CRtIEC Updates: Tier 2 Vocabulary and Comprehension Intervention Results

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www.crtieec.org
Center for Response to Intervention in Early Childhood: Our Team

JGCP

KU The University of Kansas

Dynamic Measurement Group
Supporting School Success One Step at a Time

Center for Early Education and Development

UNIVERSITY OF MINNESOTA
Driven to Discover

THE OHIO STATE UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN ECeOLOGY
Presentation Outline

- Oral Language Interventions in Preschool RTI
- Overview of the Story Friends Program
- Early Efficacy Studies and the Iterative Development Process
- Measurement Development: the Assessment of Story Comprehension
- Preview of the Story Friends Efficacy Trial
Tier 2 Embedded Storybook Interventions

- As part of an RTI model, there is a need for high-quality interventions to improve early language and literacy skills for preschool children who are falling behind.

- Overview of design and development work on interventions feasible for high fidelity implementation in preschool classrooms.

- How findings from early efficacy studies have informed our development.
To effectively implement response to intervention in early childhood...
...how should we design Tier 2 interventions?
We need interventions that work in classrooms...
...and that don’t place additional demands on teachers.
Children learn best when we teach explicitly...
... and when we give children opportunities to respond.
So we designed an intervention.
Story Friends Program
Small groups of children participate in ‘listening centers.’
Prerecorded storybooks and explicit embedded lessons are delivered under headphones.
<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Picture of students]</td>
<td>![Picture of students]</td>
<td>![Picture of students]</td>
</tr>
</tbody>
</table>

Multiple listens provide repeated exposures to instruction and many opportunities to respond.
<table>
<thead>
<tr>
<th>Vocabulary Words</th>
<th>Ellie’s First Day</th>
<th>Leo’s Brave Face</th>
<th>Jungle Friends Go to the Beach</th>
</tr>
</thead>
<tbody>
<tr>
<td>enormous</td>
<td>brave</td>
<td>soaked</td>
<td></td>
</tr>
<tr>
<td>different</td>
<td>grin</td>
<td>gorgeous</td>
<td></td>
</tr>
</tbody>
</table>

**Comprehension Questions**

- **Ellie’s First Day**
  - How do you think Ellie feels about meeting new friends? [Why?]
  - Where did Ellie go in our story?
  - At the end of the story, Ellie was happy. Why was Ellie happy?

- **Leo’s Brave Face**
  - How do you think Leo feels about going to the dentist? [Why?]
  - What did Leo learn from the dentist?
  - At the beginning of the story, Leo was afraid of the dentist. What do you do when you are afraid?

- **Jungle Friends Go to the Beach**
  - What do you think will happen in this story?
  - How did Tanisha feel when the wave knocked over her sandcastle?
  - Do you think the Jungle Friends will go to the beach again? [Why or why not?]
enormous, different

brave, grin

soaked, gorgeous

reckless, ignore

unusual, greet

ill, discover

leap, pause

speedy, unique

ridiculous, tumble
The Forest Friends were thrilled! They are excited to go to the carnival. Thrilled. Say thrilled. (2) Thrilled means excited. Tell me, what word means excited? (2) Thrilled! Good work! When are you thrilled? (2) What about… when you get a present! …Or your friends come over to play! I bet that makes you feel excited. Now, lift the flap. Look! These boys are at a birthday party. They are excited. They are thrilled! Tell me, what does thrilled mean? (3) Excited! That’s right.
The friends all tried to help Ellie Elephant. Why did they help Ellie? (3) Because she couldn’t get out by herself. She was stuck! The friends were worried, so they worked together to get Ellie out.
Measures of instructional content are administered periodically.
Early Efficacy studies
Timeline

- Year 1, 2008-2009: intervention development
- Year 2, 2009-2010: pilot study
- Year 3, 2010-2011: early efficacy study with single case design, implemented by research staff
- Year 4: 2011-2012: early efficacy study, group design with embedded single case design, implemented by research staff
- Year 5: 2012-2013: efficacy trial with randomized cluster design, implemented by classroom staff
Year 3 VC Early Efficacy Study

2010-2011
Participants

- 9 preschool children in 3 classrooms were identified with limited oral language skills in fall.
- Multiple gating procedures for identification that included a teacher survey, Picture Naming IGDI 2.0, norm-referenced tests.
## Characteristics of Participants

<table>
<thead>
<tr>
<th>School</th>
<th>Child</th>
<th>Age</th>
<th>Gender</th>
<th>Picture Naming 2.0</th>
<th>PPVT-IV</th>
<th>CELF-P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>School A</td>
<td>A1</td>
<td>4;9</td>
<td>Female</td>
<td>6</td>
<td>80</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>4;9</td>
<td>Male</td>
<td>10</td>
<td>78</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>4;6</td>
<td>Male</td>
<td>7</td>
<td>88</td>
<td>77</td>
</tr>
<tr>
<td>School B</td>
<td>B1</td>
<td>4;11</td>
<td>Male</td>
<td>5</td>
<td>83</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>4;10</td>
<td>Female</td>
<td>9</td>
<td>87</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>B3</td>
<td>4;11</td>
<td>Female</td>
<td>6</td>
<td>96</td>
<td>90</td>
</tr>
<tr>
<td>School C</td>
<td>C1</td>
<td>4;10</td>
<td>Male</td>
<td>11</td>
<td>83</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>4;5</td>
<td>Male</td>
<td>6</td>
<td>80</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>C3</td>
<td>4;3</td>
<td>Female</td>
<td>5</td>
<td>84</td>
<td>94</td>
</tr>
</tbody>
</table>

**PPVT-IV:** $M = 84.3$, Range 78 – 96; **CELF-P2:** $M = 86.4$, Range 73 - 94
Method

- Single-case repeated acquisition design
- Intervention was 9 books with embedded vocabulary and comprehension lessons.
- Implemented by research staff

Measures:
- Mastery monitoring probes at pretest and posttest for each book
- 2 outcomes: Vocabulary and Comprehension
Mastery Monitoring Items and Scoring

- Taught Vocabulary
  - Maximum score at pretest and posttest was 4

- Untaught Vocabulary
  - Maximum score at pretest and posttest was 2

- 2 points possible per word
  - "Tell me, what does enormous mean?“
    - "Really big" 2 points
    - “means a big building” 1 points
    - “I don’t know” 0 points
Comprehension

Maximum score at pretest and posttest was 6.

Three 2-point comprehension questions

"At the end of the story, Ellie is happy. Why is Ellie happy?"

- “Because she made new friends” 2 points
- “Because she likes playing” 1 point
- “Her big” 0 points
Year 3 Results: Vocabulary

[Graphs showing the vocabulary monitoring scores for different children and schools, with individual scores plotted against books numbered 1 to 9.]
Year 3 Results: Vocabulary

- Average number of words learned (per child) = 8.11, Range 3 - 13
- Average number of children who learned each word = 4.06, Range 0 – 8
- Lowest “unusual” - no children learned
- Highest “ill” – 8 children learned
Year 3 Results: Comprehension
Year 3 Results: Comprehension

- Criterion for treatment effect:
  - Pretest-posttest difference of at least 2
- Treatment effects for most participants for many books (Range: 0 - 6 books).
- Average gain score per book was 1.1 points ($SD = 1.66$, Range = -4 - 4)
We learned a lot...
...but there was still work to be done.
Revisions for Year 4

- Replaced 5 words, rewrote 1 story, revised 7 embedded lessons.
- Words that were replaced were the lowest performing words (e.g., unusual). Lessons that were revised were for lower performing words and were based on observations from the facilitators.
  - EXAMPLE: picture for ‘ridiculous’ was changed from an illustration in the story to a photo of a ridiculous dog.
  
  (next slide)
Revisions for Year 4

- Inclusion of simple unit review books
  - Repeat of lessons from a set of 3 books
- Development of Unit Tests
  - Measure of vocabulary learning in 3 books plus a review book
  - Designed to be administered ~ once per month
- Refinements to training materials, staff manuals, fidelity procedures, scoring reliability
- Development of the Assessment of Story Comprehension
Assessment of Story Comprehension (ASC) For Preschoolers

Measurement Development

Supported by a cooperative agreement from the Institute of Education Sciences (2324C080011)
Measurement Development Guidelines

- Curriculum Based Measurement (Deno, 2003)
  - Sample authentic child behaviors that reflect key outcomes
  - Have standardized administration and scoring procedures
  - Be time efficient, economical, and easy to use
  - Meet the requirements of technical adequacy
  - Be sensitive to growth due to intervention or change over time
Characteristics of the ASC

- Children listen to a brief story

  - Stories have relatable content: crashing on a bike, dropping teddy bear in mud, spilling paint on a picture, playing a game, etc.

  - Nine ASC stories with the same:
    - Story grammar structure
    - Language complexity
    - Length (160 words)

- Examiner asks questions about the story

  - Recall (3), inferential (4), and vocabulary (1) questions
  - Same type of questions across forms
Sample ASC Form

Assessment of Story Comprehension

1. Danny and the Big Hill

You are going to listen to a story. It is called Danny and the Big Hill.
Hmm. I wonder what will happen in this story. Let’s think about the title, Danny and the Big Hill.
What do you think will happen?

Now you are going to listen to the story. Listen carefully because I’m going to ask you some questions about the story. Are you ready?

A few days ago, Danny was riding his new black bike on the sidewalk. He rode up and down the sidewalk in front of his house.

When Danny rode past his neighbor’s house, he started going down a big hill. Then Danny’s bike hit a bump in the sidewalk. He fell off his bike and injured his arm. Danny cut his arm on the rough ground.

Danny was sad.

He picked up his bike and slowly walked home. He found his mom and said, “Mommy, I fell and injured myself. My arm is cut.”

His mom gently cleaned his cut. Then she put a bandage on his arm. After Danny got a bandage, his mom gave him a hug. He asked his mom if she would watch him ride his new bike. She said, “Of course. I want to watch you, but don’t injure yourself again.” Danny rode his bike so well that his mom clapped and cheered for him.

Thanks for listening. Now I’m going to ask you some questions.

Turn Over to Continue ASC Administration.

ASC (continued)

Danny and the Big Hill

2. What was Danny doing in this story?

3. In this story, Danny was sad. Why was Danny sad?

4. Danny hit a bump in the sidewalk. What happened then?

5. Why do you think Danny’s mom gave him a hug?

6. What happened at the end of the story?

7. The next time Danny rides his bike, do you think he will go down a big hill? Why / Why not?

8a. Does injure mean to do something or to hurt something? (Circle response)

Total Score 17

Quality Control ID Scorer 1 Scorer 2 Data Entry 1 Data Entry 2
## ASC Fidelity Checklist

### ASC Administration Fidelity Checklist

1. **Danny and the Big Hill**

<table>
<thead>
<tr>
<th>The examiner says...</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are going to listen to a story. It is called <em>Danny and the Big Hill</em>. Hmm. I wonder what will happen in this story. Let’s think about the title, <em>Danny and the Big Hill</em>. What do you think will happen?</td>
<td></td>
</tr>
<tr>
<td>□ Yes, exactly □ Paraphrased with minor changes</td>
<td>1</td>
</tr>
<tr>
<td>□ No □ Paraphrased with major changes</td>
<td>0</td>
</tr>
</tbody>
</table>

(1b) Now you are going to listen to the story. Listen carefully because I’m going to ask you some questions about the story. Are you ready?

<table>
<thead>
<tr>
<th>The examiner says...</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes, exactly □ Paraphrased with minor changes</td>
<td>1</td>
</tr>
<tr>
<td>□ No □ Paraphrased with major changes</td>
<td>0</td>
</tr>
</tbody>
</table>

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\[
\% \text{ Fidelity} = \left( \frac{\text{No. Items Scored Correct}}{\text{No. Items Scored}} \right) \times 100
\]

- No. Items Scored Correct ______
- No. Items Scored* ______
- \% Fidelity of Administration ______

*Note that 7a, 8a, and 8c may not have been administered or scored (N/A).
Standardized Scoring Procedures

- Answers are recorded in real time.
- After administration is completed, answers are scored.
- ASC Scoring Guides are specific to each story but consistent across stories.
- Questions 1-7 are scored 0-1-2
- Question 8a is scored 0-2-3.
  - If answer receives a 0, 8b is administered and it is scored 0-1.
- Total = 17 points
## ASC Scoring Guides

**1. Danny and the Big Hill**

<table>
<thead>
<tr>
<th>Questions</th>
<th>Score</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do you think will happen?</td>
<td>2 = plausible, complete, and clear</td>
<td>He will get hurt; He will have fun</td>
<td></td>
</tr>
<tr>
<td>1 = plausible but incomplete or unclear</td>
<td>Fail; fun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 = unrelated or implausible</td>
<td>Go shopping; watch tv</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| What was Danny doing in this story? | 2 = correct, complete, and clear | riding his bike; playing on bike |
| 1 = correct but incomplete/unclear | bike; falling; going down street |
| 0 = incorrect | running; crying; mad; play |

| In this story, Danny was sad. Why was Danny sad? | 2 = correct, complete, and clear | fell on bike; hurt his arm; him elbow bleed |
| 1 = correct but incomplete/unclear | bump; crash; bleed; hurt |
| 0 = incorrect | cry; riding bike |

| Danny fell off his bike and cut his arm. What happened next? | 2 = correct, complete, and clear | walked home; told his mom; got a band-aid |
| 1 = correct but incomplete/unclear; action by secondary character | ran away; home; band-aid; told her; mom gave a band-aid |
| 0 = incorrect | cry; bleed; ride bike; sad |

| Why do you think Danny’s mom gave him a hug? | 2 = plausible answer that incorporates story AND background knowledge | help him feel better; she loves him; moms help their kids |
| 1 = answer that is in the story OR includes background knowledge; characteristic | he’s sad; he got hurt; she’s nice |
| 0 = not plausible or not an answer to the question | he was naughty; happy |
Time Efficient, Economical, and Easy

- Administration takes about 3-5 minutes each.
- Administration materials: double sided administration and scoring forms, clipboard, and a pencil.
- Very easy to learn: follow script, read slowly and clearly, provide encouragement, but don’t prompt, and write answers quickly.
- Children like the stories and mixed difficulty of questions keeps children engaged.
ASC Technical Adequacy

- **Study 1**
  - 36 preschool children received 3 ASC forms
  - Preliminary evidence of construct/concurrent validity, inter-scorer reliability, and implementation fidelity
  - Used results to identify outlier stories and items

- **Revisions**
  - Rewrote 3 stories
  - Eliminated 1 question
  - Developed story specific scoring guides
ASC Technical Adequacy

- Study 2 (N=20) and Study 3 (N=72)
  - Undergraduate research assistants administered preschool children all 9 revised ASC forms in sets of 3 within one week.
  - The order of ASC forms were counterbalanced across children.
  - Children received the Clinical Evaluation of Language Fundamentals (CELF-P) a day or two before beginning ASC administration.

- Outcomes
  - Fidelity is very high (97-100%)
  - Scoring Reliability is adequate (mean 89%; lower for 2 items)
    - Revised scoring guides
  - Alternate Form Reliability is moderate (mean correlation = .72)
Measurement Development: Next Steps

- 2012-2013 ASC Studies
  - Investigate the ASC’s technical adequacy using a larger sample
  - Investigate the ASC’s sensitivity to growth due to development
    - In Arizona, testing 150-200 children in Fall, Winter, and Spring
  - Investigate the ASC’s sensitivity to growth due to intervention
    - In Ohio, ASC is an outcome measure in Story Friends efficacy study
Year 4 Study

- Randomized group design with embedded single case design
- 3 classrooms with 6 children in each, children randomly assigned to treatment or delayed treatment.
- Intervention implemented by research staff
Year 4 Participants

- N = 18; 11 girls, 7 boys
- African American
- Recruited from public pre-K settings
- Identified as having limited oral language skills

<table>
<thead>
<tr>
<th></th>
<th>PPVT-IV</th>
<th>CELF-P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>Range</td>
</tr>
<tr>
<td>Treatment</td>
<td>83.44</td>
<td>77-90</td>
</tr>
<tr>
<td>Comparison</td>
<td>83.44</td>
<td>78-89</td>
</tr>
</tbody>
</table>

No significant difference between groups on these measures.
Year 4 Measurement

- **Group Design**
  - Unit Test of vocabulary words taught in 3 books
  - Assessment of Story Comprehension

- **Embedded Single Case Design**
  - Mastery Monitoring Probes administered at pretest and posttest for each book.
Year 4 Results: Vocabulary

![Bar chart showing vocabulary results for UT1 Pre, UT1 Post, UT2 Pre, UT2 Post, UT3 Pre, and UT3 Post. The chart compares participant and comparison groups.]
Year 4 Results: Vocabulary

- ANOVA of gain scores for each Unit Test
- Significant differences favoring the treatment group at each time point
- Average gain of 4.44 – 6.33 points per Unit Test
- Effect sizes between 1.37 – 2.84
Word Level Data from Year 4

- Average number of words learned (per child) = 10, Range 3-17
- Average number of children who learned each word = 4.94, Range 4-8.
- Lowest “enormous”, “brave”, “soaked”, “comfort”, “speedy”, “ridiculous” - 3 children learned
- Highest “ill” – 8 children learned
## Year 4 Results: Comprehension

### Assessment of Story Comprehension

<table>
<thead>
<tr>
<th></th>
<th>Treatment Mean (SD)</th>
<th>Comparison Mean (SD)</th>
<th>Effect Size (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-intervention</td>
<td>5.22 (3.70)</td>
<td>4.89 (4.51)</td>
<td>.08</td>
</tr>
<tr>
<td>Post Unit 1</td>
<td>6.89 (2.21)</td>
<td>6.33 (4.69)</td>
<td>.15</td>
</tr>
<tr>
<td>Post Unit 2</td>
<td>8.11 (3.55)</td>
<td>4.56 (3.13)</td>
<td>1.06</td>
</tr>
<tr>
<td>Post Unit 3</td>
<td>9.78 (4.21)</td>
<td>6.44 (4.19)</td>
<td>.80</td>
</tr>
</tbody>
</table>
Year 4 Results: Comprehension

![Graph showing Year 4 results for comprehension. The graph compares treatment and comparison groups over four years. The treatment group shows an upward trend, while the comparison group remains relatively flat.]

- **Treatment**
- **Comparison**
Year 5 Story Friends Efficacy Trial

- 2012-2013 school year, 24 classrooms in OH, 8 in KS
- Cluster randomized design: classrooms randomly assigned to Treatment and Comparison
  - Treatment: Story Friends Program
  - Comparison: Story Friends books with no embedded interventions
- Implemented by educational staff
- Research staff provides assistance to teachers and administers assessments
Questions?