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How Much is Enough: The Intensity Evidence in Language Intervention

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How Much is Enough?  
The Intensity Evidence in Language Intervention

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The Plan

1. For morphosyntax, vocabulary, phonology, narrative, print knowledge, and phonemic awareness
2. The research, clinical, and conceptual evidence on how much for how long
3. Issues of defining, providing, and measuring the active elements of teaching and learning
4. Clinical recommendations
5. Next steps in research

Comparing Interventions without Intensity Evidence

• EBP involves providing evidence-based interventions and selecting interventions with strongest outcomes
• However, relatively little attention has been paid to the issue of intervention intensity
• Intensity based on convention, resources, & clinical craft
  – But not on research evidence
  – Nor even on systematic consideration of how much, how to measure, or equivalence across approaches

How then can we say what works best?

The Inspiration for this Panel


Warren, Fey, and Yoder (2007)

• There is no standard or widely accepted definition of treatment intensity in the communication and language intervention literature, or, for that matter, the literature on early intervention in general (p. 71)

• It is time to begin the creation of a systematic research base examining this critically important dimension of treatment efficacy (p. 71)
What is Intervention Intensity?

• The quality and quantity of services delivered in a given period of time (Barnett & Escobar.), the number of hours of intervention over a specific time period (Lovaas), the ratio of adults to children (Graff et al.), the number of specific teaching episodes per unit of time (Guralnick)

• Duration (min or hr per day or week for months or years) is a constant dimension of intensity and sometimes the only dimension reported

Warren et al. (2007)

“Duration” as the Meaning of Intensity

≠ “active ingredients” of tx

• Active ingredients: procedures presumed to teach or enhance new learning and behavior

• Required
  – More molecular approach of teaching episodes
  – Define & quantify teaching episodes

= Density ratio of active ingredients for specified units of time

The Intervention Pill

*Pharmacology applied to speech-language intervention*

Quantifying Intensity

• Dose: Number of properly administrated teaching episodes during a single intervention session (e.g., 20 response opportunities in 30 min.)

• Dose Form: The physical manner in which the active ingredient is dispensed (e.g., In play format)

• Dose Frequency: Number of times a dose is provided per day or week (e.g., 2x per week)

Intervention Dosage

• Total Intervention Duration: Time period over which intervention is presented (e.g., 10 weeks)

• Cumulative Intervention Intensity: Product of dose x dose frequency x total intervention duration (e.g., 20 x 3 x 10 = 600 teaching episodes)

Warren et al. (2007)

More is Not Necessarily Better and Other Considerations

• More is not necessarily better

• Massed versus distributed trials

• Differing dose forms

• Supplementary ingredients

• What should constitute a teaching episode?

• How do episodes change across areas of communication?

• Teaching versus learning episode:
  – What are all the sources of learning in a session?
  – Between sessions?
  – Are there “sessions”? ...
**This Sounds Really Difficult**

- We readily acknowledge that defining teaching episodes can be a surprisingly complex task (p. 73)
- A benefit is that it requires clinicians and researchers to identify the specific essential aspects of their programs
- To examine what coinstitutes teaching/learning moments, contexts, and frequencies
- Leads to larger questions of what works and why

_This is fundamentally important to the development of optimal interventions (p. 73)_

(Warren et al., 2007)

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**So Let’s Be Brave and Try It**

For morphosyntax, vocabulary, phonology, narrative, phonemic awareness, and print concepts

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**Dosage and Distribution in Morphosyntax Intervention**

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**Techniques**

**What We Know**
- Imitation > Models
  - (Connell & Stone, 1992)
- Models > Imitation
  - (Courtright & Courtright, 1976, 1979)
- Recasts > Imitation
  - (Camara & Nelson, 1990; Camara et al., 1994; Nelson et al., 1996)
- Recasts = Models
  - (Morgan et al., 1995; Farrar, 1990; Proctor-Williams et al., 2001)

**What We Don’t Know**
- How the most effective use of one technique compares to the most effective use of another technique
- Whether techniques are more effective when used in combination than in isolation
- If combinations of techniques are more effective, which ones presented in which order?

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**Active Ingredients/Teaching Episodes:**

“procedures presumed … to teach or enhance new learning and behavior”

**Techniques**
- Time-delay
- Models
- Recasts
- Expansions
- Mands
  - Questions
  - Imitation
- Direct Instruction

**Procedures**
- Milieu Treatment
- Enhanced Milieu Treatment
- Conversational Recast Intervention
- Focused Stimulation
- Drill/Drill-play

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**Dose Form:** “the typical task or activity within which the teaching episodes are delivered”

**What We Know**
- Client-Centered
  - Increased communication frequency and generalization particularly when caregiver training is involved
- Hybrid
  - Fastest route to generalized use
  - Can increase production of rare naturally-occurring forms
- Clinician-Directed
  - Rapid accurate production that is task-specific
  - Highest rates of use of rare naturally-occurring forms
  - Generalization must be specifically incorporated

**What We Don’t Know**
- How specific tasks and activities affect immediate success and generalization within each procedure
- Which procedures are most effective for which morphosyntactic forms and with which populations
Dose: “number of properly administrated teaching episodes during a single intervention session”

Massed vs. Distributed Practice: “given an equal number of exposures, distributed practice at skills is almost always superior to massed practice with a skill” (Childers & Tomasello, 2002).

Average Rate of Teaching Episodes/Time

Distribution of Teaching Episodes within Sessions

What We Know
• Children with SLI require more exposures to specific forms that they are ready to learn than are available in typical conversation to acquire morphosyntactic forms at the same rate as children with TL
• Our best estimate is that they require twice as many recasts
• There may be a limit beyond which the input is no longer facilitative

What We Don’t Know
• The optimal doses of different techniques
• The optimal doses for different morphosyntactic structures
• The optimal doses for children with different etiologies

Expressive language outcomes are very similar for clinician- and parent-delivered intervention (Law, Garrett & Nye; 2004; Fey et al., 1993, 1997)
• This is as likely attributable to total frequency and distribution as it is to dose rates
• We can teach parents a wide variety of techniques and procedures (Girolametto et al., 1998; Hemmeter & Kaiser, 1994; Kaiser & Hancock, 2003; Kott & Law, 1995; Wilcox 1992)

What We Don’t Know
• What is the dose frequency and distribution that caregivers use in the home/classroom and can we measure this?
• How can we help caregivers sustain and adjust their dose frequency as the child’s performance changes?
• The impact on children and their families when parents become intervention agents
What We Know
- Children more accurately produced and generalized a complex syntactic construction (e.g., It was the cup that the frog took) when exposed to it over 5 or 10 days than when exposed to it for 1 day (Ambridge, Theakston, Lieven & Tomasello, 2008)
- Children with TL (but not SLI) more accurately produced novel verbs when recasts were distributed across 5 sessions than when recasts were massed within 3 sessions (Proctor-Williams & Fey, 2007)

What We Don’t Know
- The optimal distribution of dose frequency within and across sessions for:
  - different morphological forms and syntactic frames
  - for children with different etiologies
- Whether principles of distribution can be applied to techniques and procedures as well as specific targets

Total Intervention: “the time period over which a specified intervention is presented”

Mediator vs. Direct Intervention Example

What We Know
- Intervention of more than 8 weeks seems more effective than those of less than 8 weeks (Law et al., 2004)
- Intervention of 4-12 weeks seems optimal (Nye & Seaman, 1987)
- Intervention in the first 4.5 months resulted in greater gains than in the second 4.5 months (Fey et al., 1997)
- Children who attended a Head Start preschool more regularly produced more complex utterances and benefited more from LFC and LST (Justice, Mashburn, Pence & Wiggins, 2008)

What We Don’t Know
- The outcomes we can expect based on length of intervention
- The optimal length of treatment for different techniques and procedures
- The effects of classroom-based curricula and programs on child language outcomes - immediate and long-term
- The consistency of attendance on individual treatment outcomes

Cumulative Intervention Intensity = dose X dose frequency X total intervention duration

Experiment 1: Rate
- Low Rate Recast Condition:
  - .5 recasts/min X 10 min/day X 5 days = 25 teaching episodes
  - 1.5 recasts/min X 10 min/day X 5 days = 75 teaching episodes

Experiment 2: Distribution
- Distributed
  - .4 recasts/min X 10 min/day X 5 days = 20 teaching episodes
- Massed
  - 2 recasts/min X 10 min/day X 1 session = 20 teaching episodes

Vocabulary Instruction

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**Intensity in Vocabulary Instruction and the Effects on Reading Comprehension: Are 4 Enough? Are 12 too Many?**

**A Vexing Issue**
- Conventional wisdom in vocabulary research is that more instruction is better
- Assumed that even more teaching of word meanings is needed to affect reading comprehension
- But what is “more”? More word repetitions? More or longer lessons? Richer instruction?
- We think we know the answers to these questions, but do we really?

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**The Purpose:** Tease out of the research literature what we know (and don’t know) about the relationship between intensity in vocabulary instruction and its effects on reading comprehension.

**The Plan:**
1. Provide an Overview of the “More is Better” research.
2. Identify and Critique select studies examining vocabulary instruction and reading comprehension.

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**OVERVIEW “More is Better”**

**Exposure to Oral Language**
- Greater volume and complexity of adult language promotes vocabulary growth (Hart & Risley, 1995)

**Vocabulary During Read Alouds**
- Reading aloud results in vocabulary growth (Bus et al., 1995; van Kleeck et al., 2003)
- Re-readings (Senechal, 1997), word repetitions (Elley, 1989), reader-listener interactions (Wasik et al., 2006), and explicit instruction further promote word learning (Beck & McKeown, 2007; Juel et al., 2003; Biemiller & Boote, 2006)

**Independent Reading**
- School-age children develop vocabulary by just reading (Nagy et al., 1987), but repeated exposures produce more and deeper vocabulary knowledge (Anderson, 1996)
- Independent reading also predicts reading comprehension (Taylor et al., 1990)

**Teaching Reading Vocabulary**
- Explicit vocabulary instruction works in general education (Blachowicz & Fisher, 2000) and special education (Jitendra et al., 2004) classrooms

**But, for Vocabulary Instruction to Affect Reading Comprehension...**
- Research suggests that longer interventions, more word encounters, and more active processing are needed (Baumann et al., 2003a; Graves, 1986; Mezinski, 1983)

**CRITIQUE**
OK, so “More is Better,” but what do we know about intensity in vocabulary instruction?

**The Stahl and Fairbanks (1986) meta-analysis** provided insight by revealing that:
1. Teaching words in context only works pretty well ($d = .76$ to .92) ($d$’s compared to controls w/ no vocab exposure)
2. Teaching words through definitions only works quite well ($d = 1.1$ to 1.4)
3. Teaching words through definitions and in context works very well ($d = 1.47$ to 2.36)
Multiple word repetitions or exposures ($d = 1.6$ to $2.3$) were more effective for word learning than were just 1-2 word exposures ($d = 1.0$).

“Depth of processing” factor did not predict performance on vocabulary measures (compared to assoiciational or contextual approaches), but was a distinguishing feature for passage comprehension ($d = 1.5$ to $1.8$).

For vocabulary instruction to affect comprehension, it had to (a) include both definitional and contextual information, (b) have high depth of processing, and (c) involve multiple word exposure.

**Cool, but how much is enough?**

- I.e., is there any common “Intensity” metric for judging efficacy of vocabulary research and effects on reading comprehension? Can we analyze any vocabulary studies according to the Warren et al. (2007) framework?

**Exemplar Studies: Beck and McKeown trilogy of studies.** Studies 1 and 2 (Beck et al., 1982; McKeown et al., 1983): Does vocabulary instruction affect 4th graders’ word learning and text comprehension?

- 75 days of instruction across 5 months; 30 minutes/day; 104 words taught
- Some Exposure words: 10-18 exposures per word; 60 days; 1,800 minutes
- Many Exposure words: 26-40 exposures per word; 60 + 15 days; 2,250 minutes
- 43 No Exposure Words: pre- and posttested only

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Results</th>
</tr>
</thead>
</table>
| 1. Many Word Exposures | Word meanings $1 + 2 > 3 + 4$
| 2. Some Word Exposures | Or, teaching word meanings worked. |
| 3. No Word Exposures | Comprehension (recall & questions) $1 + 2 > 3 + 4$ |
| 4. Uninstructed Controls | 1 > 2 (recall only) |

Or, rich vocabulary instruction enhanced reading comprehension of stories with many taught words. But little was revealed about frequency in vocabulary & comprehension.

**Exemplar Studies: Study 3 (McKeown et al., 1985):**

What is the relative contribution of instruction type and word frequency on 4th graders’ word learning and reading comprehension?

- 14 days of instruction across 3 weeks; 30 minutes/day; 24 words taught
- Extended/Rich Instruction: Elaborate vocabulary teaching with a home component (Word Wizard)
- Rich Instruction: Elaborate vocabulary teaching
- Traditional Instruction Definitions & synonym.
- High (12 encounters) and Low (4) for preceding
- Uninstructed Control: Business as usual

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Results</th>
</tr>
</thead>
</table>
| 1. Extended Rich Instruction (High & Low Exposures) | Word meanings $1 + 2 + 3 > 4$
| 2. Rich Instruction (High & Low Exp.) | $1 = 2 = 3$ H > L
| 3. Traditional Instruction (High & Low Exp.) | Or, any vocabulary instruction worked, with High better than Low |
| 4. Uninstructed Controls | Comprehension (recall) $1H + 2H > 4$ |

Or, only Rich instruction with High numbers of encounters influenced comprehension of stories that included many taught words.
What have we learned from the three studies?
• Most any kind of instruction (Rich or Traditional) in any kind of frequency (Many, Some, High, Low) results in word learning.
• To achieve comprehension effects, instruction must be Rich and involve Many, Some, or High word frequencies.

But what don't we know?
• “How much” rich vocabulary instruction is enough to affect comprehension?
• Do we know anything about relative efficiency of approaches?

### In Conclusion...

#### So, are 4 enough?
• Yes, for teaching word meanings.
• No, for comprehension, at least if you are talking about 7 minutes of instruction per word.

#### Are 12 too many?
• Probably, at least if you are talking about over 22 minutes of instruction per word.
• It looks like paring that back to about 17 minutes per word works just as well.

#### Lessons
• Keep in mind your instructional goal.
• Look beyond frequency, # of words, and duration.

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**Select Vocabulary References**


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**Phonological Disorder**

- Definition - deficit in one’s ability to organize the phonemes (“speech sounds”) of one’s language.
- Prevalence - about 10% of preschool and school-aged populations (Gierut, n.d.)

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**Vocabulary**


We Know

We Don't Know

Generally Speaking...

• Clear evidence that phonological interventions improve phonological skills (Williams, 2000a; Morissette & Gierut, 2002; Gillon, 2000)

• Optimum treatment intensities

• Relative effects of differing intensities

<table>
<thead>
<tr>
<th>Research</th>
<th>Dose Form</th>
<th>Dose</th>
<th>Frequency</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Williams (2000)</td>
<td>Multiple oppositions</td>
<td>20-50 responses</td>
<td>30 min. x 2</td>
<td>Varied (averaged 65.3 sessions)</td>
</tr>
<tr>
<td>Gillon (2000)</td>
<td>PA</td>
<td>N/A</td>
<td>60 min. x 2</td>
<td>20 hours</td>
</tr>
<tr>
<td>Harbers et al. (1996)</td>
<td>Metaphon/Cycles</td>
<td>N/A</td>
<td>45 min. x 2</td>
<td>Varied (5-8 months)</td>
</tr>
<tr>
<td>Klein (1996)</td>
<td>Traditional Phonological</td>
<td>N/A</td>
<td>50 min. x 2/3</td>
<td>Varied (averaged 101 &amp; 82 sessions)</td>
</tr>
</tbody>
</table>

Research Questions

• Does a phonological intervention provided at three times the intensity have a better outcome than a weekly schedule?

• Does a phonological intervention provided three times per week for 8 weeks have a better immediate outcome than when provided weekly for 24 weeks?

• Does a phonological intervention provided three times per week have a better outcome after a 5-week maintenance period than the immediate gains of a weekly schedule?

Inclusion criteria:

– Misarticulate at least 6 sounds across three manner classes as documented by a relational analysis
– Pass a hearing screening (file review)
– Present with typical speech structures and functions as measured by an oral-motor exam
– Receive speech services from STRIDE Learning Center

Participants
Intervention Intensity Panel

Participants for Cohort 1: Descriptive Information

<table>
<thead>
<tr>
<th>Group</th>
<th>Number</th>
<th>Age (months)</th>
<th>Severity (PCC)</th>
<th>TELD-3 Receptive (SS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonology: 1 x per week</td>
<td>16</td>
<td>50.4</td>
<td>53%</td>
<td>92</td>
</tr>
<tr>
<td>Phonology: 3 x per week</td>
<td>15</td>
<td>51.1</td>
<td>53%</td>
<td>94</td>
</tr>
<tr>
<td>Control: Storybook</td>
<td>15</td>
<td>50.1</td>
<td>51%</td>
<td>90</td>
</tr>
</tbody>
</table>

Research Design

- Randomized experimental design
- Control for age and severity (randomized block)
  - Two treatment conditions: multiple oppositions approach
    - 1 time per week schedule
    - 3 times per week schedule
  - One control condition: storybook intervention
    - 1 time per week schedule

Intervention: Treatment Condition

- Multiple oppositions approach: teach phonemic contrasts by presenting contrastive pairs

(Presented in Kamhi & Pollock, 2005, based on Williams, 2002)

Intervention: Control Condition

- Storybook intervention: Increase print awareness
- Target prompts address the following constructs:
  - Print conventions
  - Concept of word
  - Alphabet knowledge

Summary of Treatment Intensity Variables

<table>
<thead>
<tr>
<th>Group</th>
<th>Dose Frequency</th>
<th>Total Intervention Duration</th>
<th>Cumulative Intervention Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 session per week</td>
<td>~80 episodes per 30 minutes</td>
<td>1 session per week</td>
<td>24 weeks</td>
</tr>
<tr>
<td>3 sessions per week</td>
<td>~80 episodes per 30 minutes</td>
<td>3 sessions per week</td>
<td>8 weeks</td>
</tr>
<tr>
<td>Control</td>
<td>~80 episodes per 30 minutes</td>
<td>1 session per week</td>
<td>8 weeks</td>
</tr>
</tbody>
</table>

Dose x Dose Frequency x Total Intervention Duration = Cumulative Intervention Intensity

Dependent Variables

- Sounds-in-Words subtest of the GFTA-2
- KLPA-2
- Percent of consonants correct (PCC)
- Preschool Word and Print Awareness task developed by Justice and Ezell (2001)
Narratives: Dosage & Intensity
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University of Virginia
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Narratives in Intervention

- Macrostructure
  - Episodic elements
  - Episodic structure
- Microstructure
  - Cohesion & coherence
  - Dialogue
  - Creativity & Interest

Intervention Data*

<table>
<thead>
<tr>
<th>Year</th>
<th>LI Age</th>
<th>Teaching Episode</th>
<th>Session Length</th>
<th>Sessions per Week</th>
<th>Duration in Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davies, Shankel, &amp; Davies</td>
<td>2004</td>
<td>5 to 7 yr</td>
<td>40 min</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Hayward &amp; Schneider</td>
<td>2000</td>
<td>PreK</td>
<td>30 min</td>
<td>2</td>
<td>4 to 6</td>
</tr>
</tbody>
</table>

*Limited to oral narratives & LI
**Intervention Intensity Panel**

**Intervention Data***

<table>
<thead>
<tr>
<th>Year</th>
<th>Age</th>
<th>Skill(s)</th>
<th>Session Length</th>
<th>Sessions per Week</th>
<th>Duration in Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gillam et al. 2008</td>
<td>6 to 8 yr</td>
<td>100 min</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Justice et al. 2008</td>
<td>8 to 9 yr</td>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joffe et al. 2007</td>
<td>8 to 13 yr</td>
<td>Language Comprehension via Mental Imagery</td>
<td>30 min</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Adams &amp; Lloyd 2007</td>
<td>6 to 9 yr</td>
<td>Pragmatics</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Swanson et al. 2005</td>
<td>7 to 8 yr</td>
<td>50 min</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Steiger &amp; Hoffman 2001</td>
<td>9 yr</td>
<td>Word Finding</td>
<td>15 min</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

*Limited to oral narratives & LI

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**ILI: Literature-based Lang Tx**

- Randomized Controlled Trial
- School age children, SLI
- Comparison of Language Intervention Programs
  - CCC-SLP
    - Each treatment designed to highlight its own critical feature
    - 3 computer-based treatment arms
  - Individual Language Intervention

---

**ILI: Literature-based Lang Tx**

- Teaching Context: Storybook unit
- Target domains:
  - Phonological awareness
  - Semantics
  - Grammatical morphology
  - Clause structure
  - Narrative macrostructure
- Each domain targeted at three ability levels
- Structured daily & unit activities

---

**ILI: Literature-based Lang Tx**

- Dose (teaching episode):
  - Functional and interactive exchanges between clinicians and children
  - Language facilitation strategies
    - Slower rate (Weismer, 1997)
    - Emphatic stress (Weismer, 1997)
    - Growth-relevant recasts (Camarata, Nelson, & Camarata, 1994; Nelson et al., 1996)
    - Focused stimulation (Cleave & Fey, 1997; Fey, Cleave, Long, & Hughes, 1993)
    - Incidental teaching (Kaiser, Yoder, & Keetz, 1993)
    - Scaffolded (Schneider & Watkins, 1996)
    - Mediation (Miller, Gillam, & Pena, 2001)

---

**ILI: Literature-based Lang Tx**

- Dose Form (typical task or activity):
  - Story-based learning activities
  - Clinician-directed elicitation of target productions
  - Interactive formats:
    - Drill play
    - Barrier games
    - Exploration & construction
    - Discussion & conversation
  (each unit included activities and materials to target each domain at each of the 3 ability levels)

---

**ILI: Literature-based Lang Tx**

- Dose Frequency
  - # of times a dose is provided per day and per week
    - 1 hour, 40 min / day
    - 5 days / week
- Total Intervention Duration = 6 weeks
ILI Dosage Challenges

- Quantifying teaching episodes (Warren, Fey, & Yoder, 2007)
  - Discrete, observable and measureable

  Discrete Boundaries
  - Emphatic stress
  - Recasts
  - Focused stimulation

  Permeable Boundaries
  - Mediation
  - Incidental teaching
  - Scaffolding
  - Slowed rate

- Even the simplest treatments are fundamentally multi-faceted
  - Following child’s attentional lead
  - Pacing
  - Engagement

- Following child’s attentional lead
- Pacing
- Scaffolding
- Slowed rate

ILI Dosage Challenges

- Quantifying teaching episodes (Warren, Fey, & Yoder, 2007)
  - Discrete, observable and measureable
  - Lit-based intervention designed to capitalize on multiple facets in an integrated process via
    - Meaningful context
    - Integrating oral/written language modalities
    - Address multiple language domains

  Each factor must be parsed & measured to calculate dose using frequency counts
  - Discrete instances
  - # of strategies used
  - Or # per minute

- Reading & interest level match/mismatch
- Genre
- Episodic structure
- Discourse level teaching and learning
- Cultural context & morals teaching

(= More facets to parse and measure)
Clinical Implications

- Definition of teaching episodes
- Analysis of unique characteristics of narratives
- EBP:
  - Carefully controlled investigations that measure outcomes when varying each of these factors
  - Shape responsible & informed best practices

Future Directions

Language intervention may be more than the sum of its discrete instances:

Narrative ≠ 1 page (discrete instance) x # pages
Discourse is inherently a process
meaningfulness is developed within and throughout the whole

Language intervention is contingent and dynamic process between two or more people.

Future Directions

Measures of intervention intensity should encompass contingent & dynamic aspects of tx:

“Process Quality Indicators”

- Engagement, pacing, scaffolding skill
  - How can these be defined and measured?
  - Do they impact outcome?
  - Are there differences among practitioners?
  - Are there practitioner / patient interactions that influence outcome?

Coda

Investigating discrete indicators of intervention intensity is a very good place to begin,
but we also need to keep our attention on the whole story.

Many Phonemic Awareness Tasks

- All the ways of manipulating the sounds in words, such as:
  - Generating words based on first sounds;
  - Isolating first or last phonemes in words;
  - Matching words on first or last sounds;
  - Blending phonemes into words;
  - Deleting and substituting phonemes
  - Segmenting words into phonemes
- Plus bigger-than-phoneme syllables and rhyme tasks

Intensity in Phonemic Awareness Intervention

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Main Phoneme Tasks
1. Isolating first sounds
2. Matching first sounds
3. Segmenting simple words
4. Blending simple words

An Overview of Phonemic Awareness Instruction
1. A hierarchy of environmental sound, word, syllable, rhyme, and phoneme activities
2. Phoneme tasks embedded in reading and writing activities
3. Phoneme tasks with manipulatives or letters in ordered drill/games

Teaching Episode
• Episode = Initiation, Response, Evaluation (IRE)
• But may also have
  – Clinician model without response
  – Peer response heard as model
  – Choral response belonging to whom?
  – Multiple task IRE

Combining Tasks in a Complex Teaching Episode
• Let’s see if sun and slow match. What is the first sound in sun?
• Let’s say the all the sounds in sun. You start, the first sound is --
• What am I holding in this bag? /P-i-ch/.
  Peach. Your turn. You say the sounds in the next word and I will guess.

Intensity Evidence up to 2001
• Large number of controlled studies have obtained significant and large gains
• Intensity has varied considerably:
  – Session lengths of 15 to 90 minutes
  – Frequencies of 1 to 5 times weekly
  – Durations of 4 to 32 weeks
  – Individual, group, and whole class arrangements
  – Learners from 4 to 8 years, of a range of abilities
• No report of number of teaching episodes
• Rare tx fidelity or child attendance info

Ehri et al. (2001) Meta-Analysis
• Part of NRP (2000):
• Evidence for phonemic awareness treatment effects
• 52 studies with 96 treatment-control comparisons reviewed
  – Studies mixed supra-phonemic and phonemic
• Results:
  – Small group better than individual or whole class
  – Typical learners had larger gains than weaker learners
  – 1-2 tasks better than 3+ phonemic/pre-phonemic tasks
  – 5 to 18 hours best, with no difference in this span
6 Months or 7 Weeks of Tx?

- **Maybe 6 months** if full phonological spectrum, whole K class 15-30 min daily tx:
  - Brady et al. (1994), moderate gains on segmenting: $d = 0.57$
- **Maybe 7 weeks** if phoneme-level only and small K groups, 3-4x/wk 20-30 min. tx:
  - Ukrainetz et al. (2000): Sound talk embedded in rhyming books and shared writing activities; Segmenting: $d = 1.37$

Tx Intensity for Ch w/ Language Impairment

- 7 controlled group studies at phoneme level (incl. rhyme) for 4-7 yr olds
  - Warrick et al. (1993), van Kleeck et al. (1998),
    - Gillon (2000, 2005), Segers & Voerhoeven (2004),
    - Denne et al (2005), Hesketh et al. (2000)
- 4 included other speech/language obj
- Individual or small group, 3-20 hrs
- Best results for 12-20 hours, large segmenting effect (> $d = 1$)

But Does the Old Evidence Still Apply?

- Past studies compared phonemic awareness tx to regular class instruction with no phonemic awareness
- BUT now, phonemic awareness is:
  - One of the 5 pillars of reading (NRP, 2000)
  - Part of K-1 standardized reading dx (DIBELS)
  - Often taught in RTI
  - Frequently present in the regular classroom
- So how much is enough for tx now with a background of classroom phonemic awareness instruction?

A Study of Intensity

- Ukrainetz, Ross, & Harm (in press)
- 41 5-6 year old kindergartners, including 22 English learners, with low letter and first sound knowledge on DIBELS
- 11 hours of tx in 3 conditions:
  1. Concentrated (CP, 3x/wk, Oct - Dec)
  2. Dispersed (DP, 1x/wk, Oct to March)
  3. Vocabulary control (CON, 1x/wk to March).

Programming Intensity

- ≥ 5 teaching episodes per task & child across 3-4 activities ≥ 20 episodes per session
- Number of teaching episodes roughly controlled in 3 ways:
  1. Maximum of 30 minutes for all sessions
  2. Consistent number and array of activities
  3. Minimum number of teaching opportunities per session
Intervention Intensity Panel

Dose Form

<table>
<thead>
<tr>
<th>Order</th>
<th>Horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tasks</td>
<td>First isolate, last isolate, blend, segment</td>
</tr>
<tr>
<td>Activities</td>
<td>Name, picture, object, book, &amp; writing activities (fingers for segmenting)</td>
</tr>
</tbody>
</table>

Dose Strength

<table>
<thead>
<tr>
<th>Grouping</th>
<th>3 children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session length</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Episodes (IRE+)</td>
<td>≤ 5 per task per child = 20 + listening to 1/2 the 40 peer models / ... Session dose = 40 episodes</td>
</tr>
</tbody>
</table>

Dose Frequency & Duration

<table>
<thead>
<tr>
<th>Frequency</th>
<th>1 or 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>8 or 24 weeks</td>
</tr>
<tr>
<td>Total time</td>
<td>12 hours of tx</td>
</tr>
<tr>
<td>Total intensity</td>
<td>960 teaching episodes</td>
</tr>
</tbody>
</table>

Effect of Intensity on Phonemic Awareness

Results for Phonemic Awareness Intensity Tx

Tx over a school year, along with class instruction:
1. English learners = native English speakers
2. Short intense tx = long weekly tx
3. Ks with mod deficit benefit from tx
4. Ks with mild deficit, tx = classroom

Recommendations for Phonemic Awareness Intensity

- Total intensity
  - 5-18 hours for typical ch
  - 12-20 hours for ch w/ lang imp
- Most of this can be in the regular classroom
- Additional tx?
  - 4 hrs of 20 episodes per child, concentrated or dispersed with other objs
Phonemic Awareness References


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Print Knowledge

- Writing one's name (emergent writing)
- Writing letters and words (emergent writing)
- Pretend writing a story (emergent writing)
- Pretend reading from favorite books (print knowledge)
- Identifying major elements of a book (print knowledge)
- Naming words in environment (print knowledge)
- Knowing the letters in one's name (alphabet knowledge)
- Reciting all the letters (alphabet knowledge)
- Knowing some letter-sound correspondences (alphabet knowledge)
Intervention Intensity Panel

Individual Differences in Print Knowledge at 4 Yrs

![Chart showing individual differences in print knowledge at 4 yrs.](chart1.png)

Individual Differences in Print Knowledge at 4 Yrs

![Chart showing individual differences in print knowledge at 4 yrs.](chart2.png)

Print Referencing Intervention

Explicit, systematic referencing of print during storybook reading

Active Ingredients:
- Explicit targeting
  - Scope
- Systematicity
- Sequence
- Repetitive
  - Schedule-bound
- Meaningful

![Image of a child reading a storybook.](image.png)

Mechanism:
Increase children’s contact with print

- Many children’s experience with print is at “little contact” end of continuum – at home and classroom
- Certain texts and behaviors may increase print contact

![Diagram showing mechanism of print referencing intervention.](diagram.png)

- 44 3- to 5-year-old children
- Very good preliteracy skills
- Four conditions
  - VERBATIM
  - VERBAL PICTURE
  - VERBAL PRINT
  - NONVERBAL PRINT
- Four print-salient books

![Chart showing gain scores on 5 measures.](chart3.png)

Example of Child Outcomes Study in Head Start

![Graph showing child outcomes study in Head Start.](graph.png)
**Intervention Intensity Panel**

**Print Referencing Intervention: The Package**

- **Scope:**
  - print meaning, print organization, words, letters
  - cycles
- **Goal attack:**
  - trade storybooks with print-salient features
- **Intensity:** highly variable
  - Dose frequency: 16 sessions to 120 sessions
  - Dose:
    - Targets hit per session (2-3 recommended)

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Dose Frequency</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Justice, Ezell, &amp; Parsons (2000)</td>
<td>4 children with communication disorders</td>
<td>4 weeks (4 readings per week)</td>
<td>16 sessions</td>
</tr>
<tr>
<td>Justice &amp; Ezell (2002)</td>
<td>16 moderately developing children with language delay</td>
<td>4 weeks (2 readings per week)</td>
<td>20 sessions</td>
</tr>
<tr>
<td>Justice, Ezell, Skibbe, &amp; Stewart (2008)</td>
<td>20 children with language disorders</td>
<td>6 weeks (2 readings per week)</td>
<td>48 sessions</td>
</tr>
<tr>
<td>Justice, Skibbe, Mcginty, &amp; Hunt (2008)</td>
<td>7 children with language disorders</td>
<td>6 weeks (2 readings per week)</td>
<td>2 targets per week</td>
</tr>
<tr>
<td>Lovelace &amp; Stewart (2006)</td>
<td>11 children with language disorders</td>
<td>12 weeks (4 readings per week)</td>
<td>120 sessions</td>
</tr>
<tr>
<td>Justice &amp; Ezell (2006)</td>
<td>28 children from economically stressed homes</td>
<td>6 weeks (4 readings per week)</td>
<td>106 sessions</td>
</tr>
<tr>
<td>Justice, Skibbe, &amp; Peterson (2008)</td>
<td>29 children from economically stressed homes</td>
<td>8 weeks (3 readings per week)</td>
<td>24 sessions</td>
</tr>
<tr>
<td>Justice &amp; Ezell (2008)</td>
<td>4 children with communication disorders</td>
<td>4 weeks (4 readings per week)</td>
<td>16 sessions</td>
</tr>
<tr>
<td>Justice &amp; Ezell (2000)</td>
<td>5 children with communication disorders</td>
<td>4 weeks (4 readings per week)</td>
<td>20 sessions</td>
</tr>
<tr>
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<td>4 children with communication disorders</td>
<td>4 weeks (4 readings per week)</td>
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</tbody>
</table>

**General Effects**

Daily reading vs Daily reading with Print Referencing

**Variability in Dose**

**Scope**

- print meaning, print organization, words, letters
- cycles

**Participants**

- trade storybooks with print-salient features

**Study**

- scope: highly variable
  - Dose frequency: 16 sessions to 120 sessions
  - Dose:
    - Targets hit per session (2-3 recommended)
Dosage Study

- Randomized controlled trial
- Preschool teachers (N = 55) randomly assigned to two conditions:
  - High dosage print referencing (n = 31)
    - 120 sessions over 30 weeks
  - Low dosage print referencing (n=24)
    - 60 sessions over 30 weeks

Measures

- Child outcome measures:
  - Alphabet knowledge
  - Name writing
  - Print-concept knowledge
- Covariates
  - SES (mom ed)
  - Initial abilities
  - Classroom quality
- Dose
  - Attendance: number of days child was present
  - Dose frequency: group assignment (high or low dosage)
  - Dose: frequency targets hit averaged over observations

Findings

- Child attendance predicted spring name writing skills and alphabet knowledge
- Dose predicted spring print-concept knowledge
- Dose frequency predicted spring print-concept knowledge
- All effect sizes were small
- Not clear that more is better

Analytical Approach

- Hierarchical Linear Modeling
  - Level 1 - child characteristics
  - Level 2 - classroom characteristics

\[
Y_{ij} = \beta_0 + \beta_1 (\text{age}) + \beta_2 (\text{attendance}) + \beta_3 (\text{initial level}) + \epsilon_{ij} \\
\beta_0 = \lambda_{00} + \lambda_{01} (\text{dose frequency}) + \lambda_{02} (\text{classroom quality}) + \lambda_{03} (\text{dose}) + \mu_{ij}
\]
Interaction: dose, attendance, alphabet

Children with lower attendance have better outcomes with higher dose

Interaction: dose, initial level, alphabet

Children with lower initial skills have better outcomes with higher dose

Concluding Thoughts

• We know far less about dose frequency (intensity) than we think we do
• Dose is not a one-size-fits-all construct; our findings indicate that the relationship between dose frequency/dose and child outcomes depend upon characteristics of child and contexts
• We generally find good effects with four sessions per week (about 40 min total) and moderate dose but know little about individual differences
• Children with SLI show attenuated effects so intervention may need to be more intense or extend for longer periods of time

Thanks!