). Targets for which a child demonstrates readiness and stimulability should be selected based on the client's severity level (e.g., profound) as well as the sounds/patterns in error. A major goal for phonological remediation in cycles is for the child to experience immediate and tangible success (Hodson, 2007a; Hunt, 1961).

The recommended order for treatment targets for cycles (i.e., primary and secondary target patterns) is a result of formulating and testing clinical research hypotheses in a university clinic since 1975 to determine which patterns would increase intelligibility most expeditiously. Table 6.4 provides potential primary and secondary target patterns based on these clinical research findings.
Table 6.4. Primary and secondary target patterns for the cycles approach

<table>
<thead>
<tr>
<th>Potential Optimal Primary Target Patterns* for Beginning Cycles</th>
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<tbody>
<tr>
<td>Target only those that are consistent deviations. Targets must be stimulable (otherwise would reinforce inaccurate kinesthetic image)</td>
</tr>
<tr>
<td>Stimulate nonstimulable sounds (e.g., /k/) for a few minutes during sessions until they become stimulable. (Exception: Facilitate liquids even if not stimulable.)</td>
</tr>
<tr>
<td>Word/syllable structures (omitted segments)</td>
</tr>
<tr>
<td><strong>Syllableness</strong> (i.e., number of vowels/diphthongs)</td>
</tr>
<tr>
<td>- Compound words (e.g., cowboy, baseball)</td>
</tr>
<tr>
<td>- Three-syllable/word combinations (e.g., cowboy hat, baseball bat)</td>
</tr>
<tr>
<td>- Singleton consonants (syllable/word structures)</td>
</tr>
<tr>
<td>- CV (word-initial /s/, /t/, /l/, /n/ if lacking)</td>
</tr>
<tr>
<td>- VC (voiceless final stops /p/, /t/, /k/, final /m/, /n/ if lacking; also these depend on child's word-initial phonetic repertoire [e.g., if child produces prevocalic /l/ or /d/, then word-final /l/ can be targeted])</td>
</tr>
<tr>
<td>- VC (e.g., apple)</td>
</tr>
<tr>
<td>/s/ clusters (for omissions, not substitutions/distortions)</td>
</tr>
<tr>
<td>- Word-initial (e.g., /sp/, /st/, /sm/)</td>
</tr>
<tr>
<td>- Word-final (e.g., /ts/, /ps/)</td>
</tr>
<tr>
<td>*Note: Add /s/ to consonant child already produces (e.g., if child produces /b/ or /p/, can target /sp/).</td>
</tr>
</tbody>
</table>

Incorporate phrase “It’s a [s/ cluster word]” after child demonstrates facility producing /s/ clusters in production-practice words (typically by third cycle). |

Reminder: Model soft, short, precise /s/.

Anterior/Posterior Contrasts (when stimulable)
- Velars (if frontier)
  - Word-final /k/ (before prevocalic velars; never final /g/)
  - Word-initial /k, g/ |
- Alveolars/labials (if backer)

Facilitation of Liquids (even if nonstimulable)
- Word-initial /l/ (preceded by week of tongue-tip clicking)
- Word-initial /l/ (suppress gliding initially)
- Exaggerate and prolong the vowel (rather than /l/)
- Do not blend initially

Incorporate /k/s, /g/ (when child has velars typically by third cycle)

General Comments Regarding Targets
- Spend approximately 60 minutes per PHONEME target.
- Target at least two phonemes per target PATTERN.
- Reassess phonology between cycles.
- Recycle primary patterns as needed (until they begin to emerge in everyday conversation).

Proceed to SECONDARY Patterns after
- Early developing patterns are established
- /s/ clusters are in conversation
- Contrastive use of velars and alveolars
- Practice words for liquids—produced without glide

Potential Optimal Secondary Targets
Target any of the following secondary patterns/phonemes that are still consistently lacking/deficient. Incorporate minimal pairs for production practice when possible.

Palatals
- Glide /l/ and glide clusters (e.g., /kl/)
- Palatal sibilants
- Medial and vocalic /j/; other /s/ clusters
- Singleton fricatives (e.g., /f/, /s/)

All other consonant clusters (e.g., three consonants)

Potential Optimal Primary Phonological Target Patterns

Word/syllable structures (omissions) are the first targets (if lacking) for children with highly unintelligible speech. Most 2-year-olds, for example, commonly produce utterances that contain two or three syllables, as well as word-initial and word-final consonants. In addition, typically developing 2-year-olds produce word-initial singleton stops, nasals, and glides (particularly labials) and some word-final nasals and voiceless obstruents (Preissor et al., 1988; Stoel-Gammon & Dunn, 1985). Children with expressive phonological impairments, however, vary greatly in their abilities to produce these early developing patterns.

Syllability (omission of syllable nuclei: vowels, diphthongs, vocalic/syllabic consonants) is a target for children who speak in monosyllables. Preschool children are generally able to produce at least two syllables. Two- and three-syllable compound words (e.g., cowboy, ice-cream cone) are optimal early targets for children who have not yet learned to produce syllables in sequences. For these early targets, an emphasis on the appropriate number of syllables, rather than on the accuracy of specific consonants, is recommended.

Singleton consonants (when consistently omitted in a word position (e.g., CV, VC) are appropriate early intervention targets. Although word-initial singleton consonants rarely need to be targeted, the consistent omission of word-initial consonants seems to have a particularly adverse effect on intelligibility. When a child lacks word-initial consonants, the labial stops /p, b/, nasal /m/, and glide /w/ (for 2 or 3 hours) are ideal targets to help the client learn to produce prevocalic consonants. Word-final singleton consonants are frequent targets for children with highly unintelligible speech. Targeting voiceless word-final stops (e.g., /p/, /t/, and/or /k/, depending on whether the child has velars or alveolars in his or her word-initial consonant repertoire) for 2 or 3 hours helps children become aware of word closings.

The most frequent targets for all children with severe-to-profound phonological impairments are /s/ clusters/sequences. Virtually every young child with highly unintelligible speech has demonstrated difficulty with /s/ clusters. For example, at the University of Illinois Phonology clinic (i.e., 1975–1977), /s/ and /l/ singletons were targeted initially. When words such as sun and soap were presented, children typically said stun and stoap. Then after they learned to say /s/ singleton appropriately in words, they lost the stop in clusters and would say say for stay, thus requiring considerable additional time to teach the children to say /s/ clusters. It was hypothesized that starting with /s/ clusters might be easier for children rather than requiring deletion of the stop and putting on the /s/. This finding has passed the test of time during the last 30 years with hundreds of children. Moreover, because the English language is loaded with /s/ consonant sequences in connected speech, the incorporation of /s/ clusters in a child’s speech truly expedites intelligibility gains. After children learn to produce /s/ clusters consistently, it is extremely easy for them to learn /s/ singleton productions.

Anterior/posterior contrasts are targeted for children who lack velars (either because of fronting or omissions) or alveolars or labials (either because of backing or omissions). Velars need to be targeted much more frequently than anterior consonants. Some children have an incredibly difficult time producing velars; thus, velars need to be stimulated until they are stimulable and then can be produced appropriately in production practice words. Typically word-final /k/ is targeted before word-initial /k/ or /g/. For backers, typical targets are /l/ and /d/.
Liquids typically are targeted at the end of each of the beginning cycles even if they are not assimilable. This is another change from what was done the first few years at the Illinois Phonology Clinic. It has been found that facilitating liquids at the end of each cycle lays a foundation for later productions. Typically, /l/ is fairly easy to elicit after the child has been taught to click his or her tongue independent of jaw movement. When targeting /t/, the initial emphasis is on suppressing the /w/ substitution. The /s/ is modeled for the child, followed by wide open mouth position and an exaggeration of the vowel. For some children, this is an easy procedure; for others it is very difficult. Also, after the child produces velars, the /kw/ and /gj/ clusters are incorporated because these have a facilitative phonetic environment.

Beginning cycles typically last from 10 to 15 weeks depending on the number of patterns/phonemes needing to be targeted. The HAPP-3 is readministered at the end of each cycle to document progress and to determine what needs to be recycled.

### Potential Secondary Target Patterns

Secondary patterns are not targeted until the following criteria have been achieved in spontaneous utterances: 1) appropriate syllableness, 2) productions of singleton consonants, 3) some emergence of /s/ clusters and velars, and 4) productions of practice words for /l/ and /s/ without inserting the glide.

Many of the secondary patterns that had been noted on the original HAPP-3 will no longer need to be targeted. The most common targets at this time are 1) palatals (glide /j/, sibilants, /s/), 2) all other consonant clusters/sequences (e.g., /f/ clusters, lateral /l/ clusters, /l/-consonant clusters), and 3) other singleton stridents (e.g., /I/, /l/, /l/). If there are any remaining vowel/diphthong or prevocalic voicing/devoicing difficulties, these would be targeted at this time.

### Inappropriate Targets for Preschoolers

Some phonemes/patterns have been identified as being inappropriate targets for preschoolers because many, if not most, of their typically developing peers do not fully produce these. These include 1) voiced final obstruents (e.g., /b/, /d/); 2) the velar nasal (a common substitution by American adults as well as children, especially in bisyllabic words, is the alveolar nasal /s/ for /sing/); 3) postvocalic /v/ (children and adults often simply alter their pitch more than placing the tongue tip to the alveolar ridge); 4) unstressed weak syllables (e.g., /probably/), which are commonly omitted by adults as well as typical peers; and 5) “th” sounds, which generally are considered to be among the last sounds acquired and not optimal targets for preschoolers. It seems inappropriate to ask preschoolers to produce sounds that their typically developing peers (and sometimes even adults) are not fully producing.

### Advanced Target Patterns for Older Children with Intelligibility Issues

Some older elementary school (and also middle school and high school) children demonstrate difficulties with productions of multisyllabic words (e.g., /extinguisher/, /aluminum/). These students usually will score well on a traditional articulation test. The HAPP-3 Multisyllabic Word Screening instrument is administered first. Then typically a list of troublesome words is obtained with the help of parents and teachers. The students are
first taught how to break the words into syllables. Then phonetic writing is used for each
syllable. After the student can produce all the sounds of each syllable, syllables are put
together two at a time, then three at a time, and so forth. After the student can say the
 multisyllabic words with automaticity, sentences using the words are generated.

**Materials and Equipment Required**

Few materials and equipment are required for proper implementation of the cycles ap-
proach. Although practitioners adapt the approach for individual client needs, the follow-
ing materials are recommended: an amplification device, 5 × 8-inch index cards, and mo-
tivational experiential play items. An amplifier is recommended for slight amplification
of the listening list at the beginning and ending of the session. The child does not repeat
words from the listening list. The amplifier also can be used so that children hear their
own productions of targets and contrast error productions with target productions. Some
practitioners have used audio recording devices (e.g., a tape recorder or iPod with micro-
phone) to set up listening stations. Large cards are recommended for production-practice
activities for target patterns during treatment sessions. Experiential play items
(games/toys) vary (depending on the child’s interests). A manila folder commonly is used
to include a metathrenological awareness rhyme. Moreover, a listening list is sent home
with caregivers for the home program along with the production-practice cards contain-
ing pictures of the practice words for the week.

**ASSESSMENT AND PROGRESS**

**MONITORING TO SUPPORT DECISION MAKING**

The HAPP-3 (Hodson, 2004), which is a standardized norm-referenced as well as criterion-
referred test, is administered prior to intervention to determine 1) severity level (based
on total occurrences of major phonological deviations; TOMPD), 2) major phonological
deficiencies (e.g., omissions and consonant category deficiencies) to determine optimal
target patterns, and 3) baseline data to be used for comparisons to document treatment
effects over time. The HAPP-3 is also administered after each cycle in order to evaluate
changes in a child’s phonological system and also to determine what needs to be recycled.
Graphs are made to illustrate changes in phonological patterns and TOMPD over time.
After optimal target patterns are identified, probing occurs at the end of each session to
determine the optimal phoneme/pattern target for the next session.

**CONSIDERATIONS FOR CHILDREN FROM**

**CULTURALLY AND LINGUISTICALLY DIVERSE BACKGROUNDS**

The seven underlying concepts that serve as the foundation for the cycles approach are
highly universal. Considerations related to amplification, development of accurate kines-
thetic images, and facilitative phonetic environments of production-practice words, for
example, are critical and applicable to children from all backgrounds. Children (regard-
less of language) are actively involved in their phonological acquisition. The main struc-
ture and model of the cycles approach, therefore, is transferrable to other populations.
The implementation of the cycles approach is individual client needs, the following is recommended for slight amplification. The child does not repeat words so that children learn to recognize them with target productions. Sometimes a tape recorder or iPod with micro recomended for production-practice sessions. Experimental play items in a manila folder commonly is used. However, a listening list is sent home with the production-practice cards containing.

CASE STUDY

Joey (pseudonym) was age 3.5 when he was referred to our university phonology clinic. Video clips of his speech over time (from 3:6 to 5:7) are available from the American Speech-Language-Hearing Association in Enhancing Phonological and Metaphonological Skills of Children with Highly Unintelligible Speech (Hodson, 2005).

At the time of his initial evaluation, Joey produced the following consonants: /p, b, t, d, m, n, w, j/. His utterances were lengthy with the appropriate number of syllables, but no final consonants or consonant clusters were evidenced. The only word that could be identified by unfamiliar listeners in a connected-speech sample at the time of his initial evaluation was Daddy. Many characteristics of his speech were identical to those commonly reported for children with CAS. Table 6.5 provides pretreatment phonological assessment scores (Hodson, 2003, 2004).

Joey’s parents were well-educated professionals, and he had one younger sibling. His medical history was unremarkable except for chronic upper respiratory infections and recurrent otitis media. Four months after treatment began, pressure-equalizing tubes were inserted in his tympanic membranes, and his adenoids were removed.

Joey attended 60-minute treatment sessions once a week during the university semesters. In addition, his parents provided a 2-minute home program on a daily basis. Targets during his first cycle of treatment included 1) word-final consonants (/p/ and /b/), 2) /s/ clusters (word-initial and word-final), 3) velars (word-final /k/, word-initial /l/, and word-initial /g/), and 4) facilitation of prevocalic liquids. By the end of the first cycle, Joey was producing velars and word endings in spontaneous speech, although there were some substitutions for word-final consonants. In addition, he readily produced /s/ clusters in his production-practice words, but carryover into conversation had not yet begun to occur.
Table 6.5. Pretreatment phonological assessment scores for Joey at age 3/6, based on the Hodson Assessment of Phonological Patterns—Third Edition (HAPP-3; Hodson, 2004)

<table>
<thead>
<tr>
<th>Major phonological deviations</th>
<th>Occurrence percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Omissions</strong></td>
<td></td>
</tr>
<tr>
<td>Syllables</td>
<td>0%</td>
</tr>
<tr>
<td>Consonant clusters/sequences*</td>
<td>118%*</td>
</tr>
<tr>
<td>Consonant singletons</td>
<td></td>
</tr>
<tr>
<td>Prevocalic</td>
<td>0%</td>
</tr>
<tr>
<td>Intervocalic</td>
<td>7%</td>
</tr>
<tr>
<td>Postvocalic</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Consonant category deficiencies</strong></td>
<td></td>
</tr>
<tr>
<td>Sonorants</td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>100%</td>
</tr>
<tr>
<td>Nasals</td>
<td>76%</td>
</tr>
<tr>
<td>Glides</td>
<td>60%</td>
</tr>
<tr>
<td>Obstruents</td>
<td></td>
</tr>
<tr>
<td>Stridents</td>
<td>100%</td>
</tr>
<tr>
<td>Velars</td>
<td>100%</td>
</tr>
<tr>
<td>Other (Anterior Nonstridents/Back ing)</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Substitutions and other major strategies</strong></td>
<td></td>
</tr>
<tr>
<td>Other phonological deviations</td>
<td>Occurrences</td>
</tr>
<tr>
<td>Vowel alterations (phonemic)</td>
<td>31</td>
</tr>
<tr>
<td>Stopping</td>
<td>16</td>
</tr>
<tr>
<td>Fronting</td>
<td>12</td>
</tr>
<tr>
<td>Gilding</td>
<td>12</td>
</tr>
<tr>
<td>Reduplication</td>
<td>10</td>
</tr>
<tr>
<td>Labial assimilation</td>
<td>8</td>
</tr>
<tr>
<td>Total occurrences of major phonological deviations**</td>
<td>195</td>
</tr>
</tbody>
</table>

Severity interval level—high profound

*The percentage for consonant sequence omissions exceeds 100% if all consonants of any cluster/sequence are omitted (rather than being reduced with at least one consonant remaining).
**For severity intervals, 0-50 = mild; 51-100 = moderate; 101-150 = severe; >151 = profound. In addition, the top 10 points per interval are designated “high” and the bottom 10 points are “low.”


During the second cycle of phonological treatment, /s/ clusters were recycled and then were incorporated into “It’s a __________” phrases (e.g., “It’s a spoon”). Liquids were also recycled with /kl/ and /gj/ being added. In addition, other consonant clusters were targeted including medial and final /st/ (e.g., toast, toaster) and glide clusters /kw/ and /kj/ (e.g., queen, cue).

For cycles three and four, liquids were recycled. In addition, palatal sibilants and other consonant clusters (e.g., three-consonant clusters) were presented. Table 6.6 provides pretreatment, interim, and posttreatment phonological assessment scores (ages 3/6, 4/7, and 5/7) for the patterns that were targeted. Figure 6.1 shows TOMPD for the five assessment sessions based on his results from
**Table 6.6. Pretreatment, interim, and posttreatment Hodson Assessment of Phonological Patterns—Third Edition (HAPP-3; Hodson, 2004) phonological assessment results for targeted phonological patterns**

<table>
<thead>
<tr>
<th>Phonological deviation</th>
<th>Chronological age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3;6</td>
</tr>
<tr>
<td><strong>Omissions</strong></td>
<td></td>
</tr>
<tr>
<td>Consonant sequences</td>
<td>118%*</td>
</tr>
<tr>
<td>Postvocalic singletons</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Consonant category deficiencies</strong></td>
<td></td>
</tr>
<tr>
<td>Stridents</td>
<td>100%</td>
</tr>
<tr>
<td>Velars</td>
<td>100%</td>
</tr>
<tr>
<td>Liquids</td>
<td>100%</td>
</tr>
<tr>
<td><strong>TOMPD</strong></td>
<td>195</td>
</tr>
</tbody>
</table>

**Severity level**

<table>
<thead>
<tr>
<th></th>
<th>High profound</th>
<th>Moderate</th>
<th>Mild</th>
</tr>
</thead>
</table>

*The percentage for consonant sequence omissions exceeds 100% if all consonants of any cluster/sequence are omitted (rather than being reduced with at least one consonant remaining). Key: TOMPD: total occurrences of major phonological deviations.


Joey was dismissed from the phonology clinic after 52 contact hours of treatment over a period of 2 years and 1 month. His speech was not perfect, but he was essentially intelligible. When he entered kindergarten in the fall, he did not qualify for speech services in the school because the only consistent deviation at that time was liquids. By the time he entered second grade, he produced liquids appropriately and reportedly was an excellent reader.

![Figure 6.1. Total occurrences of major phonological deviations (TOMPD) for Joey. ages 3;6-5;7.](image)
STUDY QUESTIONS

1. What is the major goal of the cycles approach?
2. What is the critical age hypothesis and why is it important?
3. Why is the emphasis of the cycles approach on targeting phonological patterns in a
cyclical manner rather than mastering (e.g., 90%) individual sounds in all positions,
one at a time?
4. Why do sounds need to be stimulable before being targeted in production-practice
   words?
5. Why should assessment instruments for speech sounds/patterns differentiate among
types of deviations (e.g., omissions vs. distortions) in final scores?
6. What evidence is available regarding effectiveness of the cycles approach?

FUTURE DIRECTIONS

A large, randomized, well-designed, controlled study comparing results of approaches
(e.g., oral motor, contrasts, patterns, phoneme mastery) for highly unintelligible children
by independent investigators is needed—with the proponents of the respective methods
being involved for fidelity. Moreover, children in the various groups would need to be
matched as well as possible at the onset of treatment.

In addition, more research is needed to determine how the cycles approach can be
adapted for use with children who speak languages other than English. Optimal interven-
tion modifications and implementations for specific languages are needed.

SUGGESTED READINGS

Hodson, B.W. (2005). Enhancing phonological and metaso-
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Cycles Phonological Remediation Approach


