TOWARD PHENOTYPIC SPECIFIC EARLY COMMUNICATION INTERVENTION FOR CHILDREN WITH DOWN SYNDROME (DS)

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This talk and supporting materials will be posted at http://vkc.mc.vanderbilt.edu/kidtalk/
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TODAY’S TALK

- Children with Down Syndrome
  - Characteristics of language development, learning, and interaction
  - What children with DS bring to intervention

- Kidtalk/Enhanced Milieu Teaching Communication Intervention Program
  - Intervention outcomes for children with DS across studies
  - What we have learned
  - Future research
YOUNG CHILDREN WITH DOWN SYNDROME

Delayed in the acquisition of both speech and language
- motor development
- auditory memory
- cognitive impairment
- executive functions

Relative strengths in receptive vocabulary and social engagement, affect expression, visual memory

Challenges in transition to productive syntax, comprehension of complex syntax, pragmatics of conversation

Nearly all children with DS benefit from early communication intervention and continuous support for language development
KIDTALK PROGRAM OF RESEARCH RELATED TO CHILDREN WITH DOWN SYNDROME

Goals:

- Improving language and communication outcomes for children with DS
- Understanding the influence of child characteristics on teaching and learning language and communication
- Teaching partners strategies for supporting children’s language and communication
KIDTALK: ENHANCED MILIEU TEACHING

Naturalistic language teaching strategy designed to teach communication skills in everyday conversational interactions

More than 50 studies have investigated the effects of KidTalk and related naturalistic teaching procedures on children's communication development

See Kaiser & Hampton, 2016
ENHANCED MILIEU TEACHING: ACTIVE INGREDIENTS

Environmental arrangement to promote communication
Play and engage
Follow child’s interests in play and activities
Respond to child communication
Model language in context
Expand child communication
Use Time Delays to promote requests and initiations
Use Milieu Teaching Prompts to promote target practice
Teach across settings, activities and partners
CHILD COMMUNICATION GOALS

1. Increase duration of engagement
   - Social (joint engagement)
   - Objects (play)

2. Increase rate of communication
   - Emphasize spontaneous social initiations

3. Increase diversity of communication
   - Same level forms
   - More words and phrases
   - More functions (requests, comments, questions)
   - Across more contexts

4. Increase complexity of communication
   - Higher level forms
   - Prelinguistic to linguistic,
   - Mean length of utterances
   - Complexity of utterance types

5. Increase independence
   - Initiated social communication
   - Generalization across contexts, people
COMMUNICATION IS LEARNED IN TRANSACTIONS WITH PARTNERS

Children learn language in every day interactions with their parents and caregivers.

Caregivers are affected by the child and the child is affected by the caregiver.

When children have communication delays, interactions between children and their partners are different.

Parents, siblings, teachers and other partners may benefit from training to use naturalistic teaching strategies.
WHAT CHILDREN BRING TO EMT

- Imitation
- Auditory memory
- Efficiency

- Person
- Object
- Activity

- Access to Input
- Intelligibility
- Fluency

- Rate
- Form
- Functions
- Transparency to partners

Mode

Engagement Strategies

Baseline Communication

Learning Strategies

DS CONFERENCE OSLO 2017
MODIFICATIONS TO FIT CHILDREN WITH DS

- Teach linguistic content and behavior
- Add discrete trials
- Increase dosage

- Increase rate of communication
- Support partner comprehension and responding

- Teach play skills
- Increase object-person engagement
- Increase coordinated joint attention with symbols

- Provide alternative mode
- Teach partners mode
- Recast/support speech

- Teach play skills
- Increase object-person engagement
- Increase coordinated joint attention with symbols
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<thead>
<tr>
<th>EMT Active Ingredient</th>
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<tbody>
<tr>
<td>Play and engage</td>
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<tr>
<td>Follow child's lead in play and activity</td>
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<tr>
<td>Respond to child communication</td>
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<tr>
<td>Model language in context</td>
</tr>
<tr>
<td>Expand child communication</td>
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<tr>
<td>Use time delay to prompt requests or initiations</td>
</tr>
<tr>
<td>Use Milieu teaching prompts to promote practice</td>
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<tr>
<td>EMT Active Ingredient</td>
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<tr>
<td>Use time delay to prompt requests or initiations</td>
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<tr>
<td>Use Milieu teaching prompts to promote practice</td>
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EFFECTS OF AN INTERVENTION DEPEND ON CHILD RECEIVING THE INTERVENTION AT SUFFICIENT DOSAGE

Child characteristics can make it more difficult to deliver the intervention
- Brief attention paired with difficulty in auditory-based learning
- Limited task persistence
- Limited object interest and play skills

Even when the adult is providing the intervention components at fidelity, the child may not be receiving them
- Non-response or refusals of prompts
- Limited spontaneous imitation
- Difficulty with multi-turn conversation even when supported

Modifications in the intervention procedures (delivering) may be needed to increase the child’s participation in intervention (receiving)
RQ1 Can parents learn and generalize EMT strategies in interactions with their children with ID across settings at home?

RQ2 Is Parent plus Therapist more effective than Therapists only as a communication intervention for preschool children with ID?

What are the primary effects of EMT delivered by Parents +Therapists vs Therapists only?

What are the generalized effects of EMT delivered by Parents + Therapists vs Therapists only?
<table>
<thead>
<tr>
<th>Study Component</th>
<th>Description</th>
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</table>
| **Design**      | Randomized Clinical Trial  
                 38 Therapist Condition, 39 Parent +Therapist |
| **Intervention**| EMT with training across activities, settings, partners  
                 36 sessions (24 clinic, 12 at home across routines) |
| **Parent vs.**  | Pre, Post, 6 months, 12 months  
                 Standardized, observational, parent report |
| **Therapist**   | Average age: 40 months  
                 Average Leiter NV IQ: 70  
                 Gender: 74% male  
                 PLS-3 Total Standard Score: 60  
                 Disability Type: DD (55%), ASD (22%), DS (23%) |
## PARTICIPANTS

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<tr>
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<th>DD</th>
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<th>ASD</th>
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<td>40</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>Age (mos)</td>
<td>40.47 (8.05)</td>
<td>45.83 (8.94)*</td>
<td>40.93 (6.74)</td>
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<tr>
<td>Gender (% Male)</td>
<td>80%</td>
<td>57%</td>
<td>77%</td>
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<tr>
<td>Ethnicity</td>
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<td></td>
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</tr>
<tr>
<td>AA</td>
<td>30%</td>
<td>36%</td>
<td>6%</td>
</tr>
<tr>
<td>Caucasian</td>
<td>63%</td>
<td>57%</td>
<td>71%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
<td>7%</td>
<td>23%</td>
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<tr>
<td>PLS Total</td>
<td>60.98 (7.83)</td>
<td>55.12 (6.9)</td>
<td>55.65 (7.10)</td>
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<tr>
<td>PLS-Aud</td>
<td>60.63 (10.17)</td>
<td>55.36 (7.09)</td>
<td>55.12 (8.85)</td>
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<tr>
<td>PLS Exp</td>
<td>68.22 (8.52)</td>
<td>60.86 (9.54)</td>
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<td>MLU</td>
<td>1.51 (.58)</td>
<td>1.23 (.27)</td>
<td>1.25 (.39)</td>
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<td>Leiter (NV IQ)</td>
<td>72.10 (8.5)</td>
<td>68.50 (7.61)</td>
<td>68.24 (8.60)</td>
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<tr>
<td>Parents</td>
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<td></td>
<td></td>
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<tr>
<td>Age (yrs)</td>
<td>32.74</td>
<td>41.21 (6.67)*</td>
<td>35.53 (5.02)</td>
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<tr>
<td>College</td>
<td>45%</td>
<td>79%</td>
<td>69%</td>
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</table>
RESULTS

Significant differences in all measures of EMT behaviors for parent group
- Large ES 1.17-2.83.
- No differences by population, SES

No significant differences in child standardized language outcome
- Small ES for standardized assessments
- At T3 ES -.01-.30

Significant differences in child language in home observations at all time points
- Moderate to Large ES for observational measures
- At T3 ES .33-1.03

Predictors of child language outcomes
- IQ: PPVT, EVT, MLUw, IPSYN
- Disability: EVT, MLUw, PPVT
- Children with DS generally performed lower, but differences NS

Some indications of growth over time in both interventions
OUTCOMES FOR CHILDREN WITH DS AND CHILDREN WITH DD AND ASD

Adjusted PLS-4 Total Standard Scores

Post 1
Post 2
Post 3

Therapist - DD + ASD
Parent + Therapist - DD + ASD
Therapist - DS
Parent + Therapist - DS

d = .24


d = .56
Pre-Post 1 Effect size = standardized difference between pre and post scores within group across measures
CHILDREN WITH INTELLECTUAL DISABILITIES

Pre-Post Effect Size = standardized difference between pre and post scores within group across measures
The number of different words gained during intervention needed to result in an increase of one EVT standard score points at the end of intervention.

<table>
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<th>Intellectual Disabilities</th>
<th>Down Syndrome</th>
<th>Autism</th>
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<tr>
<td>Therapist-NDW</td>
<td>1.52*</td>
<td>9.00</td>
<td>1.46*</td>
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<tr>
<td>Parent-NDW</td>
<td>2.33*</td>
<td>50.00</td>
<td>1.23*</td>
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<td>Language Sample-NDW</td>
<td>3.14*</td>
<td>13.70</td>
<td>3.91</td>
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*P < .05
LANGUAGE USE AT HOME: TARGETS

Total Sample

Frequency of Unique Language Targets

Children with DS

- Parent + Therapist - Trained Probe
- Parent + Therapist - Untrained Probe
- Therapist - Trained Probe
- Therapist - Untrained Probe

- Therapist Only - Trained Probe
- Therapist Only - Untrained Probe
- Parent + Therapist - Trained Probe
- Parent + Therapist - Untrained Probe
LANGUAGE AT HOME: NUMBER OF DIFFERENT WORDS

Total Sample

Children with DS

Number of Different Words

Pre Post 1 Post 2 Post 3

Parent + Therapist - Trained Probe
Parent + Therapist - Untrained Probe
Therapist - Trained Probe
Therapist - Untrained Probe

T0 T1 T2 T3

Therapist Only - Trained Probe
Therapist Only - Untrained Probe
Parent + Therapist - Trained Probe
Parent + Therapist - Untrained Probe
DISCUSSION

Effects on parents learning and generalization

- Actual dosage of parent intervention unknown as in all parent-implemented studies
- No differences in parent outcomes by population

Better effects in Parent+ Therapist Group over time

- Differences by population
  - DS children were lower at the start and end of the study
  - DS did show generalization to home, but at a lower level
  - DS children needed more proximal evidence of learning to show an effect on distal measures

- Groups are small and heterogeneous—interpret with caution!
FACTORS RELATED TO ADAPTING EMT

For All Children with ID

Dosage may be too low for strong effects

- 36 hours over 6 mos
- Not enough high quality learning opportunities
- (joint engagement low, prompting not effective in promoting new learning)

Intervention effects vary by proximity of measure

- Standardized measures and functional outcomes differ

In Addition, For Children with DS

Low responsiveness to EMT strategies

- Low rates of requesting (few Time Delays)
- Low responsiveness to prompting
- Low rates of spontaneous imitation of new words and phrases (Less responsive to modeling)

Stepwise programming of generalization

- Monitor use of targets
- Teach targets across settings, partners
- Increase rate of communication across settings
KIDTALK TACTICS: MODEL EARLY INTERVENTION PROJECT  OSEP#H326M070004

- Children 15-36 months with early identified disabilities and their parents
- Blending EMT with Family Guided Routines Based Intervention (FGRBI)
- Collaborator: Juliann Woods, CCC-SLP, PhD Florida State University

Coaching Parents
EMT In Home Routines

Planning for transitions and continuity in communication intervention

KTTP Communication Teams

Teacher and Service Provider Training
EMT Across Settings
KTTP EARLY COMMUNICATION INTERVENTION

Coaches teach EMT in family-identified and child-preferred routines and play activities
- 24 sessions at home (1-2 x/week)

Parent coaching continues based on parent and child needs
- Adapted to child and family priorities
- Expand routines, activities
- Addresses child’s communication mode

Parent assumes role as leader, decision maker in communication teams

Plan with family to support transition to preschool services

<table>
<thead>
<tr>
<th>Routines</th>
<th>Play</th>
<th>Caregiving</th>
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<tr>
<td>Literacy</td>
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<td>Family</td>
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DS CONFERENCE OSLO 2017
### KTTP: Young Children with DS

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<tr>
<th></th>
<th>All DS</th>
<th>No health problems</th>
<th>Health problems</th>
<th>High Cognitive &gt; 60</th>
<th>Low Cognitive &lt; 60</th>
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<td>16</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>7</td>
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<tr>
<td>Percent Male</td>
<td>69%</td>
<td>63%</td>
<td>75%</td>
<td>44%</td>
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<td>Age at entry</td>
<td>21.75 months</td>
<td>20.38 months</td>
<td>23.13 months</td>
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<td>SD</td>
<td>4.29 months</td>
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<td>Mullen Cognitive</td>
<td>64.1</td>
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<td>58.38</td>
<td>72.67</td>
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<td>Range</td>
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<td>11.99</td>
<td>10.19</td>
<td>10.89</td>
<td>8.18</td>
<td>4.96</td>
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EARLY COMMUNICATION GROWTH IN RESPONSE TO INTERVENTION

Health Status

Cognition

Weighted Communication Score

Weighted Igdi Communication Score

Age in Months

Age in Months

No Health Problems

Health Problems

Cognitive Scores < 60

Cognitive Scores > 60
COMMUNICATION GROWTH IN CHILDREN WITH DS VARIES

- Age at entry
- Cognitive skills
- Health
- Secondary risks

IGDI-ECI Scores During Intervention

<table>
<thead>
<tr>
<th>Intervention Session</th>
<th>Katie</th>
<th>Julie</th>
<th>Lucy</th>
<th>Luke</th>
<th>Nathan</th>
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EFFECTS OF NATURALISTIC SIGN INTERVENTION ON EXPRESSIVE LANGUAGE OF TODDLERS WITH DOWN SYNDROME.

## CHILDREN WITH DOWN SYNDROME

<table>
<thead>
<tr>
<th>Communication Challenges</th>
<th>Adaptations</th>
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<tbody>
<tr>
<td>Low rate of symbol infused joint attention</td>
<td>Model communication in joint engagement episodes</td>
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<tr>
<td>Poor articulation skills</td>
<td>Teach sign + word as mode</td>
</tr>
<tr>
<td>Poor auditory memory/ strong visual skills</td>
<td>Model words + sign</td>
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<tr>
<td>Poor generalization across partners, settings</td>
<td>Teach with multiple partners, settings, activities</td>
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<tr>
<td>Study Component</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
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<tr>
<td>Design</td>
<td>Multiple Baseline Single Subject</td>
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| Intervention    | EMT Words + Signs  
24 sessions at home  
Therapist + Parent |
| Measures        | Pre, Post, ever 3 months  
Standardized, observational, parent report  
Use of signs |
| Participants    | Gender: 1 male, 2 female  
Average age: 25 months (2.83)  
Average Mullen: 69 (8.04)  
Average PLS-Total Standard Score: 67.25 (5.32) |
INTERVENTION VARIATION

EMT Words + Signs

Simplify and reduce prompting

Parent training after responding to prompts was established with therapist
CHILDREN WITH DOWN SYNDROME
EFFECTS ON SIGN
WRIGHT, KAISER, REIKOWSKY & ROBERTS 2013

Number of Different Unprompted Signs

Ryan

Erin

Jay

Gretchen

DS CONFERENCE OSLO 2017  37
EFFECTS ON WORD PRODUCTION

Total Words and Number of Different Unprompted Words

Ryan

Erin

Jay

Gretchen

DS CONFERENCE OSLO 2017 38
THREE CURRENT ADAPTATIONS FOR CHILDREN WITH DS

1. Phenotypic Specific Communication Intervention: RCT

2. Dialogic Reading with AAC and peers

3. Direct instruction with AAC building word combination skills
PHENOTYPIC SPECIFIC COMMUNICATION INTERVENTION FOR CHILDREN WITH DOWN SYNDROME

(KAISER, KASARI & WRIGHT, IN PROGRESS)

Blend EMT with JASPER (J-EMT) to teach symbolic play, symbol infused joint engagement and emotion regulation

- Similar to an adapted intervention for children with ASD (Kasari, et al, 2014)
- Supports transition from prelinguistic to linguistic communication

Use iPad/SGD as an AAC System

- Support foundations for word combinations by arrangement of array, use of expansions
- Expanded noun and verb vocabulary that are activity specific

Increase dosage of therapist intervention component

- 2 sessions per week with child only (45 minutes each); total of 4 sessions per week
- Based on previous outcomes for DS children (Yoder et al, 2016)

Train parents across play, social and activity routines at home
PHENOTYPIC SPECIFIC COMMUNICATION INTERVENTION FOR CHILDREN WITH DOWN SYNDROME

Randomized Clinical Trial

72 children with DS
- 30-42 months
- 18 months cognitive on Mullen
- MLU less than 1.25 (single word users)
- About 50% low SES, Spanish speaking

Parent + Therapist J-EMT
- 48 total sessions, 4/week, 45 minutes
- 2 therapist only and 2 parent/therapist at home
RQ1. Does implementing an aided AAC modeling intervention during small group instruction increase symbol identification by children with DS?

RQ 2. Does implementing an aided AAC modeling intervention during small group instruction increase the rate of symbolic communication by children with DS?
AAC MODELING INTERVENTION COMPONENTS

Read, Ask, Answer, Prompt (RAAP) Dialogic Reading Strategy

**AAC modeling:** demonstrating use of child’s AAC system while simultaneously speaking word or words indicated by the selected symbols

**AAC Expansions:** Interventionist restated child’s utterance (spoken or generated on the iPad) and added 1-2 new words, and modeled the corresponding graphic symbols representing the new words on the child iPad.

**AAC Recasts:** interventionist replaced an inaccurate word expressed by the child with an accurate word and (b) selecting the graphic symbol for the replaced word on the child’s AAC system
AAC MODELING DURING DIALOGIC READING USING READ, ASK, ANSWER, PROMPT

Read + Model Target Vocabulary on AAC
“I see TADPOLES swim”  {Press TADPOLE on iPad}

Ask a Question
“What is that?”

Wait for child to respond with an Answer.

Prompt the child’s answer on AAC
“Say Tadpole”  ” {Press TADPOLE on iPad}
RQ (1) DOES IMPLEMENTING AN AIDED AAC MODELING INTERVENTION DURING SMALL GROUP INSTRUCTION INCREASE SYMBOL IDENTIFICATION BY CHILDREN WITH DS?
RQ (2) DOES IMPLEMENTING AN AIDED AAC MODELING INTERVENTION DURING SMALL GROUP INSTRUCTION INCREASE RATE OF SYMBOLIC COMMUNICATION BY CHILDREN WITH DS?
Pre-teach expressive labeling of agents, action verbs and agent+ action combinations using direct instruction before naturalistic teaching

- Teach task persistence, response to prompts, prompt sequence
- Teach multiple responses to single picture stimuli (agents, action verbs)
- Teach agent + action in matrix training format to promote generative word combinations
- Use iPad to provide option for easier motor response in prompt sequences
- Incorporate multiple approaches to support motivation: tangibles, preferred activities, dense reinforcement schedule, pacing, breaks; as needed by the child
Research Questions

RQ1. Is an augmentative assisted direct instruction intervention effective at increasing production of sets of objects, actions, and action+object combinations on a Speech Generating Device (SGD)?

RQ2. Do effects generalize to novel stimuli (i.e., toys) in a semi-structured generalization assessment?

RQ3. Do results maintain over time?
PROCEDURES

- 5 year old child with DS
  - SGD user (iPad with Proloquo2go)
  - MCDI parent report: 175 productive words
  - Language Sample: 11 SGD words, 5 spoken words, no word combinations

Direct instruction across 9 exemplars for agents, actions, agents+ actions
  - Pictures as stimuli
  - Trials to criterion for each picture
  - Trials teaching discrimination between pictures
  - Systematic prompt fading across trials within session
Object

Title

Axis Title

Percent Correct Responses

Action

Action + Object

Sessions
RESULTS

RQ1: The intervention increased accurate use of agents, actions, agent+action

RQ2: Results maintained over time
   • 4 weeks following intervention

RQ3: Generalization to objects in a less structured setting
   • Lower levels of generalization for action+object combinations
CHILDREN WITH DS: HOW MUCH CAN WE CLOSE THE GAP?
WHAT HAVE WE LEARNED

Children with DS present specific challenges in intervention that appear to be generally related to their phenotypic characteristics

Adaptations of interventions that may improve outcomes:

1) Train partners to be responsive to communication to model, expand and prompt new language
2) Include an alternative mode plus spoken language; teach use of the mode
3) Teach symbolic play to increase joint engagement with objects
4) Provide direct instruction for prerequisite skills (sustained attention, imitation, response to prompts, use of SGD) and specific language skills if needed
NEXT GENERATION OF EARLY LANGUAGE INTERVENTION RESEARCH FOR CHILDREN WITH DS

**Experimental comparisons of adaptations**
- Mode: learning, generalized use, promotion of spoken language
- Dosage, context, timing, sequence of skills
- Blended direct and naturalistic teaching vs single approach
- Adaptive research designs
  - Benchmarks for treatment response, determine sequences of treatments, optimizing treatments
- **Fine grained analysis of child responding to treatment components**
  - What are the active ingredients for children with DS?
  - What is the specific dosage of active ingredients being received?
  - Will child outcomes improve with increases in “received” dosage?
  - What underlying language learning processes change with intervention?

**Multi-partner/multi-setting interventions for generalized change in communication**
- Assess generalization as a primary outcome
- Systematic generalization programming across distal measures, settings, and people
REFERENCES


THANK YOU!

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This talk and supporting materials will be posted at http://vkc.mc.vanderbilt.edu/kidtalk/

A handout summarizing strategies for practitioners will be included, along with key articles