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 Using the Repeated Acquisition Single Case Design: Developing Tier 2 Language and Early Literacy Interventions

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 **CRTIEC's Key Partners**

- ♦ University of Kansas
 - Charles Greenwood & Judith Carta
- ♦ Dynamic Measurement Group; Eugene, OR
 - Ruth Kaminski
- ♦ University of Minnesota
 - Scott McConnell
- ♦ Ohio State University
 - Howard Goldstein
- ♦ Division for Early Childhood-CEC




 **Important Acknowledgments**

- ♦ Work has been coordinated by: Beth Spencer, Gabriela Guerrero, and Jane Atwater and a group of dedicated research assistants at University of Kansas and the Ohio State University
- ♦ We want to acknowledge the partnership of the many early education programs that collaborated with us on this important study.




The Problem(s)

- ❖ We need more evidence-based strategies for use in preschool RTI at Tier 2 and 3
- ❖ How can we efficiently develop and accumulate high-quality evidence that promising techniques actually help children acquire new skills?
- ❖ How do we meet the evolving *What Works Clearinghouse* Single Case Design Standards?




The Challenges

- ❖ Some of design challenges we faced as developers of Tier 2 vocabulary and early literacy curriculum interventions are:
 - The universe of new skills content to be taught and learned must be specified in advance
 - The content to be taught must be organized in a scope and sequence for implementation in lessons over time
 - The appropriate measures of student mastery or progress monitoring need to be specified




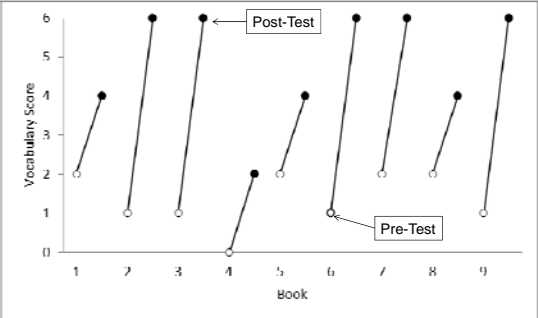
Unique Design Requirements

- ❖ Our efficacy research questions require an experimental design capable of comparing alternative instructional conditions delivered in small groups
- ❖ The design needs to depict repeated acquisition by individuals and groups
- ❖ Reversals or withdrawals of treatment are not desirable
- ❖ Short baselines are desired with no delays all children receiving intervention
- ❖ These requirements ruled out most of the well-known single case designs (e.g., ABAB, multiple baseline)
- ❖ But, they are a good match to the Repeated Acquisition Design (RAD) ([Kennedy, 2005, pg 163](#)).


 **Repeated Acquisition Design**

- ❖ The RAD is well adapted to assessing acquisition of academic skills and tasks as a function of instructional interventions.
- ❖ RAD allows repeated demonstration of new word learning of relatively equivalent difficulty and thus, strong, repeated evidence that the treatment is responsible for said acquisition ([Kratochwill et al., 2010](#); [Odom et al., 2005](#))
- ❖ Words measured and taught in the study were selected because of the low likelihood that children would not know any of them, providing an uncontrolled, naturalistic baseline (Kennedy, 2005).


 **Our Particular RAD Layout**



Book	Pre-Test Score	Post-Test Score
1	2.0	4.0
2	1.0	6.0
3	1.0	6.0
4	0.0	2.0
5	2.0	4.0
6	1.0	6.0
7	2.0	6.0
8	2.0	4.0
9	1.0	6.0

 **Considering Single Case Design Quality Indicators and Evidence-based Practice**


- ❖ Design controls for threats to Internal Validity
- ❖ Children with similar skill levels (Tier 2) are selected for participation
- ❖ Direct and systematic replication by different implementers in different schools and different students
 - Ohio produces original study
 - Kansas provides replication



Participants: 2010-11 Replication Sample(s)

State	Classrooms	Children	Non-White	Non-English Home Language	Individual Education Program
Ohio	3	9	8	0	0
Kansas	3	9	8	5	3
Total	6	18	16	5	3


Note. Both samples were predominately non-White. The KS participants included dual language learners and students with IEPs



Student Risk Status at Start

State	Measure	M	Range
Ohio	Vocabulary IGD I (Max = 15)	7.2 of 15	5-11
	Peabody Picture Vocabulary Test (PPVT) (M = 100, SD = 15)	84.3	78-96
	Clinical Evaluation of Language Fundamentals (CELF) (M = 100, SD = 15)	86.4	73-94
Kansas	Vocabulary IGD I (Max = 15)	7.3 of 15	5-13
	Peabody Picture Vocabulary Test (PPVT) (M = 100, SD = 15)	86.9	73-107
	Clinical Evaluation of Language Fundamentals (CELF) (M = 100, SD = 15)	72.6	50-102

Note. IGD I = Individual Growth and Development Indicator



Measurement



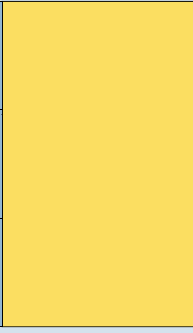


- ❖ Vocabulary and Comprehension Mastery Monitoring
 - Before Instruction
 1. Pre-test on Next Book's Words
 - After Instruction
 1. Post-test of Mastery of this Book's Words


Instructional Content by Storybooks				
Language Area	1	Books	2	3
Vocabulary	Ellie's First Day	Leo's Brave Face	Jungle Friends Go to the Beach	
Basic Concept Words	Novel Words high, low	all	many, few	
Novel words	enormous, different	brave, grin	soaked, gorgeous	
Implicit Novel Words	2 ADJ giggle 1 VB	1 ADJ, 1 VB arrive 1 VB	1 ADJ, 1 ADJ decide 1 VB	
Comprehension				
Comprehension Questions				
Pre	In this story, it is Ellie's first day of school. She is going to meet some new friends. How do	In this story, Leo goes to the dentist. How do you think Leo feels	Hmm . . . I wonder what will happen in this story. Look at the picture and	

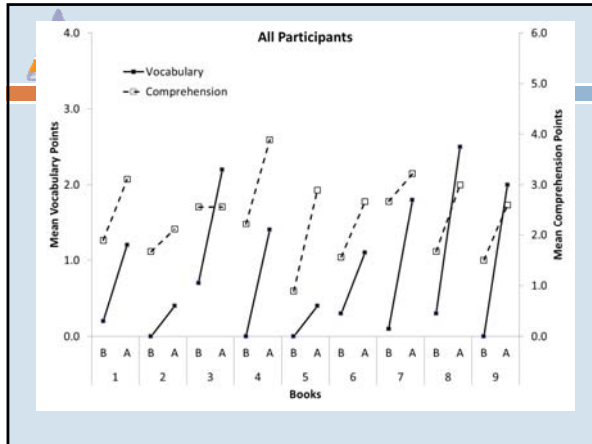
- The Vocabulary and Comprehension Tier 2 Intervention: Storybooks with Embedded Instruction**
- Center Setting Arrangement: Table and seats with some degree of privacy
 - Storybook Series: *If Elephants Could Fly*
 - Content Taught: Scope and Sequence
 - 9 Books in the Series, 1 Book per Week
 - Listening Station: MP3 player with a splitter allowing up to 3 students and an aide to listen to the Narrator-Teacher audio track

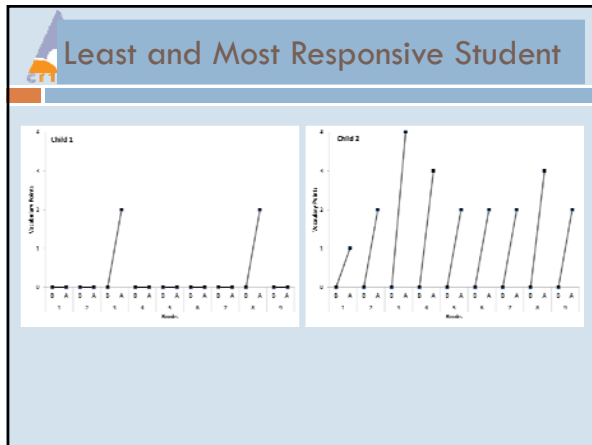
Narrator's Script with Embedded Instruction			
Table 2. Narrator's Instructional Prompts for the Book "Ellie Gets Stuck" (Regular font = Task Management, <i>Italic Font</i> = Target Word Content)			
1. Put finger under first word of title	13. Turn page	<i>between knees</i>	
2. Follow the arrows	14. Turn page	28. Turn page	
3. Open book	15. Turn page	29. Turn page	
4. Turn page	16. Turn page	30. Turn page	
5. Turn page	17. Turn page	31. Turn page	
6. Turn page	18. Say "pause"	32. Turn page	
7. Say "lap"	19. What word means "to stop"?	33. Turn page	
8. What word means "to jump"?	20. Tap finger	34. Turn page	
9. What are things that leap?	21. Tap finger again	35. Say "leap"	
10. Pretend hand can leap like a frog	22. Pause!	36. What does "leap" mean?	
11. What does leap mean?	23. What does "pause" mean?	37. Say "pause"	
12. Turn page	24. Turn page	38. What does "pause" mean?	
	25. Turn page	39. Turn page	
	26. Say "between"	40. Where is Marquez?	
	27. Pretend hands stuck	41. Raise your hand	

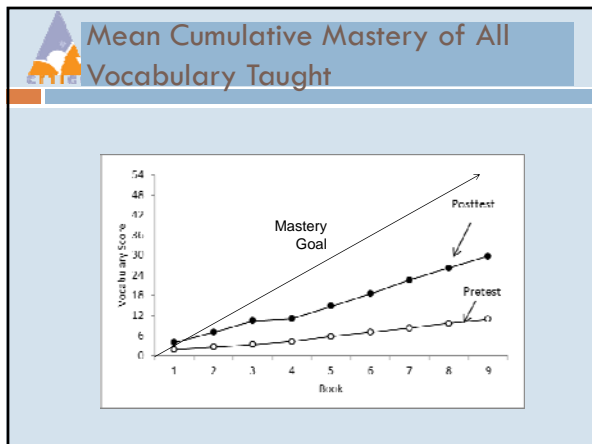



 <i>Repeated listening provides many opportunities to respond</i>		
MONDAY		
TUESDAY		
WEDNESDAY		

 <i>Organization of RAD Results</i>	
❖ Mean Results Across Storybooks	
▪ Repeated Acquisition Design	
▪ Best and Worst Participant Response	
▪ Cumulative Mastery View	
❖ Overall Effect Size	








 **Overall Effect Sizes**

- ❖ Ohio Standard Mean Difference (SMD)¹
 1. Vocabulary, $d = 1.71$
 2. Comprehension, $d = 0.59$
- ❖ Kansas Standard Mean Difference (SMD)
 1. Vocabulary, $d = 1.52$
 2. Comprehension, $d = 0.57$

Note. [$d = ((X_{\text{after}} - X_{\text{before}}) / SD_{\text{before}})$]
Note. ¹Spencer et al. (in press)

 **Evidence Produced**

- ❖ The Vocabulary and Comprehension Tier 2 intervention is developed, implementable
- ❖ Efficacy was demonstrated in two replications by different teams in different schools/states, and with research staff conducting the implementation.
- ❖ A range of student response to the intervention was observed
- ❖ Future work needs to focus on
 - achieving larger student effects
 - demonstrating similar findings with implementation by preschool personnel
