



Phonological Complexity Principles:
Promoting Efficient Change
in Overall Intelligibility

Jennifer Taps Richard, M.A., CCC-SLP
SLPath
2020
jen@slpath.com



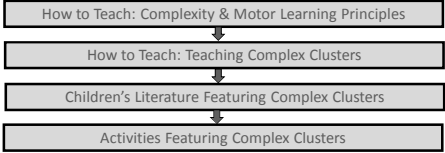
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Session 3: Intervention



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Handouts

- PPT Handout
- Supplementary Handout (Same for all 3 sessions)
 - **Blue** text boxes in PPT indicate pages of SH
 - e.g., **Supplementary Handout: pp. 20-28**

Phonological Intervention Components
Williams, 2005

1. Provide opportunities for the child to discover the rule(s) being trained
2. Provide focused practice on the new target(s) to support automaticity
3. Provide the child with linguistic/communicative feedback regarding semantic meaning
4. Provide opportunities to practice the new target(s) in naturalistic play activities

Direct and Indirect Strategies

- **Direct intervention strategies:**
 - Children with phonological disorders
 - Children with concomitant language disorders
- **Indirect intervention strategies (for children who do not respond to direct intervention):**
 - **May include:**
 - Children with autism
 - Children with intellectual disability
 - Children with concomitant fluency disorders

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What to Teach Most Critical

- Research evidence suggests that **what** to teach is more critical than **how** to teach (Gierut, 2001)
 - Sound selection is **critical** in predicting outcome and inducing system-wide change
 - Phonological/linguistic intervention emphasis – not just the motoric sequences

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Complexity Methodology (How to Teach)

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Methodology in Studies

- Described in multiple studies (e.g., Gierut, 1999; Gierut & Champion, 2001)
- Treatment for children with phonological disorders (and no other developmental concerns)
- Monolingual English speakers
- Hearing WNL
- Individual intervention in university clinic

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Storytelling Procedure

Gierut, 1990

- 15-16 nonword targets (to control for lexical factors)
 - 8 nouns and 8 verbs
 - Represented the full vowel space
 - Other consonants: /m n b d/
- Nonwords embedded in story (read once per week to each child)
- Nonwords also pictured on separate cards for drill-play practice

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Phases of Treatment

- Phase 1: Imitation
 - Child repeats target nonwords until
 - 75% accuracy across two sessions OR
 - 7 sessions completed
- Phase 2: Spontaneous Production
 - Child produces words spontaneously until
 - 90% accuracy across three sessions OR
 - 12 sessions completed
- Generally provided corrective 1:1 feedback

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Activities

- Drill-play (Shriberg & Kwiatkowski, 1982)
- Elicited productions primarily at **word** level
 - Matching
 - Sorting
 - Informal story retelling
- Provided families with worksheets, coloring books and audiocassettes of the stories featuring the nonwords

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Motor Learning Principles (How to Teach)

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Specificity of Learning

- “Specificity of learning” stipulates that the “most closely related movement/activity creates most improvement in overall skill” (Skelton, 2004)
- Practice connected, meaningful speech for the most effective approach
- Oral-motor exercises unrelated and do not create improvement in overall speech intelligibility

*Why NOT to Use Nonspeech Oral Motor Exercises for Speech Sound Disorders:
Logic, Theory and Evidence
Parent-Friendly Information about Nonspeech Oral Motor Exercises*

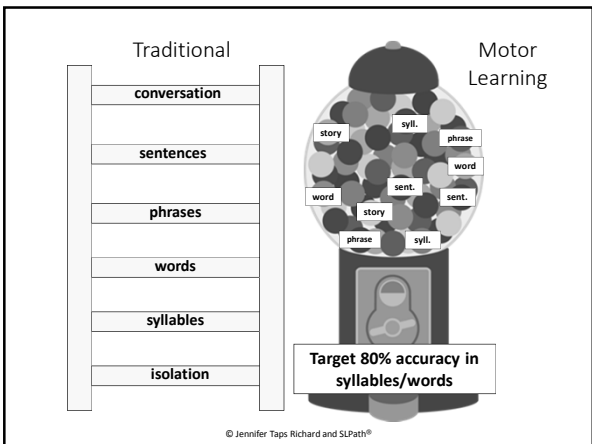
Challenge System to Learn

- Challenge point framework: Learners must be challenged in order for learning to occur (Guadagnoli & Lee, 2004)
- Challenge not so great that learning hampered
- Goes back to teaching three-element clusters → need C2 and C3 in phonemic inventory, otherwise too much (Gierut & Champion, 2001)
- To teach two-element clusters, neither sound needs to be stimulative (for most – consider child’s challenge point)

Desirable Difficulties

Kamhi, 2014; Bjork, 1978 et al

- **Performance** - short-term, context-specific
- **Learning** - long-term, context-independent
- Learning difficulties not a generalization problem
 - What children (and everyone else) have difficulty transferring: narrow limited rules to new situations
- Distributed practice – spacing effect boosts retention
- Changing instructional contexts → enhances learning



Motor Learning Skill Acquisition – Three Phases (Phonetic)

Skelton, 2004

- 1. Pre-practice/placement**
- 2. Practice**
- 3. Generalization**

Motor Learning Skill Acquisition – Phase I
Skelton, 2004

- 1. Pre-practice:** Brief placement/production phase (OK to return to this phase at any time)
- Teach target sound in syllables or words until 80% accurate
 - For some children – start with word level
 - May need to teach new strategies or make phonetic adjustments in how student produces the sound(s)

Motor Learning Skill Acquisition – Phase II
Skelton, 2004

- 2. Practice:** Randomized variable sequence of tasks
- Schema theory predicts greater transfer and retention because “rules” are flexible
 - Student practices at different levels or different numbers during each session (not “fixed” at particular level like traditional intervention)

Motor Learning Skill Acquisition – Phase III
Skelton, 2004

- 3. Generalization:** Practice skills in more representative contexts of communication
- Provides natural consequences of performance, including a listener's reaction

Letting kids be kids

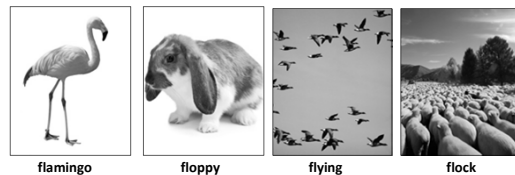


Randomization Options

- Switching levels (words, sentences, conversation)
 - Offer ready-made phrases, sentences, story prompts for some
- OR**
- Students make up own phrases, sentences, stories
 - Different target words
 - However, 3-5 words sufficient to promote transfer of targets (Elbert, Powell and Swartzlander, 1991)



Story Example

- Child chooses 3-4 cards
- SLP models story for child to retell or child makes up own story



Randomization

- Levels (words, sentences, conversation)
- Order of target words
- Number of responses
- Actions
- Emotions
- Stress
- Prosody
- Rate of speech

Randomized Card Ideas and Ideas for Centers Activity Cards

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Feedback

<p>Immediate</p> <ul style="list-style-type: none"> • Better for acquisition • Pre-practice phase • More feedback during the pre-practice stage than practice • Knowledge of performance → tongue was too far out 	<p>Delayed</p> <ul style="list-style-type: none"> • Promotes retention • Practice/generalization phases • Wait 5 seconds (Strand & Kent, 2005) • Provides opportunity for child to assemble and retrieve motor plans (Yorkston et al, 1999) • Offers child more self-monitoring opportunities • Knowledge of results → 3 out of 4 correct
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Generalization



Koegel, Koegel, Van Voy & Ingham, 1988

- Evaluated necessary conditions for generalization
- Children taught self-monitoring skills within clinic (children become own clinicians)
- Increased self-monitoring → accuracy across sites
- Accuracy of self-monitoring unrelated to transfer
- All subjects showed immediate/rapid gains when self-monitoring initiated outside of clinic

Whose speech is it anyway?

Ways to Promote Self-Monitoring





- Rating productions on tally counter (Koegel, Koegel, Van Voy & Ingham, 1988)
- Empower child to become “leader” in process (Ertmer & Ertmer, 1998)
- Toobaloos
- Recording
 - iPad
 - Digital





*Daily Generalization Plan
Student Rubrics
Fridge Log
Self-Monitoring Chart*

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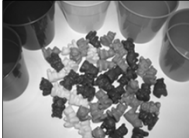
Taking Own Data

My Thinking			
Did someone understand me easily?	Just right	=	
Did someone understand me a little?	OK	=	
What can I do next time to help my listener?	Not yet	=	


Sample Data: 

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Taking Own Data (Preschool Example)



Just right



Not yet



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Modifications:
Indirect Treatment

- Complexity Approach
 - SLP elicits targets at word level via matching, sorting or book activities
 - If child produces target → Recast
 - Nonverbal response or no response → Model (Hanan strategy: "Say it as he would if he could")

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Modifications:
Indirect Treatment

- Motor Learning
 - SLP elicits targets at various levels across activities (including books) in multiple contexts
 - If child produces target → Recast
 - Nonverbal response or no response → Model (Hanan strategy: "Say it as he would if he could")
 - Elicit active participation
 - Child counts productions by SLP or other children
 - Child puts bears in cup when monitoring productions from others

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Strategies for Teaching Complex Clusters

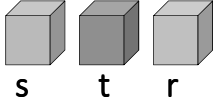
str- fl- spr-
fr- spl- fr-
skw- sl- θr- skr-

Supplementary Handout: pp. 20-28

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General Cluster Strategies

- Use blocks – each block represents a sound
 - Two blocks for CC clusters
 - Three blocks for sCC clusters
- Sweep hand next to each block to show blending of consonant sounds




s t r

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General Cluster Strategies

- Similar idea – wheels rolling together



str **f l**

- Similar idea – letters slide into each other (Mumy, 2013, Speech Stop)
 - Link on SLPath

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General Cluster Strategies

- Similar idea – letters
- Builds sound-letter relationships

THR

SPL


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Novel Syllables or Nonwords


Van Riper, 1978

- Teach cluster target in new contexts
- May break through a “frozen form”
- Experiment with teaching cluster in novel contexts by introducing different vowels to facilitate production
- Introduce with monster characters: Art is Fun site
 - Link on SLPath

“squee”
[skwi]



“shrom”
[rroom]



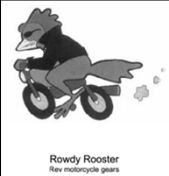
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Stimulability

Miccio & Elbert, 1996

Character and gesture for each sound

- e.g., /r/ Rowdy rooster (Rev motorcycle gears)



Rowdy Rooster
Rev motorcycle gears

- Link on SLPath to Miccio’s character cards (link to page, not actual document)

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Stimulability

Miccio & Elbert, 1996

- /p/ **Putt-Putt Pig** (Glide hands in a skating motion)
- /t/ **Talkie Turkey** (Raise a pretend phone to ear)
- /k/ **Coughing Cow** (Place hand near top of throat)
- /f/ **Fussy Fish** (Fussily push hands away from body)
- /s/ **Silly snake** (Move finger up arm)

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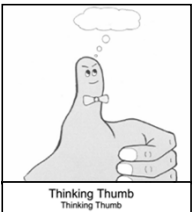
Stimulability

Miccio & Elbert, 1996

- /θ/ **Thinking Thumb** (Tap thumb on chin)
- /ʃ/ **Shy Sheepy** (Clutch hands together and push down)
- /w/ **Wiggly Worm** (Shiver)
- /l/ **Lazy Lion** (Stretch arms in “L” shape)

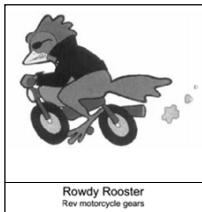
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Teaching /θr-/



Thinking Thumb
Thinking Thumb

Gesture:
Thumb on chin



Rowdy Rooster
Rev motorcycle gears

Gesture:
Rev motorcycle gears

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Segmentation

Skelton, 2004

Sequentially practice a target part and then sequentially add the other parts to it

- Start with segment needing practice, then build the word from that point
- Whole word – “Say slip.”
- Segmentation (in either direction) –

“Say /s/”
“Say /slɪ/”
“Say /slɪp/”

OR

“Say /ɪp/”
“Say /lɪp/”
“Say /slɪp/”

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Segmentation

Skelton, 2004

Practice from a motor behavior to the target in a word.

- “Do ‘tongue up to the bumps’”
- “Do ‘tongue up to the bumps and drop it’”
- “Do ‘tongue up to the bumps and drop it with ‘Mr. Voicebox on’”
- “Do /le/”
- “Do /lek/”

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Considerations about /r/

- Multiplicity of ways to produce /r/ (Boyce, 2007)
 - Binary distinction of retracted vs. retroflex insufficient
- Retracted /r/ more likely when paired with velars, /o/ and /u/
- Retroflexed /r/ more likely when paired with alveolars, /i/ and /e/
- Great news: /r/ easier to treat in clusters! (Kent, 1982)

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Prior Knowledge for CC Clusters

CC Clusters: No prior knowledge of either sound in CC clusters required (in fact, nonstimulable shown to create more change)

- e.g., teach /fl-/ if /f/ and /l/ OUT of child’s system and nonstimulable
- Beauty of CC Clusters
 - Chance to teach unknown sounds **AND**
 - Potential for significant gains in intelligibility!

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Strategies for CC Clusters

- Expect accurate productions (not approximations) of target clusters in syllables or words before proceeding to mixed practice
- Some children may insert a schwa vowel (e.g., [fərem] for “frame”); provide corrective feedback that results in a shorter duration of the schwa vowel over time until it no longer occurs
- Resources for establishing singletons (Secord, 2007; Bleile, 2005; Iowa Website, 2001; Bauman-Waengler, 2004)

Teaching /θr-/

- Teach /θ/ in isolation/syllables (visual)
- Teach /θr-/ as unit because /r/ clusters easier to teach (Kent, 1982)
- Retraction of tongue from /θ/ facilitates /r/ production for some children
- Slow motion /θ/ to /r/ then speed up

Possible target: “three”

- “Say /θ/” OR “Say /ri/”
- “Say /θri/” “Say /θri/”

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Teaching /fl-/

- Teach /f/ in isolation/syllables (visual)
- Teach /l/ in isolation/syllables (visual)
- Then blend the two – careful to model /f/ not /fʌ/; ease from /f/ to /l/ (may temporarily emphasize tongue lift on /l/)
- Slow motion /f/ to /l/ then speed up
- Suggest saying the sounds “at the same time”
- /u/ vowel may facilitate because back and tense

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Prior Knowledge for sCC Clusters

- sCC Clusters: Child must have C2 and C3 in sCC clusters (Gierut & Champion, 2001)
- No prior knowledge of /s/ in sCC required (okay if nonstimulable)
 - Beauty of sCC Clusters
 - Prior knowledge AND
 - Potential for significant gains in intelligibility!

Strategies for sCC Clusters

- Important to establish a good /s/ production (not a distortion) within the cluster
- Resources for establishing /s/ (Secord, 2007; Bleile, 2005; Iowa Phonetics Website, 2001; Bauman-Waengler, 2004)
- Expect accurate productions (not approximations) of sCC clusters in syllables/words before mixed practice

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Strategies for sCC Clusters

- Establish production of part of the sCC cluster first; for example, when teaching /str-/, start by teaching /st-/ together and adding /r/ later or start by teaching /tr-/ together and then add /s/ (Gierut, 1999; Gierut & Champion, 2001)
- Some children may insert a schwa vowel (e.g., [spəraʊt] for “sprout”); in that case, provide corrective feedback that results in a shorter duration of the schwa vowel over time until it no longer occurs

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Teaching /str-/

- /tr-/ often first /r/ cluster acquired (Elbert & McReynolds, 1975; Kent, 1982)
- Teach child to first blend /t/ and /r/ (both known sounds) in syllables or words and then add /s/ (/tr-/ first → /str-/ next)
- Careful to teach /t/ not /tʌ/; ease from /t/ to /r/
- Slow motion /t/ to /r/ then speed up
- Suggest saying the sounds “at the same time”
- /i/ vowel may facilitate because alveolar/tense

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Teaching /skw-/

- Teach child to first blend /k/ and /w/ (both known sounds) in syllables or words and then add /s/ (/kw-/ first → /skw-/ next)
- Careful to teach /k/ not /kʌ/; ease from /k/ to /w/
- Slow motion /k/ to /w/ then speed up
- For some children, suggest saying the sounds “at the same time”

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Children’s Literature Featuring Complex Clusters



Supplementary Handout: p. 29-30

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High Incidence of Concomitant Language Disorder

- Need to address both speech and language goals simultaneously
- Most effective strategies for supporting language acquisition: language expansions and open-ended questions (Sickman & Creaghead, 2007)
- Books provide opportunities for language expansions and recasts (of sounds and grammatical structures)

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Importance of Repetition

- Allow children to take a more active role
- Stories repeated until (Ezell & Justice, 2005)
 - Child understands a concept
 - New concept introduced within same story
 - Familiar concept considered in a new way
- Blues Clues study (Anderson, Bryant, Wilder, Santomero, Williams & Crawley, 2000)
- Multiple exposures provide opportunities to lift students' language (Dunaway, 2012)
 - Multiple exposures also lift their sounds

Planning for Meaningful Practice with Children's Literature

- Cluster targets in text
 - *Sleepy, Oh So Sleepy* (Fleming, 2010)
 - Sleepy (32 occurrences), sleep (1 occ.)
- Think of other targets to include based on content
 - *Watch Me Throw the Ball!* (Willems, 2009)
 - Talk about how "thrilling" it is to throw the ball
- Modifications to text for more models of target
 - *Just How Long Can A Long String Be?!* (Baker, 2009)
 - Change "it" to "the string," such as ""Will it tug a balloon? becomes "Will the string tug a balloon?"

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Planning for Meaningful Practice with Children's Literature

- Child involvement
 - Involve kids in second read (gestures, choral repetition)
 - Gradually release responsibility to kids with repeated readings
- Movement activities
 - Movements that promote naturalistic practice of clusters or concepts from the text

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Planning for Meaningful Practice with Children's Literature

- Play-based extension activities
 - Pretend play
 - Acting out stories (Pellegrini & Galda, 1982; Saltz, Dixon & Johnson, 1977; Hanen, 2011)
 - Experiments
 - Crafts

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Planning for Meaningful Practice with Children's Literature

- Literacy activities
 - Writing/dictating letters to characters
 - Making books
 - Writing a recipe
 - Steps for an experiment
 - Play with words from the text: rhyming, text features, punctuation
- Home practice ideas
 - Depends on child's motor learning phase



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First Read

- Focus on involving students in a “good read” and modeling clusters
- Stop 2-3 times to think aloud or to comment
 - Repeated interruptions interfere with enjoyment (Ezell & Justice, 2005)

THE BOOK IS THE TALK!

First Read Video

- Demo
- Boys: age 3;10
 - Acquiring full sound system (no communication concerns)
 - /fl-/ not in inventory, but produce it with some support
- *Flying* (Crews, 1989)
- What do you notice? How many /fl-/ targets occurred during this interaction?

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Extension Activity

- Demo videos
 - First and second days of reading the book
- Play: set up chairs to pretend that group on plane
- Children take turns acting as pilot or passengers
- Pilot’s jobs:
 - Say where we are flying
 - Describe what’s outside (“We’re flying through the clouds”)
 - Tell passengers that flight is over

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Clusters Curriculum

- Books that get kids talking
- Many books at public libraries
- Most in print
- 300+ books selected
 - 33 books to be featured in *Clusters Curriculum* (Taps Richard, to be published)
 - 20+ books in Spanish
- Multiple genres
 - Fiction
 - Nonfiction

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Watch Me Throw the Ball!

Willems, 2009

/θr-/

THE PIG IS
THROWING!

- Clusters in text: *threw* (4), *throw* (7), *throwing* (4), *flew* (1), *fling* (2)
- Movement activities: Throw balls high, low, forward, backwards; Pretend to throw ball all the way around the world!
- Home practice: throw balls at home – count *one throw*, *two throws*, *three throws*, etc.

Supplementary Handout: p. 29-30

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Flying


Crews, 1989

/fl-/




- Clusters in book: *flying* (8)
- Play: set up chairs to pretend that group on plane
- Children take turns acting as pilot or passengers
- Kids say what they are
 - Flying above, next to, under
 - Who they are flying to see
 - Where they are flying (e.g., “I’m flying to Florida”)
- Additional extension activity linked on SLPath

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A Squash and A Squeeze
Donaldson, 2005
/skw-/
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- Clusters in text: *squash* (10), *squeeze* (10)
- Kids climb into small area (under table, etc.)
- SLP adds a pillow and kids say, "It's a squash and a squeeze in here!" or later "I'm squished!"
- SLP continues to add pillows or stuffed animals and kids say something each time
- Subsequent readings: give nonword names to wise man and woman (e.g., Mr. Skwoni or Ms. Skweem)
- Video links on SLPath



Everything Spring
Esbaum, 2010
/spr-/
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- Clusters in text: *spring* (10), other clusters too
- First read: delight in the beauty of spring and the language of the book by thinking aloud "I can't wait to see what else happens in the spring" or "Spring – wow!"
- Subsequent readings: children discuss what they notice or think about spring and cut out/draw pictures to make own books

Other Favorites from
Clusters Curriculum (Taps Richard, in press)

- /fr-/: *My Friends* (Gomi, 2008)
- /sl-/: *A Book of Sleep* (Na, 2009)
- /jr-/: *Shrinking Mouse* (Hutchins, 1997)
- /spl-/: *Splash* (Jonas, 1997)
- /str-/: *Mr. Strong* (Hargreaves, 1999)
- /skr-/: *Ruff, Ruff, Where's Scruff?* (Weeks, 2006)


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Modifications:
Indirect Treatment

- Books
 - Invite any kind of response
 - Recast, expand or model
- Examples
 - Provide more think aloud statements
 - Child jumps when other kids recite, "Jump, frog, jump!"
 - Child acts like animals sleeping in different ways
 - Child identifies where Scruff is hiding


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Phunology
Activities Featuring Complex Clusters



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Meaningful Contexts
Hoffman & Norris, 2005




- Intervention independent of communication (i.e., drill only) → Child defaults to old motor pattern of speech used in communicative situation (generalization may take years)
- Provide multiple opportunities to produce words in a range of simple to complex contexts
- Multiple, meaningful contexts (not just SLP room)
 - Like fluency treatment

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Naturalistic Activities

- Stomping on cards
- Hide and seek (cards, not kids)
 - Child calls out for missing cards
 - E.g., "Squash, where did you go?"
- Barrier games
- Puppet shows
- Retelling stories




Supplementary Handout: pp. 31-33
Supplementary Handout: pp. 34-45
Supplementary Handout: pp. 46-49

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Naturalistic Activities

Guessing targets

- Children work as partners
- Parent or sibling partner during home practice
- One child – all cards face up
- Partner mentally notes one card (without sharing)
- Child guesses until correctly identifying card
- Meaningful practice
 - "Are you thinking of *flamingo*?"
 - "No, I'm not thinking of *flamingo*."




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Naturalistic Activities


Shopping/Grocery Store

- Toy cash register/play money
- Cards and/or objects featuring cluster targets
- One child the store owner
 - Owns all cards and toys in the store
 - Sets all prices
- Other children the shoppers
 - Inquire about the cost of their cluster items
 - E.g., "How much does *floppy* cost?" The cashier may reply, "*Floppy* costs two dollars."



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Treatment Course Links




SLPath → Resources →
Phonological Treatment Course Resources

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/θr-/ Activities

Pair with *Watch Me Throw the Ball!* (Willems, 2009)

- **Bean bag toss** (*three, throw, threw, throwing, through, thrilling, overthrow*)
- Other cluster targets (*fling, flinging, flung, flip, flipping, flipped, sling, slinging, slung, splat, splendid toss!, straight through, strong toss, strike one! strike two!*)
- Give characters nonword names (*sproni, splamu* and *threep; here you go, sproni!*)




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/fl-/ Activities

Pair with *Jump Frog Jump* (Kalan, 1989)

- **Flipping frog** (*fly, flew, flying, flip, flipping, flipped, flap, flapping, flapped, flop, flopping, flopped, one flip, two flips, flip again!*)
- Other cluster targets (*three flips, go frog!, jump frog jump!, spring high!, one spring, two springs, splash!*)
- Give frog nonword names (*shromi, threda* and *stribi; jump, shromi!*)



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/spl-/ Activities

Pair with *Splat!* (Pérez-Mercado, 2011)

- **Splat frog (and 28 other splat toys)** (*splat; ready, set, splat; the frog went splat, etc.*)



- Other cluster targets (*fling, flinging, flung, let it fly, throw, threw, throwing, one, two, three, throw!*)
- Give frog nonword names (*shromi, threda and sribi; go, shromi!*)

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Modifications: Indirect Treatment

• Activities

- Invite any kind of response
- Recast, expand or model
- Examples
 - Hide and seek with cards → Child holds up cards
 - Guessing targets → Child points to targets
 - Bean bag toss → Child counts down 3, 2, 1 on fingers
 - Screaming monkey → Child screams, too

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