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# Speech output technologies in communication interventions for individuals with Autism Spectrum Disorders

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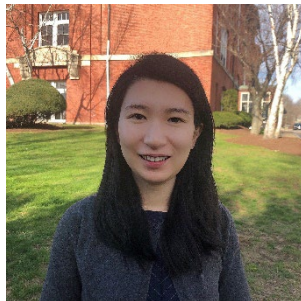
# Acknowledgements



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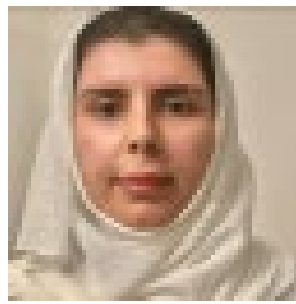
**Mimi LaValley**  
UT at Austin



**Ralf Schlosser**  
Northeastern U



**Devender Banda**  
Texas Tech U



**Nouf Alzrayer**  
King Saud U

**AAC Lab at UT Austin**

<https://slhs.utexas.edu/research/augmentative-and-alternative-communication-lab>

# Agenda

- ❖ Synthetic speech perception and auditory perception in individuals with ASD.
- ❖ Interventions using speech output technologies - systematic and scoping reviews.
- ❖ Current intervention research on social communication with individuals with ASD from UT Austin AAC Lab.

# Section 1

- ❖ **Synthetic speech perception and auditory perception in individuals with ASD.**



# Speech Output Technologies



- ❖ Increased availability and use of SGDs and mobile technologies with AAC specific apps by individuals with severe communication impairment.
- ❖ High tech AAC, specifically mobile technologies with AAC-specific apps, are relatively preferred by individuals with ASD compared to low tech AAC modalities (Lorah et al., 2014).
- ❖ Most SGDs use text-to-speech synthesis in which alphabets, digits, words, and graphic symbols are entered from an input, such as keyboard/switch/touch screen/eye gaze and are converted into a speech waveform using a set of algorithmic rules (Koul, 2011).

# Speech Output Technologies

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Digitized speech is produced by converting a recorded human voice into digits by sampling the speech waveform at equal intervals and storing it as a series of numbers (Schlosser & Koul, 2015).



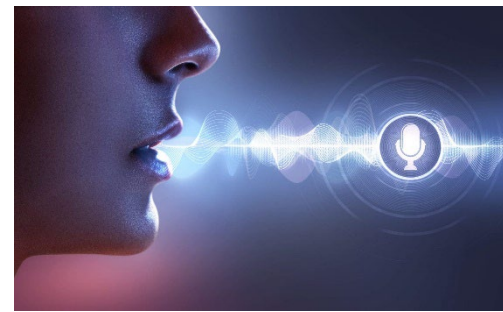
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Synthetic speech involves the production of an unrestricted amount of spontaneous speech by converting alphabets, digits, words, and sentences into speech output by utilizing a set of algorithmic rules (Schlosser & Koul, 2015).



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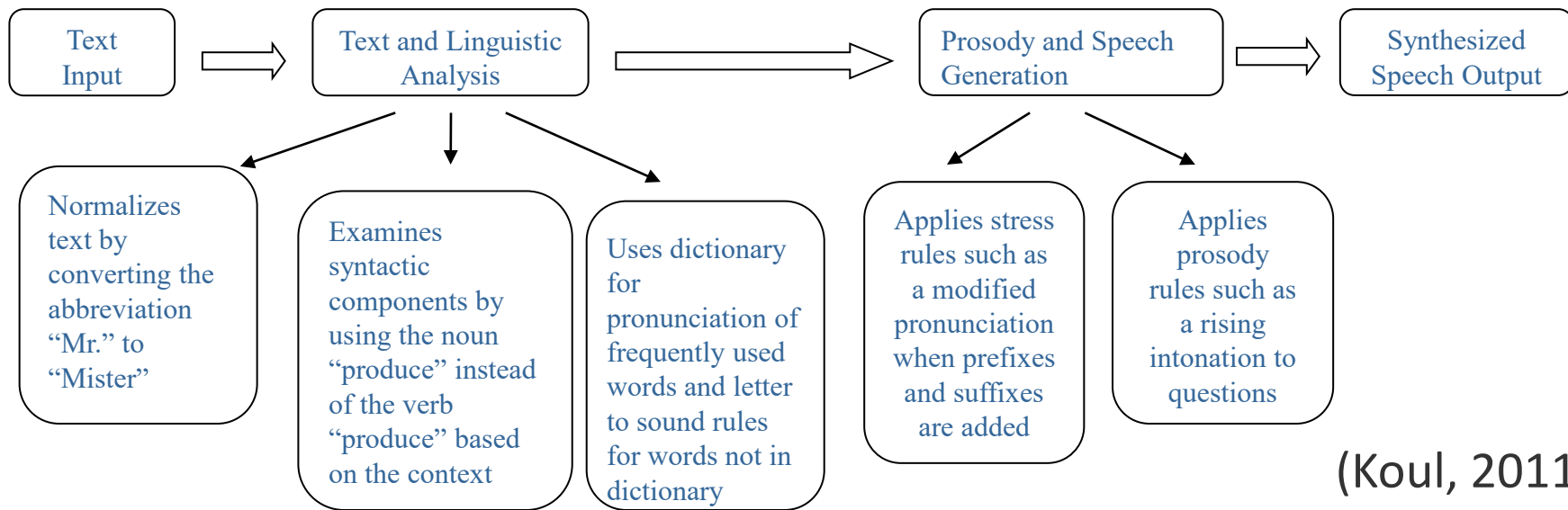
Personalized text to speech voice that combines AAC user's voice with a donor voice and creates a blended voice and reflects the user's identity (Patel, 2015).



# Text-to-speech synthesis

A diagram of text-to-speech synthesis using the example sentence

*Mr. Jones buys fresh produce from the market every day?*



(Koul, 2011)

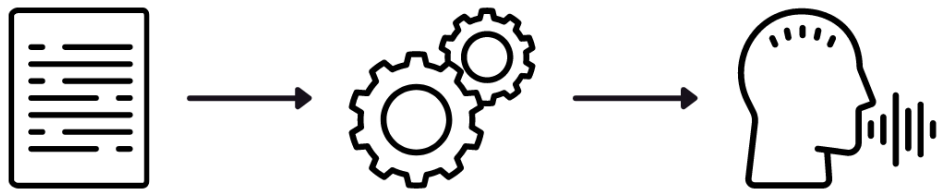
# Speech perception and language impairment

- ❖ About 60% of children on the autism spectrum are diagnosed with a language impairment.
- ❖ About 30-40% plateau at minimal or no spoken language (e.g., Anderson et al., 2007; Tager-Flusberg & Kasari, 2013; Thurm et al., 2015).

# Speech perception and language impairment

- ❖ Systematic Review (Key & Slaboch, 2021)-Electrophysiology data (Brain potentials)
- ❖ Extensive support for the **Reduced Social Motivation Theory** (Chevallier et al., 2012; Dawson, 1991; Dawson et al., 2005)
- ❖ Auditory Dysfunction-Limited and inconsistent evidence for **Atypical Early Sensory Processing of Speech Stimuli**
- ❖ Sensory responses to basic speech stimuli are preserved
- ❖ Atypical speech processing observed with complex stimuli (e.g., multisyllabic stimuli) and tasks (e.g., semantic comprehension)
- ❖ Significant variability across participants' age, preference for social stimuli, vocabulary size, language ability, and level of adaptive functioning

# Synthetic Speech



High quality synthetic speech and natural speech are not significantly different on measures of intelligibility or comprehension, but synthetic speech requires additional processing resources (e.g., memory, attention) that may limit its effectiveness for information transfer in conversational exchanges.

# Synthetic Speech Perception

- ❖ Frequently, comorbid diagnoses of Intellectual Disability (ID) and Autism Spectrum Disorder (ASD).
- ❖ 31% of children with ASD have an intellectual disability (intelligence quotient [IQ] <70), 25% are in the borderline range (IQ 71–85), and 44% have IQ scores in the average to above average range (i.e., IQ >85).

(<https://www.autismspeaks.org/autism-diagnosis-criteria-dsm-5>)

# Synthetic Speech Perception

Koul, R. K., & Hester, K. (2006). Effects of repeated listening experiences on the recognition of synthetic speech by individuals with severe intellectual disabilities. *Journal of Speech-Language and Hearing Research, 49*, 47-57.

## ❖ Variables

- ❖ Groups (severe intellectual impairment (n = 14) and matched controls (n = 14))
- ❖ Listening sessions (3)
- ❖ Type of stimuli (novel & repeated)

## ❖ Synthetic Speech: DECtalk

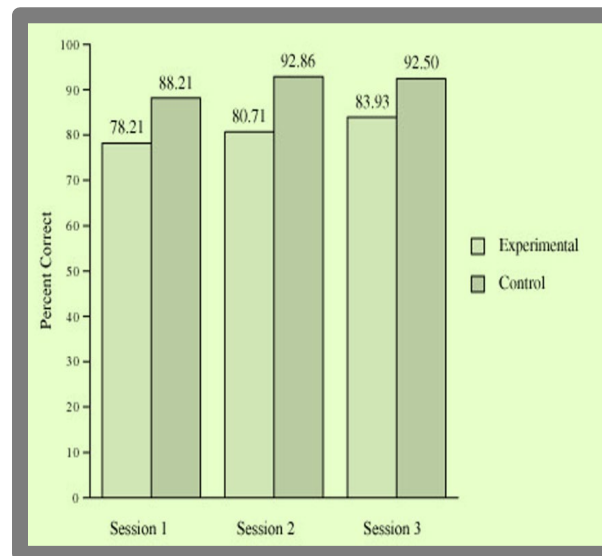
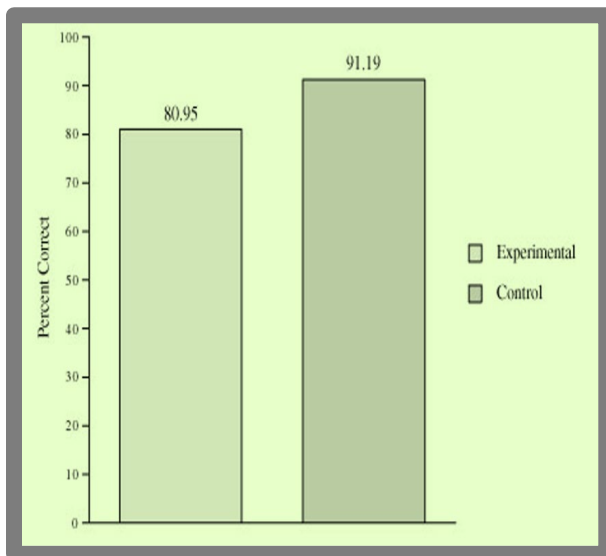
## ❖ Design: Quasi-experimental between group design

## ❖ Analysis: 2 X 3 X 2 repeated measures ANOVA

# Synthetic Speech Perception

Koul, R. K., & Hester, K. (2006). Effects of repeated listening experiences on the recognition of synthetic speech by individuals with severe intellectual disabilities. *Journal of Speech-Language and Hearing Research, 49*, 47-57.

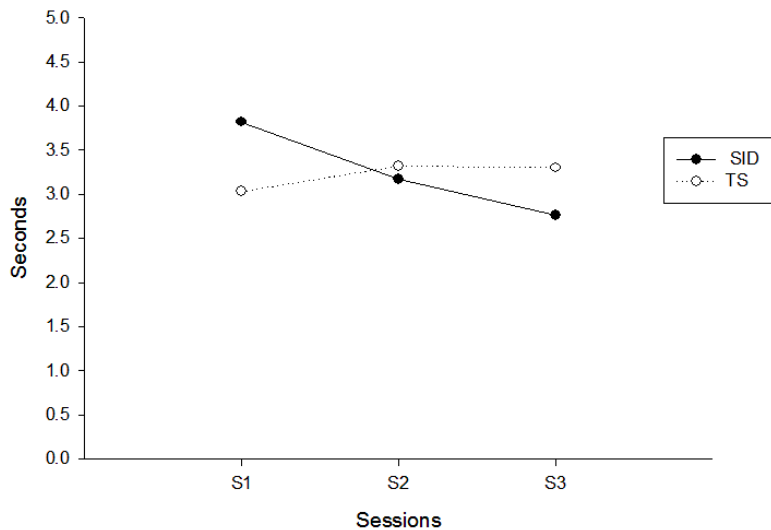
Mean Word  
Identification  
(All sessions)



Mean Word  
Identification  
(Across Sessions)

# Synthetic Speech Perception

Koul, R. K., & Hester, K. (2006). Effects of repeated listening experiences on the recognition of synthetic speech by individuals with severe intellectual disabilities. *Journal of Speech-Language and Hearing Research, 49*, 47-57.



Mean Word Identification  
Latencies

# Synthetic Speech Perception-Clinical Implications

- ❖ Accuracy decreases and latency of responses to synthetic speech stimuli increases as the stimuli or the listening task become more complex.
- ❖ Individuals with intellectual and/or language impairments experience greater difficulties in processing synthetic speech than their typical counterparts.
- ❖ Training allows both individuals with disabilities and typical individuals to identify synthetic speech with increased accuracy and speed.



# Effects of Speech Output Technologies on Communication Outcomes for Individuals with Autism Spectrum Disorders

- ❖ Schlosser, R. W., & Koul, R. K. (2015). Speech output technologies in interventions for individuals with autism spectrum disorders: A scoping review. *Augmentative and Alternative Communication*, 31(4), 285-309. <https://doi.org/10.3109/07434618.2015.1063689>
- ❖ Muharib, R., & Alzrayer, N. M. (2018). The use of high-tech speech-generating devices as an evidence-based practice for children with autism spectrum disorders: A meta-analysis. *Review Journal of Autism and Developmental Disorders*, 5(1), 43-57. <https://doi.org/10.1007/s40489-017-0122-4>

# Effects of Speech Output Technologies on Communication Outcomes for Individuals with Autism and Other Developmental Disabilities

Schlosser, R. W., & Koul, R. K. (2015). Speech output technologies in interventions for individuals with autism spectrum disorders: A scoping review. *Augmentative and Alternative Communication, 31*(4), 285-309.

## Purpose

- ❖ Map the research evidence on the effectiveness of AAC interventions using speech output technologies for individuals with ASD
- ❖ Identify gaps in the existing literature
- ❖ Posit directions for future research

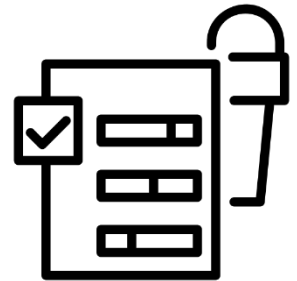
# How has speech output been studied?

- ❖ Effects of speech output technologies as part of a treatment package
- ❖ Comparison of one condition involving a speech output technology with other AAC modalities
- ❖ Comparison of speech output with absence of speech output
- ❖ Comparison of digitized and synthetic speech or high versus low intelligibility of the speech output

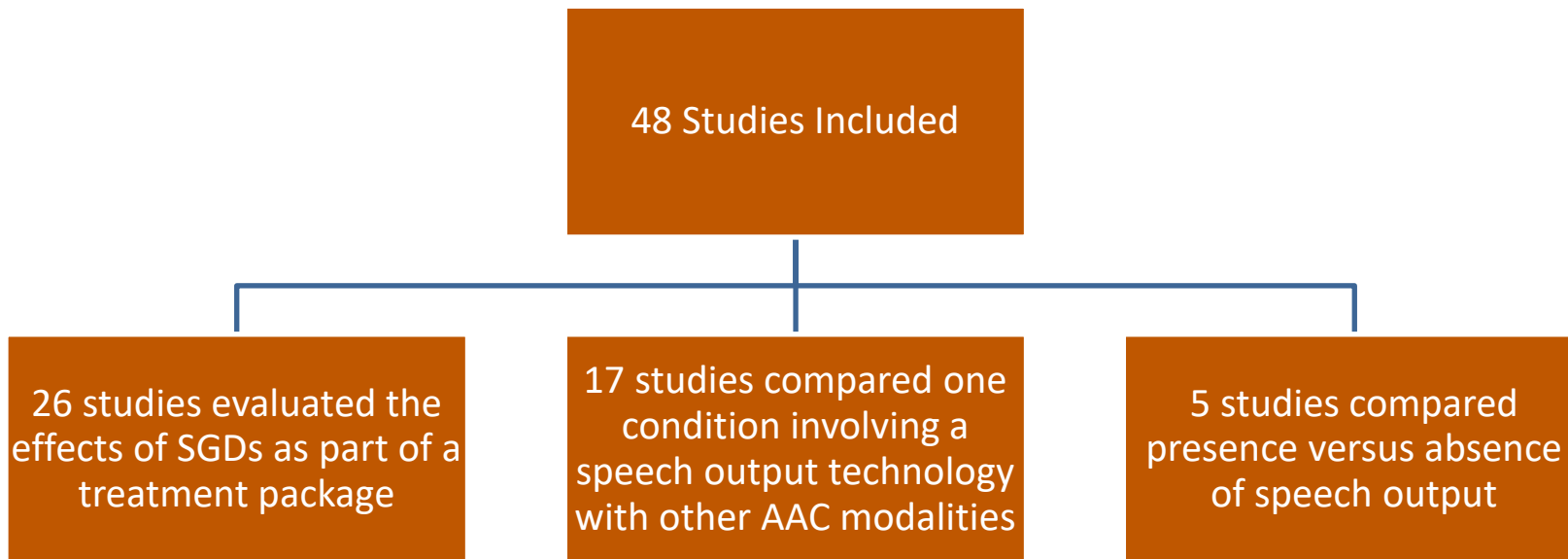
(Schlosser & Koul 2015)

# Inclusion Criteria

- ❖ For single-case experimental designs (SCEDs), only data for participants with ASD were included
- ❖ If the study offered group-level data and/or analyses, all participants had to be classified as having ASD
- ❖ Speech output had to be studied as
  - part of a treatment package
  - part of a comparison of treatment packages in which at least one condition involved speech output
  - an independent variable
- ❖ Fourth, the study needed to employ either
  - SCED capable of exhibiting a functional relationship
  - Quasi-experimental group design (e.g., RCT)
- ❖ Published in a peer-reviewed journal

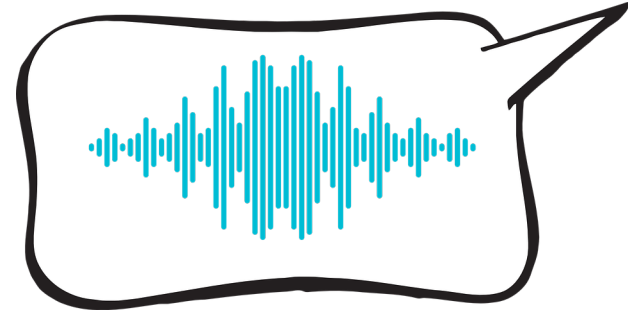


# Results



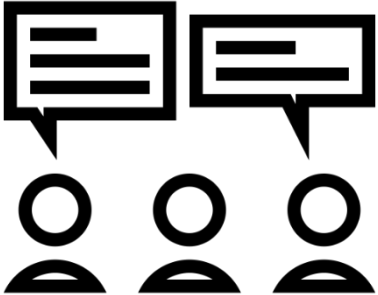
# Speech Output Technologies

- ❖ Treatment packages involving speech output
  - Majority included a dedicated SGD
  - More recent studies reported on the use of mobile technologies with AAC -specific apps
  - Greater use of digitized speech than synthetic speech
- ❖ Comparison of a treatment package with a speech output technology to one or more conditions without speech output technologies
  - Majority utilized mobile technologies with AAC-specific apps
  - Greater use of synthetic speech than digitized speech
- ❖ Presence versus absence of speech output
  - Exclusively studied speech output from dedicated SGDs
  - Greater use of synthetic speech than digitized speech



**Most** studies failed to report on the specific synthetic voice or speaker used to generate the digitized speech.

# Discussion



Dependent  
Variables

Participants

Effectiveness

Quality  
Appraisal

Speech  
Output  
Technologies

# Dependent Variables

- ❖ Speech output technologies as part of a treatment package
  - Requesting behaviors, Reduction of challenging behaviors
- ❖ Comparison of a treatment package with a speech output technology to one or more conditions without speech output technologies
  - Requesting behaviors
- ❖ Presence versus absence of speech output
  - Range of behaviors including spelling, speech production, and requesting

# Participants

- ❖ 187 participants across the 48 studies (ages 3 -21)
- ❖ Majority of studies focused on elementary aged children
- ❖ There is a clear lack of research with very young children, high school-age students, and adults

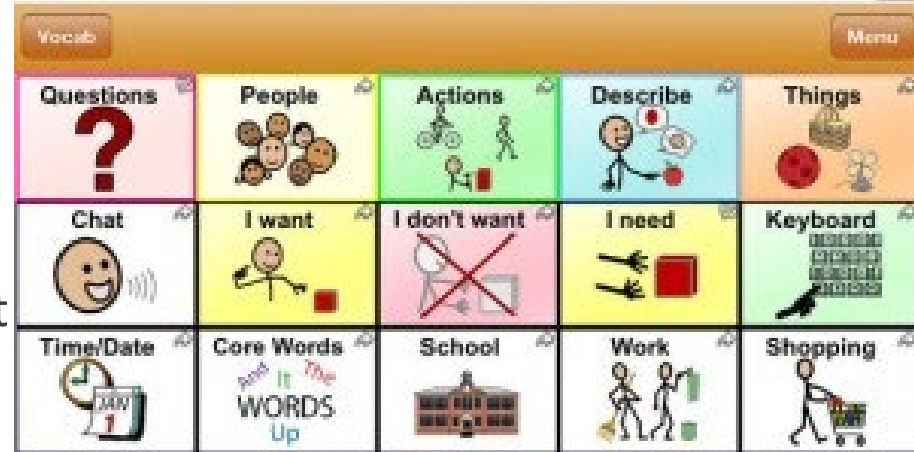
# Effectiveness & Quality Appraisal

- ❖ A robust number of studies showed that persons with ASD can benefit from speech output technologies that address increasing requesting and other communicative behaviors and reducing challenging behaviors.
- ❖ Many comparative studies involving one treatment package with speech output were deemed inconclusive due to fatal flaws in comparative designs.
- ❖ Many studies that compared the presence versus absence of speech output had an insufficient number of demonstrations of experimental control.

# Conclusions

- ❖ Majority of studies evaluated the effectiveness of treatment packages involving speech output technologies.
- ❖ Interventions with speech output technologies is successful in teaching requesting behaviors.
- ❖ Some high-quality studies support the use of speech output technologies as part of a functional communication training to replace challenging behaviors.
- ❖ Future focus on social communicative behaviors.

I want more a drink a snack



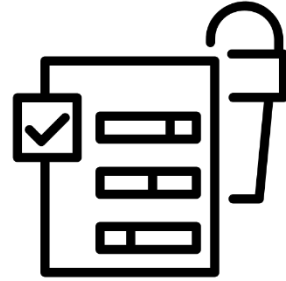
# The Use of Speech-Generating Devices in Interventions for Children with Autism Spectrum Disorders

Muharib, R., & Alzrayer, N. M. (2018). The use of high-tech speech-generating devices as an evidence-based practice for children with autism spectrum disorders: A meta-analysis. *Review Journal of Autism and Developmental Disorders*, 5(1), 43-57.

## Purpose

- ❖ Meta-analysis of single-case studies that used high-tech SGDs to develop communication skills in children with ASD from birth to age 8
- ❖ Evaluate the quality of studies and determine the level of evidence

# Inclusion Criteria



- ❖ Single-case research design that demonstrated an experimental control.
- ❖ Included participants between the birth and 8 years who were diagnosed with ASD.
- ❖ Evaluated the effects of high-tech SGDs.
- ❖ Targeted functional and/or social communication skills (i.e., requesting, labeling and naming, and answering questions) as the primary measure.

# Results

20 studies included with  
54 participants (age  
range 3-8 years)

Settings included school,  
clinic, or home

Intervention sessions in  
17 studies were  
conducted in a one-on-  
one discrete trials  
format

90% of studies used  
either an iPad or iPod

Proloquo2Go was the  
most frequently used  
AAC application

90% of studies targeted  
requesting behaviors

# Effects of High-Tech SGDs

13 studies indicated that high-tech SGDs showed a strong effect on teaching communication skills



4 studies revealed high-tech SGDs as moderately effective



1 study indicated that high-tech SGDs had a weak effect

# Conclusions

Based on Improvement Rate Difference (IRD) effect size scores

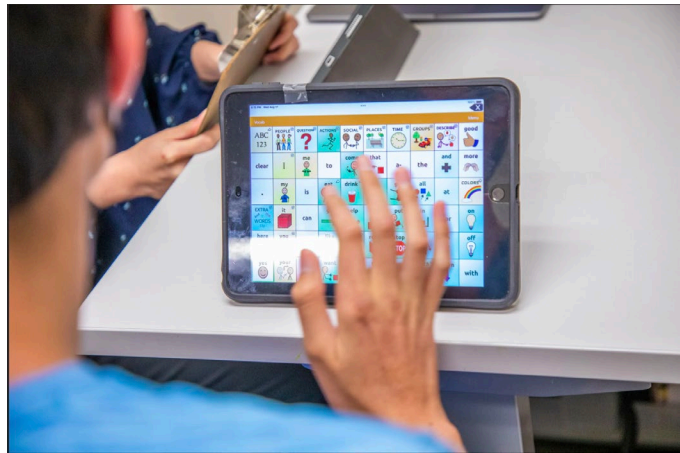
- ❖ Strong effects for single-step requesting, multi-step requesting, naming, and answering questions behaviors
- ❖ Weak effects for vocal production

# Future Directions

- ❖ More high-tech SGD based studies in naturalistic settings and contexts
- ❖ Generalization of communication skills across settings and/ or communicative partners
- ❖ Social validity measures
- ❖ More studies targeting communicative behaviors other than requesting

# Section 3

- ❖ Synthetic speech perception and auditory perception in individuals with ASD.
- ❖ Interventions using speech output technologies - systematic and scoping reviews.
- ❖ **Current intervention research on social communication with individuals with ASD from UT Austin AAC Lab.**



# Current Research from UT-Austin

## AAC Lab

- ❖ Chavers, T. N., Morris, M., Schlosser, R. W., & Koul, R. (2021). Effects of a systematic augmentative and alternative communication intervention using a speech-generating device on multistep requesting and generic small talk for children with severe autism spectrum disorder. *American Journal of Speech-Language Pathology*, 1-16. [https://doi.org/10.1044/2021\\_AJSLP-20-00353](https://doi.org/10.1044/2021_AJSLP-20-00353)
- ❖ Chavers, T.N. (2021 – ). Effects of aided AAC modeling and systematic instruction on social communicative behaviors between children with severe autism disorder and their typically developing peers.

# Social Communication

- ❖ Majority of studies have focused on teaching MV individuals with severe ASD to **request preferred items** from an adult (e.g., Alzrayer et al., 2014; Ganz et al. 2017; Lorah et al., 2021; Schlosser & Koul, 2015).
- ❖ Requesting is a fundamental skill for communicators, it is a small percentage of what most individuals communicate daily (Ganz et al., 2017).
- ❖ **Small talk** is a type of conversational exchange used for initiating and maintaining conversation.
- ❖ Generic small talk refers to communicative acts that do not contain specific shared information and is used with a variety of different communication partners ( Chavers et al., 2021).  
E.g., “good story,” ”this is awesome”.
- ❖ Ball et al. (1999) revealed that approximately **50%** of typically developing preschool children’s utterances in both home and school settings were classified as **generic small talk** whereas only **18%** of their utterances were classified as **requests**. Furthermore, **39%** of utterances produced by typically developing adults in daily conversation were classified as **small talk**.

1. Chavers, T. N., Morris, M., Schlosser, R. W., & Koul, R. (2021). Effects of a systematic augmentative and alternative communication intervention using a speech-generating device on multistep requesting and generic small talk for children with severe autism spectrum disorder. *American Journal of Speech-Language Pathology*, 1-16.

[https://doi.org/10.1044/2021\\_AJSLP-20-00353](https://doi.org/10.1044/2021_AJSLP-20-00353)

# Purpose

- ❖ To determine the effectiveness of systematic instruction in facilitating multistep requesting and social communication interactions between individuals with severe ASD and their communication partners.
- ❖ Specifically, the following research questions were addressed.
- ❖ What is the effect of systematic instruction using an SGD on
  - ❖ multi-step requesting preferred activities with experimenters and familiar communication partners?
  - ❖ engaging in **generic small talk behaviors** with experimenters and familiar communication partners?
  - ❖ the generalization and maintenance of untrained requesting and generic small talk behaviors with experimenters and familiar communication partners?

(Chavers et al., 2021)

# Participants

- ❖ Three participants between the ages of 7 and 9 years
- ❖ Inclusion criteria
  - a diagnosis of severe autism spectrum disorder
  - limited to no functional communication skills
  - no physical or sensory impairments that could interfere with operating an SGD
  - limited history of using an SGD for communication purposes

(Chavers et al., 2021)

# Clinical and demographic characteristics of the participants

Participants	Age	Gender	CARS -2			TONI-4		ROWPVT-4		Familiar Communication Partner
			Standard Score	Percentile	Severity	Standard Score	Percentile	Standard Score	Percentile Rank	
Joseph	9;1	M	42	69	Severe	95	37	<55	<1	Mother
Eleanor	9;7	F	47	86	Severe	75	5	<55	<1	ABA Therapist
Wade	7;1	M	37	42	Severe	68	2	<55	<1	Teacher

(Chavers et al., 2021)

# Study Design

- ❖ A multiple baseline across behaviors design replicated across participants was used to evaluate intervention and maintenance.
- ❖ A post-treatment multiple-generalization probes design was used to assess generalization to untrained preferred items and communication partners.
- ❖ The sessions were implemented in four phases: baseline, intervention, generalization, and maintenance.

(Chavers et al., 2021)

# Preference Assessment

## ❖ Two parts

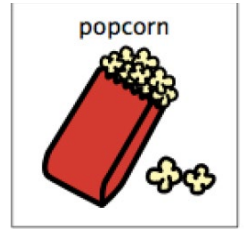
- Phone call and/or meeting with parents and teachers
- Free operant procedure (Roane, Vollmer, Ringdahl, & Marcus, 1998)
  - Place desired activities or items and observe what child would reach for the quickest
  - Three sessions lasting 10-15 minutes over a three-day period

(Chavers et al., 2021)

# Familiar Communication Partner Training

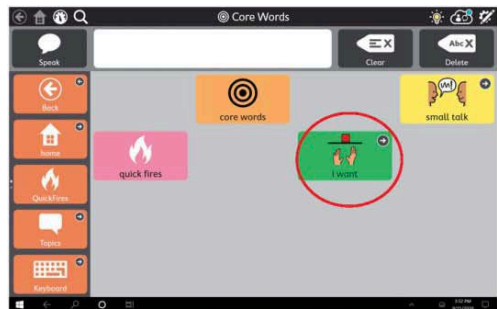
- ❖ Instructions on implementing the baseline, generalization, and maintenance probes.

# Symbol Identification Task

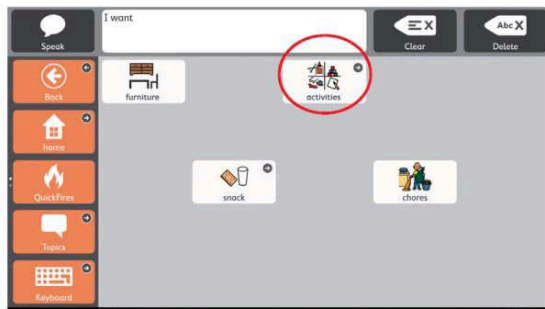


- ❖ Picture Communication Symbols (PCS) and photographs were used to represent each participant's top five preferred items and five non-preferred items.
- ❖ Four PCS or photographs randomly selected at the beginning of the session
- ❖ Participant was asked to point to symbol
- ❖ All symbols were correctly identified before proceeding to the baseline phase of the study.

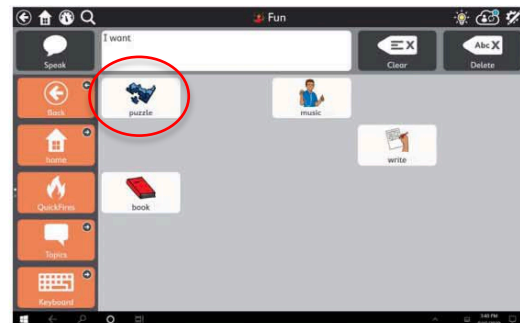
# An example of steps followed by Joseph to request a preferred activity



I want



activities

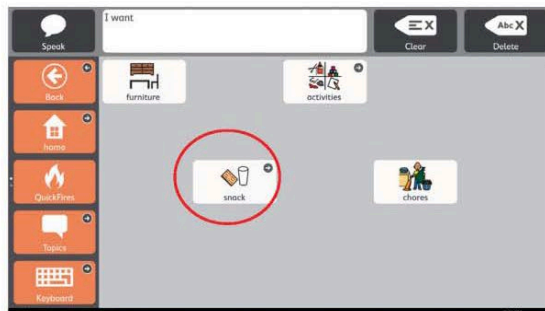


puzzle

# An example of steps followed by Joseph to request a preferred snack



I want



snack

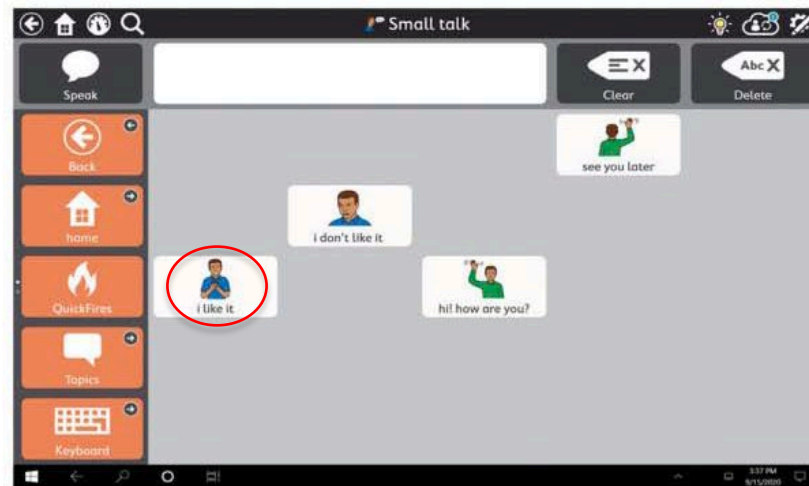


popcorn

# An example of steps followed by Joseph to engage in generic small talk



small talk



I like it

# Baseline

- ❖ Implemented by investigator and familiar communication partners
- ❖ SGD placed in front of the participant
- ❖ Time interval between prompts=30 seconds
- ❖ Participants typically did not react or use the SGD in this phase



(Chavers et al., 2021)

# Intervention



- ❖ The intervention phase was identical to the baseline phase, except the investigator implemented systematic instruction using SGD
- ❖ Error correction procedure
- ❖ Each session had 4 treatment probes targeting each dependent variable. Only experimenter was involved.
- ❖ No cues were given during the probes

(Chavers et al., 2021)

# Generalization

- ❖ One week following last intervention session
- ❖ Identical to the baseline for both multistep requesting and conducting small talk behaviors, except that the familiar communication partner probed the dependent variables

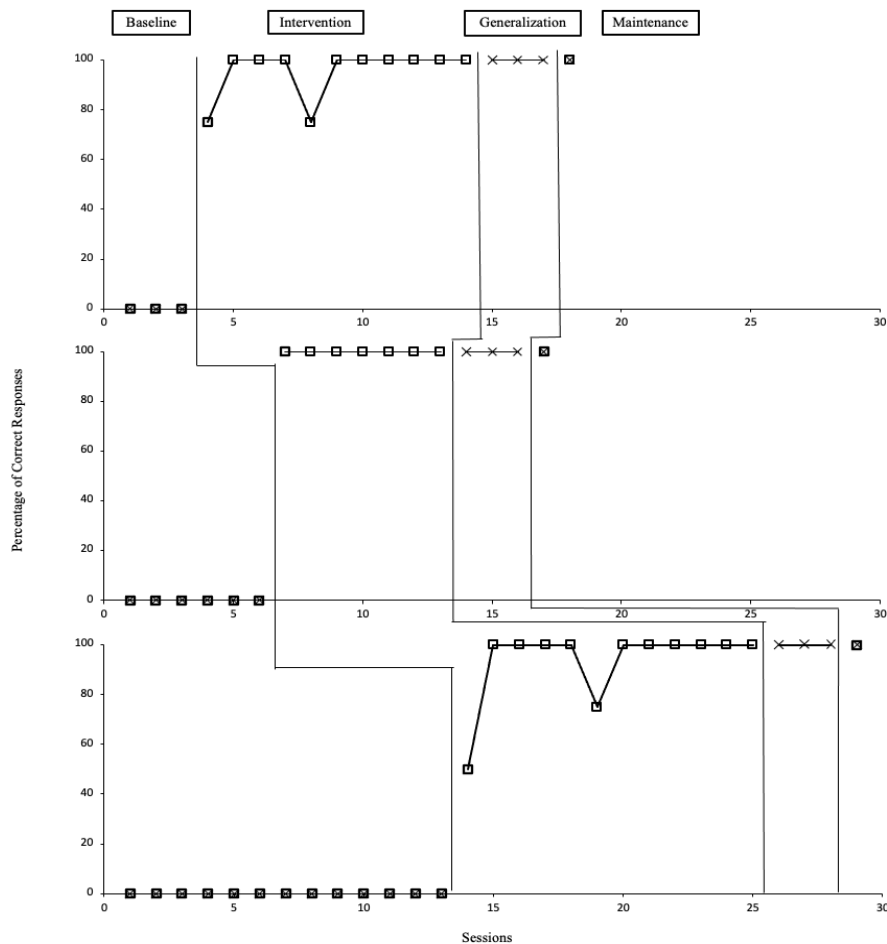
(Chavers et al., 2021)

# Maintenance

- Maintenance sessions were implemented by the investigator and the partner. This was held two weeks after the generalization phase was completed.

# Results

- ❖ Nonoverlap of All Pairs (NAP) with a 95% confidence interval (Parker & Vannest, 2009) was calculated.
- ❖ Visual Analysis
- ❖ IOA and Treatment Integrity-100%





# Multistep requesting

Joseph  
 NAP= 1 (strong effect) with 95% CI (.4605, 1)

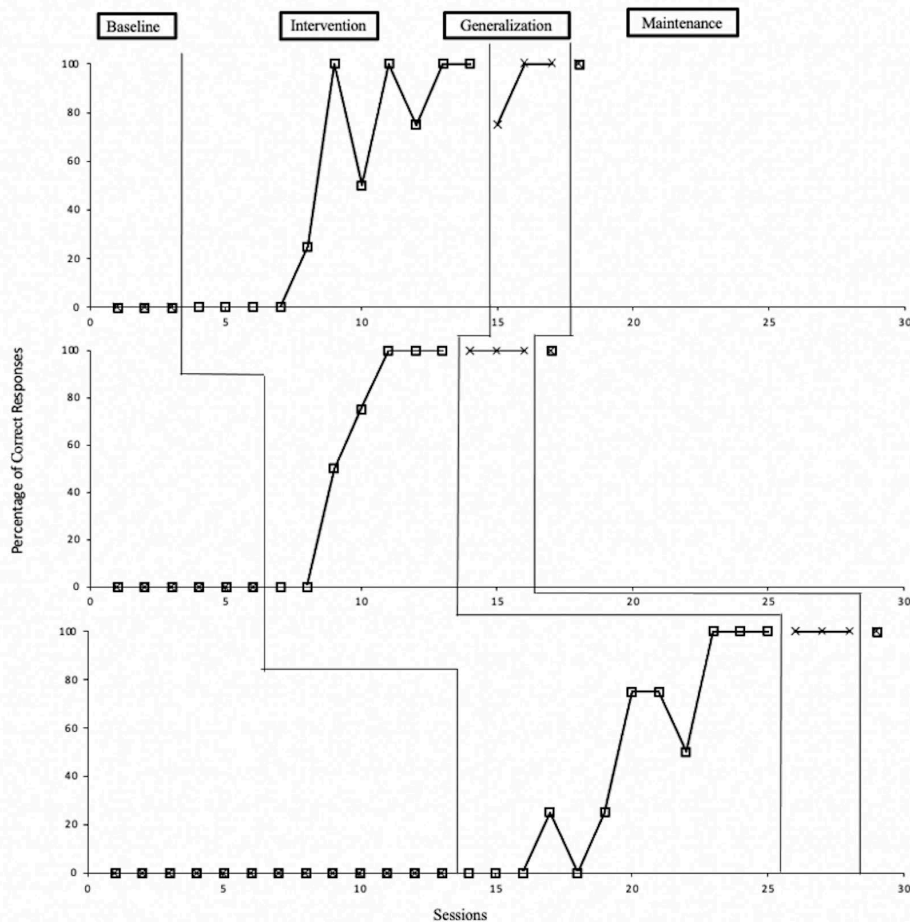
Eleanor  
 NAP= 1 (strong effect) with 95% CI (.538, 1)

Wade  
 NAP= 1 (strong effect) with 95% CI (.6733, 1)

 Requesting with the Experimenter  
 Requesting with Familiar Communication Partner

(Chavers et al., 2021)

# Small Talk



Joseph

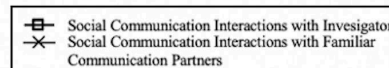
NAP= .8182 (medium effect) with 95% CI (.2787, 1)

Eleanor

NAP= .8571 (medium effect) with 95% CI (.3952, 1)

Wade

NAP= .8333 (medium effect) with 95% CI (.5067, 1)



(Chavers et al., 2021)

# Conclusions

- All three participants acquired the ability to use an SGD to make multistep requests for preferred snacks or activities and engage in generic small talk with the experimenter.
- All participants generalized the acquired communicative behaviors to request untrained preferred snacks and activities and engage in generic small talk with familiar communication partners.

(Chavers et al., 2021)

2. Chavers, T.N. (2021 – ). Effects of aided AAC modeling and systematic instruction on social communicative behaviors between children with severe autism disorder and their typically developing peers.

# Purpose

To investigate the effectiveness of systematic instruction and aided modeling using an SGD on

- ❖ the acquisition and maintenance of socio-communicative behaviors – specifically initiating requests, answering questions, and commenting – with an experimenter.
- ❖ the generalization of socio-communicative behaviors from experimenters to typically developing peers.

# Participants

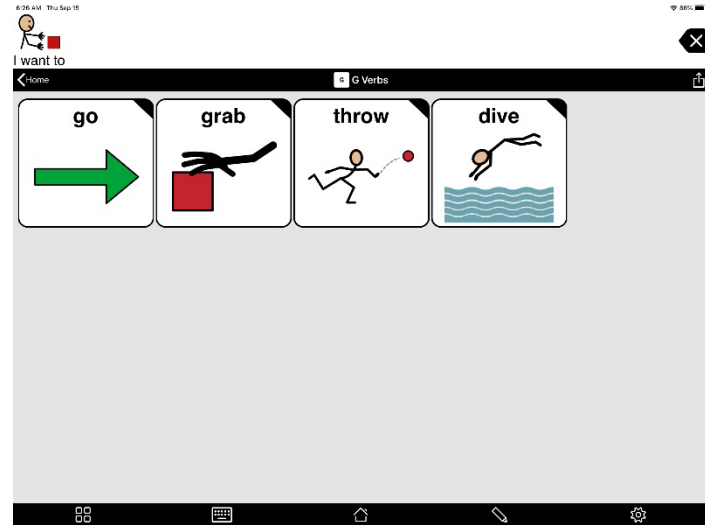
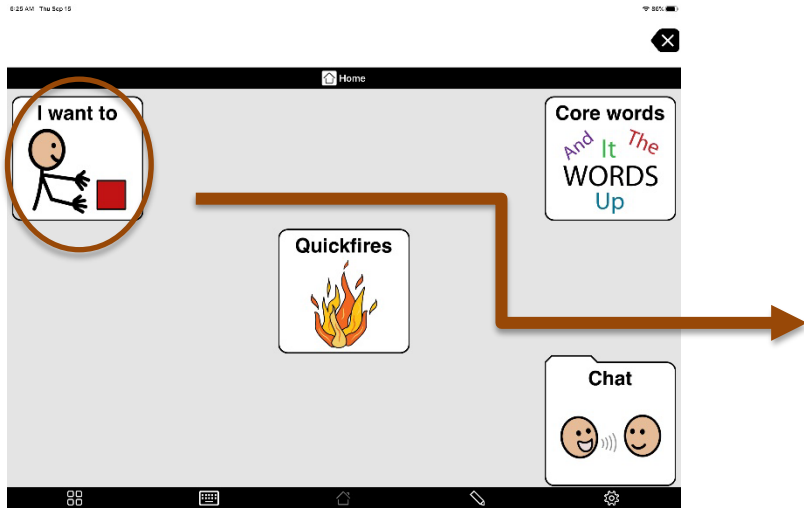
- ❖ Eight Children
  - Between ages of 3 - 10 years
  - Diagnosis of severe ASD
  - less than 10 functional words
  - no physical or sensory impairments that would serve as a barrier to operating an SGD
- ❖ Eight chronologically age-matched peers
  - age-appropriate social skills
  - consistent school attendance
  - willingness to participate
- ❖ Two public schools outside of Austin, Texas

Participants	Ajay	Matthew	John	Derek	Grace
Age	8;4	6;11	9;7	6;5	4;10
Gender	Male	Male	Male	Male	Female
Ethnicity	Asian Indian	Hispanic	White	White	White
CARS – 2 <sup>a</sup>	Raw Score: 42.5 Severity: Severe	Raw Score: 44.5 Severity: Severe	Raw Score: 51.5 Severity: Severe	Raw Score: 44 Severity: Severe	Raw Score: 46.5 Severity: Severe
TONI – 4 <sup>b</sup>	SS <sup>c</sup> : 84 Percentile: 14	SS: 78 Percentile: 7	SS: 61 Percentile: <1	SS: 75 Percentile: 5	SS: 65 Percentile: 1
ROWPVT – 4 <sup>d</sup>	SS: 63 Percentile: 1	SS: 63 Percentile: 1	SS: <55 Percentile: <1	SS: 87 Percentile: 19	SS: <55 Percentile: <1
ABDS <sup>e</sup>	Conceptual Domain: 40; Percentile: <1	Conceptual Domain: 40; Percentile: <1	Conceptual Domain: 40; Percentile: <1	Conceptual Domain: 57; Percentile: <1	Conceptual Domain: 49; Percentile: <1
	Social Domain: 40 Percentile: <1	Social Domain: 40 Percentile: <1	Social Domain: 40 Percentile: <1	Social Domain: 40 Percentile: <1	Social Domain: 40 Percentile: <1
	Practical Domain: 65 Percentile: 1	Practical Domain: 44 Percentile: <1	Practical Domain: 40 Percentile: <1	Practical Domain: 67 Percentile: 1	Practical Domain: 48 Percentile: <1
	Composite Score: 42 Percentile Rank: <1	Composite Score: 34 Percentile Rank: <1	Composite Score: 32 Percentile Rank: <1	Composite Score: 49 Percentile: <1	Composite Score: 39 Percentile: <1

Note. a, Childhood Autism Rating Scale-4; b, Test of Nonverbal Intelligence-4; c, Receptive One Word Picture Vocabulary Test-4; d, Standard score; e, Adaptive Behavior Diagnostic Scale

# Materials

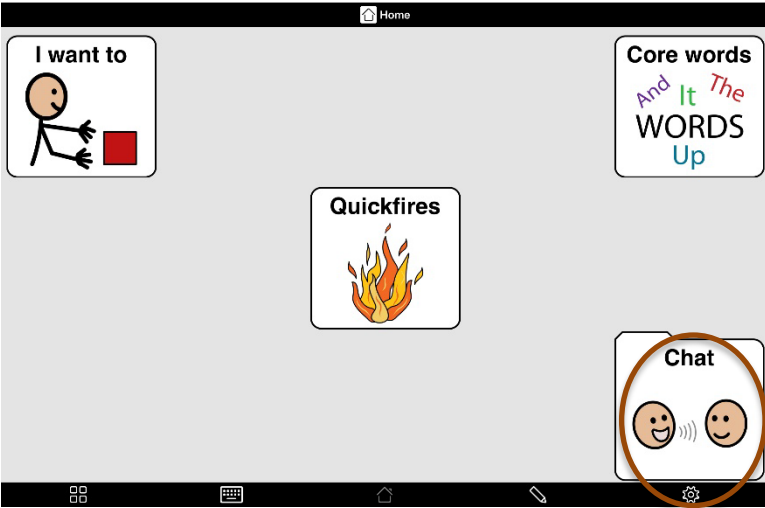
- ❖ Two iPad Pro tablets with Proloquo2Go installed and SymbolStix



Navigation for initiating a request

6:25 AM Thu Sep 15

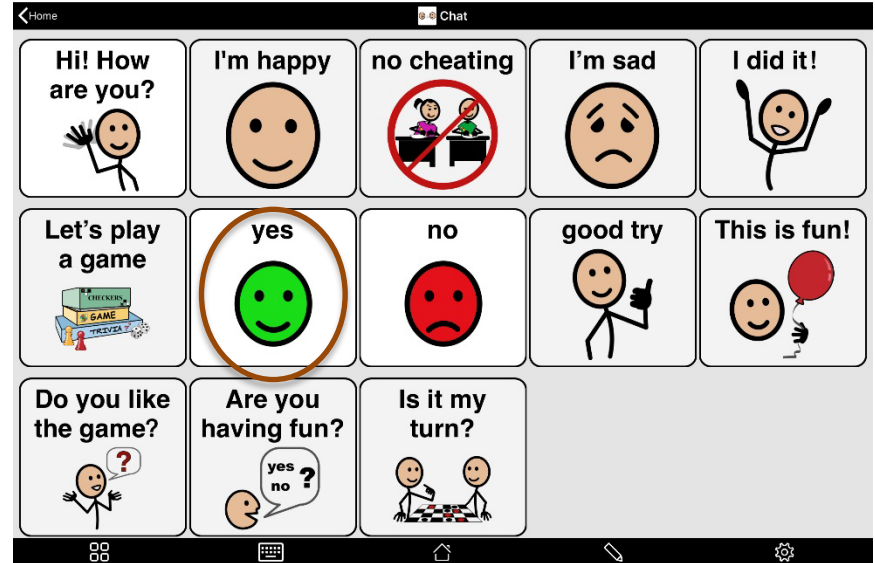
80% 



## Navigation for answering questions

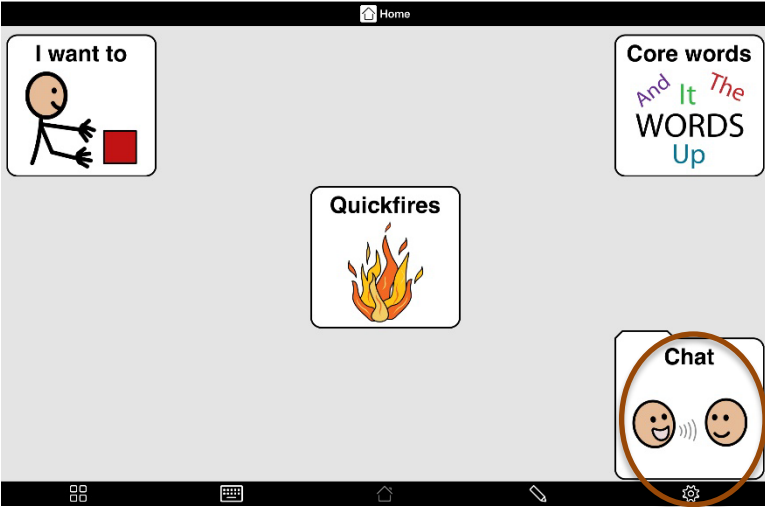
6:27 AM Thu Sep 15

86% 



6:25 AM Thu Sep 15

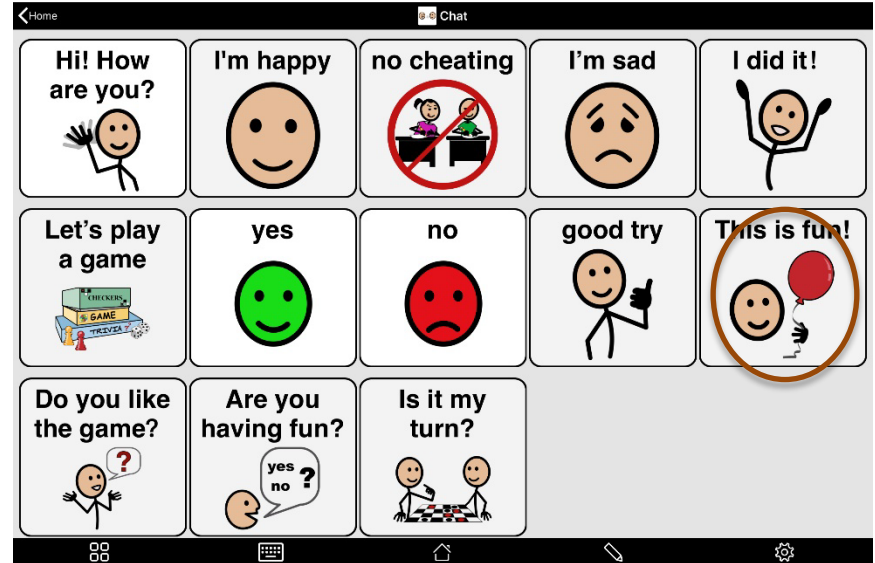
80% 



## Navigation for commenting

6:27 AM Thu Sep 15

80% 



# Experimental Design

- Multiple probe design across behaviors replicated across participants
  - Baseline, intervention, generalization, maintenance
  - Acquisition criteria: an average of 80% or higher across three consecutive sessions
- A pre- and post-treatment multiple-generalization-probes design to assess generalization across peers (Schlosser & Braun, 1994).



Initiating requests

Answering questions

Commenting

# Standardized Assessments



# Preference Assessment

- Two parts:
  - Phone call and/or meeting with parents and teachers
  - Free operant procedure (Roane et al., 1998)
    - Place desired activities or items and observe how long the child would play with each item
    - Three sessions lasting 10-15 minutes over a three-day period

# Symbol Identification Task

- Four symbols were randomly selected at the beginning of the session.
- The participants were asked to point to the target symbol in response to the experimenter's spoken instructions
- The participants were required to identify all target symbols for both requesting and social communication phrases with 100% accuracy across three consecutive trials before proceeding with the intervention.



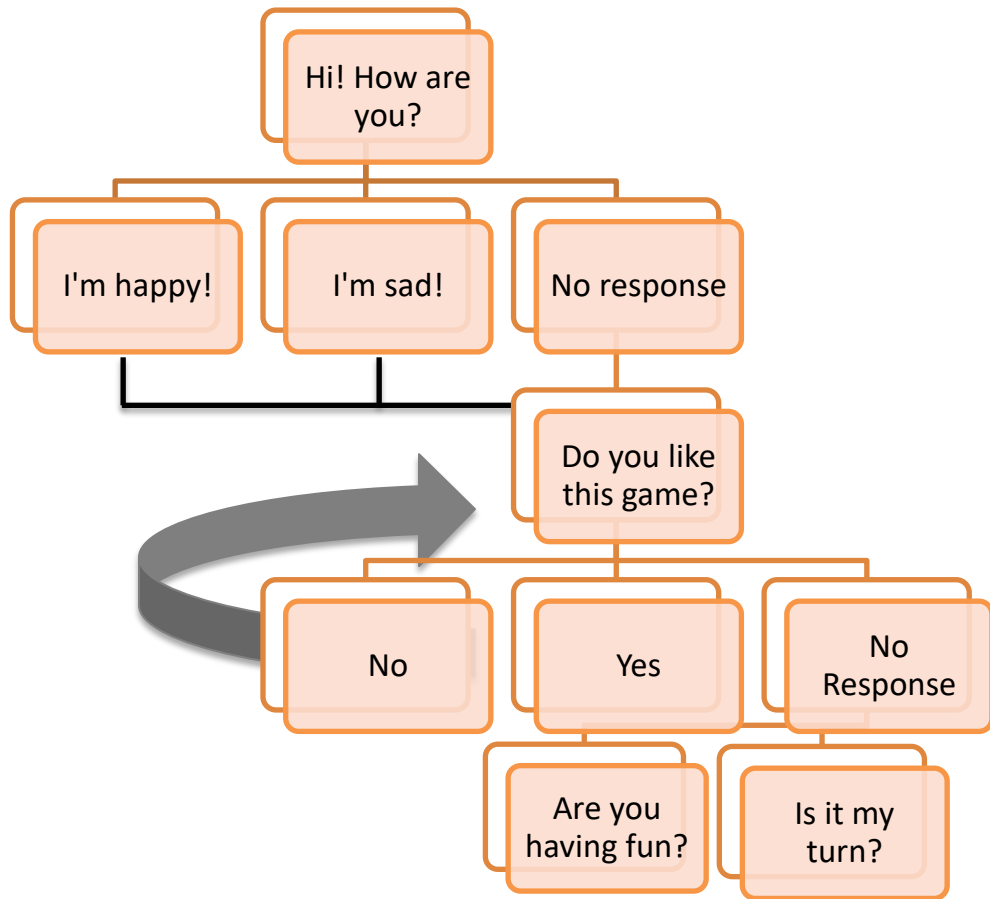
# Peer Training

- Each peer was taught:
  - to maintain proximity to the participant
  - how to use an SGD (e.g., navigating pages on the device, combining symbols, and using the volume button)
  - to implement aided modeling
  - to administer baseline, generalization, and maintenance probes

# Baseline: Initiating Requests

“Let’s play a game.”





## Baseline: Answering Questions

- ❖ Peer or experimenter administered 5 probes targeting answering questions
- ❖ 5s wait time between administering probes
- ❖ No cues given

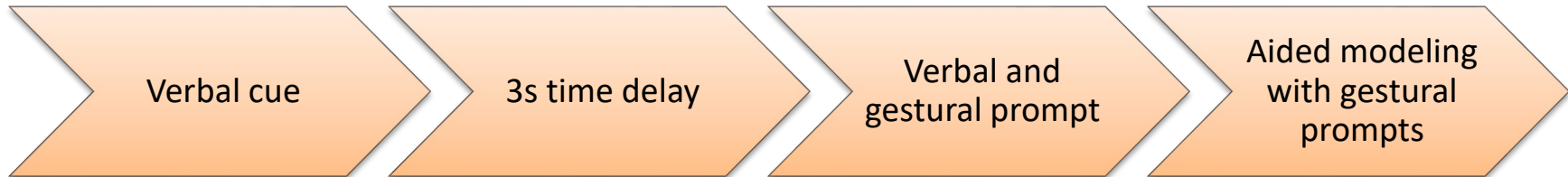
# Baseline: Commenting

- ❖ “Let’s play a game”
- ❖ Wait five seconds between turns
- ❖ Peer or experimenter administers five probes



# Intervention

- ❖ Intervention phase will be identical to the baseline phase, except only the experimenter will implement systematic instruction and probe the responses.



- ❖ Error Correction Procedure: providing verbal and gestural prompts to activate correct icons.

# Generalization

- ❖ One week following last intervention session
- ❖ Identical to the baseline for both requesting, answering questions, and commenting behaviors, except that only peer probed the dependent variables

# Maintenance

- ❖ Implemented two weeks after the generalization phase
- ❖ Identical to the procedure in the baseline phase for requesting, answering questions, commenting, except that the peer and the experimenter probed the dependent variables

# Results

- Nonoverlap of All Pairs (NAP) with a 95% confidence interval (Parker & Vannest, 2009) was calculated.
- Visual Analysis
  - Trend
  - Level
  - Variability

# Acquisition and Maintenance

## Initiating Requests

- Four participants demonstrated functional control between the independent variable and dependent variable
- NAP across all participants: 0.969 (strong effect) with 95% CI (0.859, 0.993)
- Four participants that completed the maintenance phase and maintained their ability to initiate requests with their typically developing peer.

## Answering Questions

- All participants demonstrated functional control between the independent variable and dependent variable.
- NAP across all participants was 1.0 (strong effect) with 95% CI (1.0, 1.0).
- One participant maintained the acquired behavior.

## Commenting

- Two participants met the acquisition criteria (i.e., average of 80% accuracy across 3 sessions)
- NAP across all participants was 0.9375 (strong effect) with 95% CI (0.8228, 0.9783).
- Two participants maintained the acquired behavior

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# Generalization

## Initiating Requests

- One participant generalized behavior to a peer with 100% accuracy.
- Three participants generalized the behavior but demonstrated variability

## Answering Questions

- One participant generalized behavior to a peer with 100% accuracy.
- Three participants did not generalize the acquired behavior.

## Commenting

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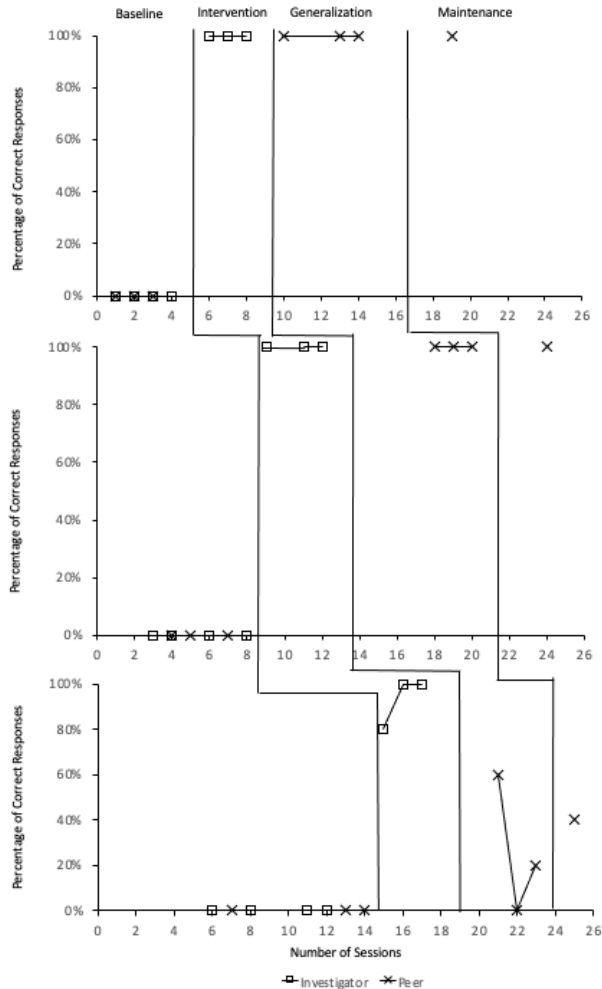
# Answering Questions

- One participant generalized behavior to a peer with 100% accuracy.
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# Commenting

- One participant generalized behavior to a peer with 100% accuracy.
- One participant generalized the behavior but demonstrated variability.

# Ajay (male, age: (8;4))



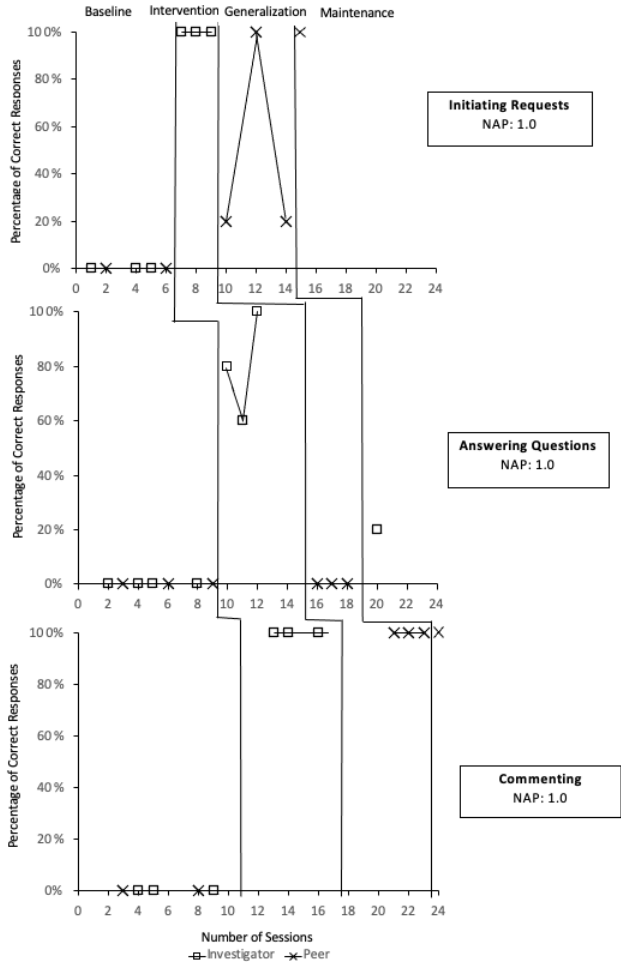
Initiating Requests  
NAP: 1.0

Answering Questions  
NAP: 1.0

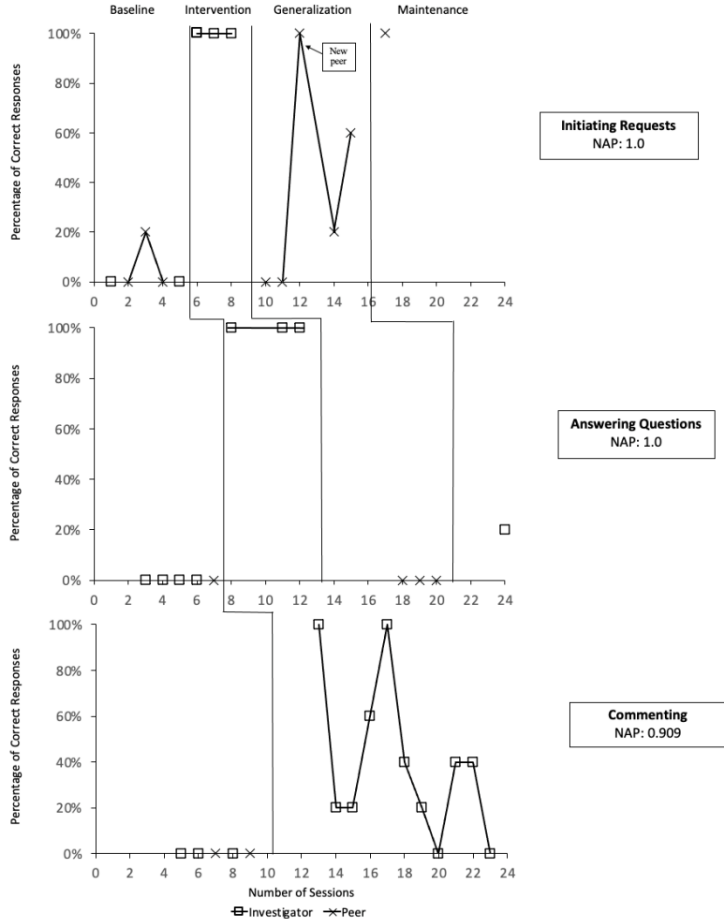
Commenting  
NAP: 1.0

- Initiating Requests
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])
- Answering Questions
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])
- Commenting:
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])

# Derek (male, age: 6;5)

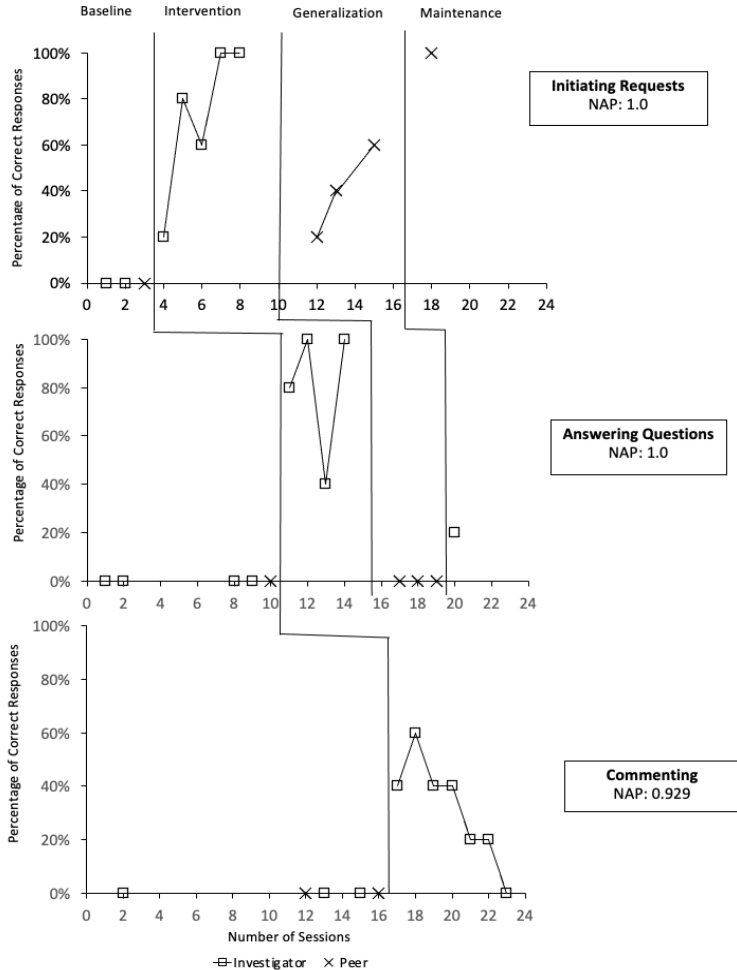


- Initiating Requests
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])
- Answering Questions
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])
- Commenting:
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])



# Matthew (male, age: 6;11)

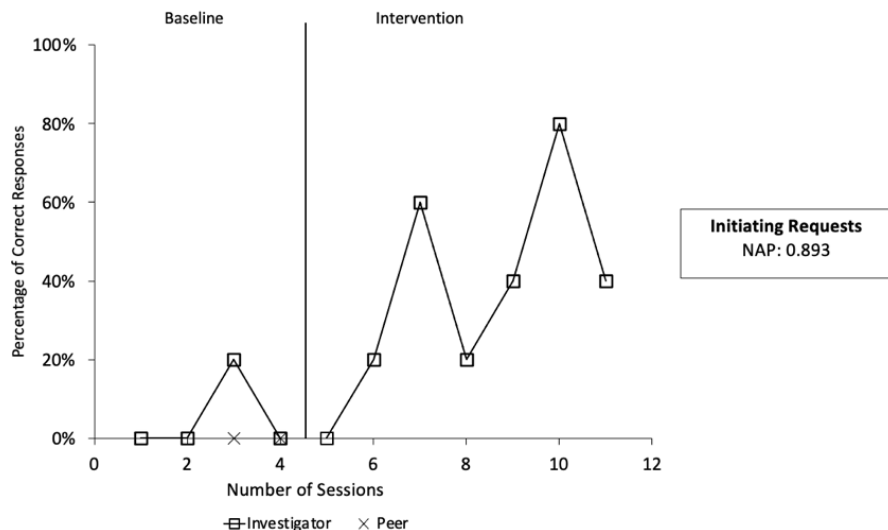
- Initiating Requests
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])
- Answering Questions
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])
- Commenting:
  - NAP: 0.909 medium effect with a 95% CI [0.602, 0.983])



# Grace (female; age: 4;10)

- Initiating Requests
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])
- Answering Questions
  - NAP: 1.0 (strong effect with a 95% CI [1.00, 1.00])
- Commenting:
  - NAP: 0.929 (medium effect with a 95% CI [0.590, 0.990]).

# John (male, age: 9;7)



- Diagnosis: ASD & severe intellectual disability
- Initiating Requests:
  - 0.893 (medium effect with a 95% CI [0.570, 0.979]).

# Discussion

Addressing  
Critical Gaps

Evidence-  
Based  
Strategies

Generalization

Acquisition of  
Commenting

# Addressing Critical Gaps

- Demonstrated that children with severe ASD can engage in advanced socio-communicative behaviors with an experimenter or typically developing peers
- Measured outcomes with different communication partners
- Reported data on the generalization and maintenance of acquired communicative behaviors
- Thoroughly reported participants' clinical and demographic characteristics

# Utilization of Evidence-Based Strategies

- Aided Modeling (Allen et al., 2017; Biggs et al., 2018)
  - Additional visual cues
  - Combination of visual and consistent auditory cues
  - Motor action of selecting an icon along with visual and auditory cues
- Systematic Instruction (Alzrayer et al., 2019; Chavers et al., 2021; Dyches et al., 1998; Finke et al., 2017)
  - Least-to-most prompting
  - Time delay
  - Positive reinforcement

# Generalization

- Data collected during the generalization phase showed high variability in transferring learned behaviors
- Diminishing social motivation
  - lack of orientation to social cues and stimuli
  - interpersonal maintenance strategies
  - response to social rewards

# Acquisition of Commenting Behavior

- Several factors may have influenced the participants' acquisition and generalization of the commenting behavior.
  - preferred activities
  - knowledge of symbol-referent relationships
  - comments related to salient features of participants' preferred activities

# Limitations

- Only one maintenance session was conducted.
- Lack of pre-experimental task solely dedicated to assessing joint attention and imitation skills
- Variability observed for generalization of trained behaviors across participants

# Conclusion

- The current study investigated the effectiveness of aided modeling and systematic instruction using an SGD on the acquisition, generalization, and maintenance of socio-communicative behaviors (i.e., initiating requests, answering questions, commenting).
- Outcomes of this study suggest that aided modeling and systematic instruction using an SGD may lead to gains in socio-communicative behaviors in MV children with severe ASD.

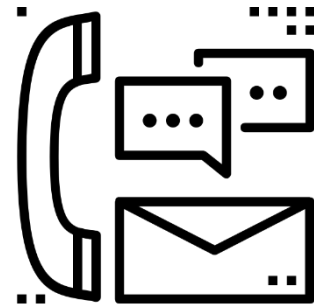
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