

Teaching Advanced Verbal Behavior to Children with Autism Using Speech Generating Devices

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May Institute

Autism (DSM-5, APA)

- Neurodevelopmental Disorder
 - Impairments in Social Communication and Social Interaction
 - Restricted and Repetitive Patterns of Behavior
- Social Deficits are the Hallmark Feature
- Language deficits can range from mild to severe

Autism

- Approximately 65% to 75% of children with ASD exhibit moderate to severe language delays (Anderson et al., 2007)
- Almost 30% were not using spoken words consistently

Table 1

Expressive Language Level at Age 9 by Age 2 Diagnosis: Percentage of 172 Participants

| Language level | Autistic (n = 84) | PDD-NOS (n = 46) | Nonspectrum (n = 42) |
|--|----------------------|---------------------|-------------------------|
| Complex sentences (ADOS Module 3) | 23.8 | 58.7 | 54.8 |
| Sentences but not fluent (ADOS Module 2) | 23.8 | 26.1 | 31.0 |
| Words but not sentences (ADOS Module 1; ADI-R = 1) | 23.8 | 10.9 | 7.1 |
| No or few consistent words (ADI-R = 2) | 28.6 | 4.3 | 7.1 |

Note. Four children were not administered ADOSs; level of language was inferred from ADI, Vineland, and best verbal IQ scores. PDD-NOS = pervasive development disorders-not otherwise specified; ADOS = Autism Diagnostic Observation Schedule; ADI-R = Autism Diagnostic Instrument-Revised

Augmentative and Alternative Communication (AAC) (Ganz, 2015)

- Provides a means of communicating when speech is delayed
- AAC does not impede spoken language
- Aided and Unaided
 - Picture exchange
 - Sign language
- Low-tech and High-tech
 - Picture exchange systems
 - Speech generating devices



High-Tech SGD

- Ubiquitous in society
 - Low cost
 - Easy to modify
 - Easy to transport
-
- Widespread use and demand has gotten ahead of the research

Research on AAC

- Majority of research on AAC focuses on teaching requesting/Mands (Ganz, et al., 2012)
- Meta-analysis of tablet use to teach communication (Alzrayer, Banda, & Koul, 2014)
 - Majority taught simple manding (requesting)
 - Single word tacts (labels), greetings, please and thank you
 - 14 of 15 targeted single-step communication

Today's Presentation

- Present a set of studies teaching advanced communication skills to children with ASD who use high-tech SGD
- Replications of previous studies with vocal participants
 - Mands for Information
 - Reporting past behaviors
 - Tacts using noun-verb combinations

Mands for Information



Motivating Operations (Michael, 1993)

1. Change the reinforcing effectiveness of other stimuli (reinforcer establishing/abolishing effect)
2. Change frequency of the occurrence of behaviors associated with those reinforcers (evocative/abative effect)

EO (motivation)

5 hours since
Breakfast

Change in value

Food
becomes
valuable

Change in Behavior

-Go to fridge
-Look up menu

-Ask for a snack

AO (no motivation)

Just finished
buffet lunch

Change in value

Food loses
value

Change in Behavior

-Take a nap
-Watch a football
game

-Do not ask for a snack

Mand Training (Request Training)

EO
Snack
Time

Change in value
Increase value
of snack item



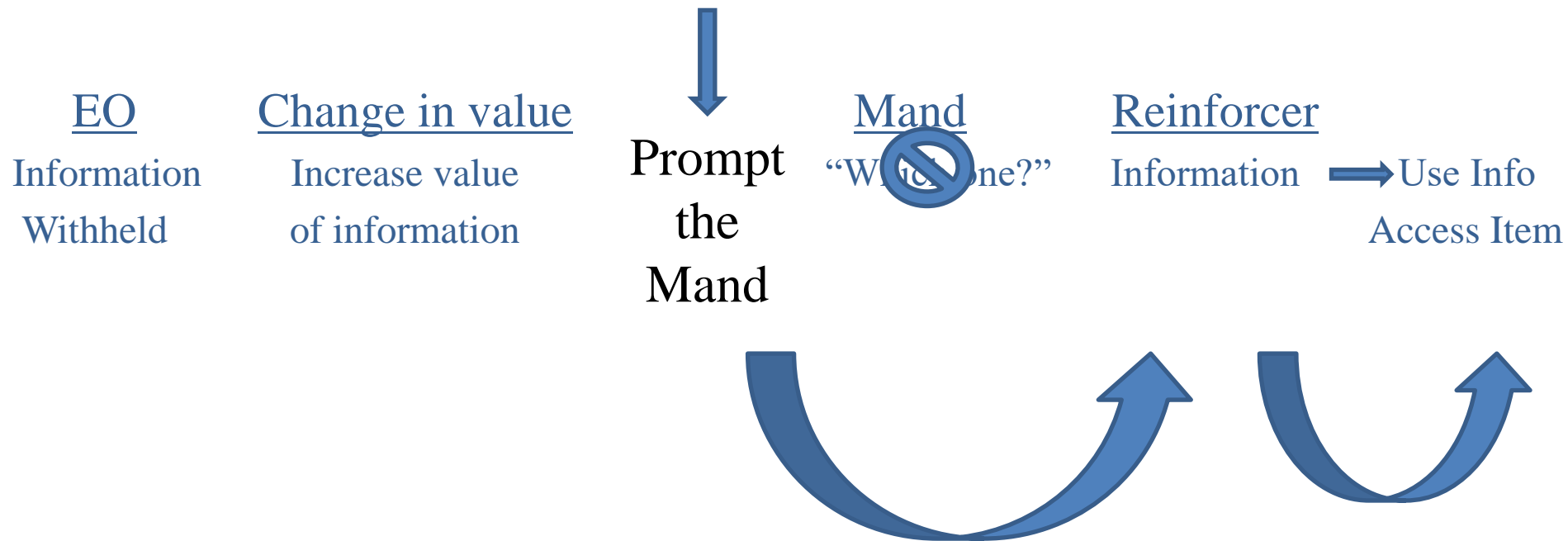
Mand
“~~NO~~”

Prompt
the
Mand

Reinforcer
Access to chips

Manding for Information

- A child asks for something he can't find
- He's told it's in a cabinet but isn't told which specific cabinet



Manding for Information

- A child asks for something he can't find
- He's told the specific cabinet where the item is



AO

Change in value

Mand

Reinforcer

Information
Provided

NO Increase value
of information

NA

NA

Use Info
Access Item

Functional Manding

- Functional manding requires discriminating EO and AO conditions
 - Manding under AO conditions
- Mands for information
 - Teach individuals to mand when information is needed
- Avoid rote responding

*MANDS FOR INFORMATION USING “WHO?” AND “WHICH?” IN THE
PRESENCE OF ESTABLISHING AND ABOLISHING OPERATIONS*

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Treatments designed to teach mands for information have included prompting and differential reinforcement, as well as procedures to manipulate the relevant establishing operation (EO). However, previous studies have not included relevant abolishing operation (AO) conditions to ensure that the mand is under relevant antecedent control. Data on listener responses (i.e., use of the information) are also absent in the literature. The current study shows differential responding under EO and AO conditions and reports listener responses that demonstrate use of the provided information. Three participants, diagnosed with an autism spectrum disorder, learned to mand for information using “who?” and “which?” questions exclusively under EO conditions. In addition,

Mands for Information—Who and Which

- Contrive relevant Establishing Operations (motivation) and Abolishing Operations (AO)
- EO Present (EO) – Information regarding location of preferred item NOT given (contriving a motivation for the information)
- EO Absent (AO) – Information regarding location of preferred item given (no motivation for information)
- Dependent Variables
 - Asking “Who has it?” or “Which” when EO is Present
 - Refraining from asking when Motivation is Absent

Mands for Information—Who and Which

- EO Present (EO) –
Hide a preferred item in a container amongst a set of similar containers and do not specify which container it is in. (contrive motivation for information)
- EO Absent (AO) –
Hide a preferred item in a container amongst a set of similar containers and DO specify which container it is in. (no motivation for information)



Mands for Information—Who and Which

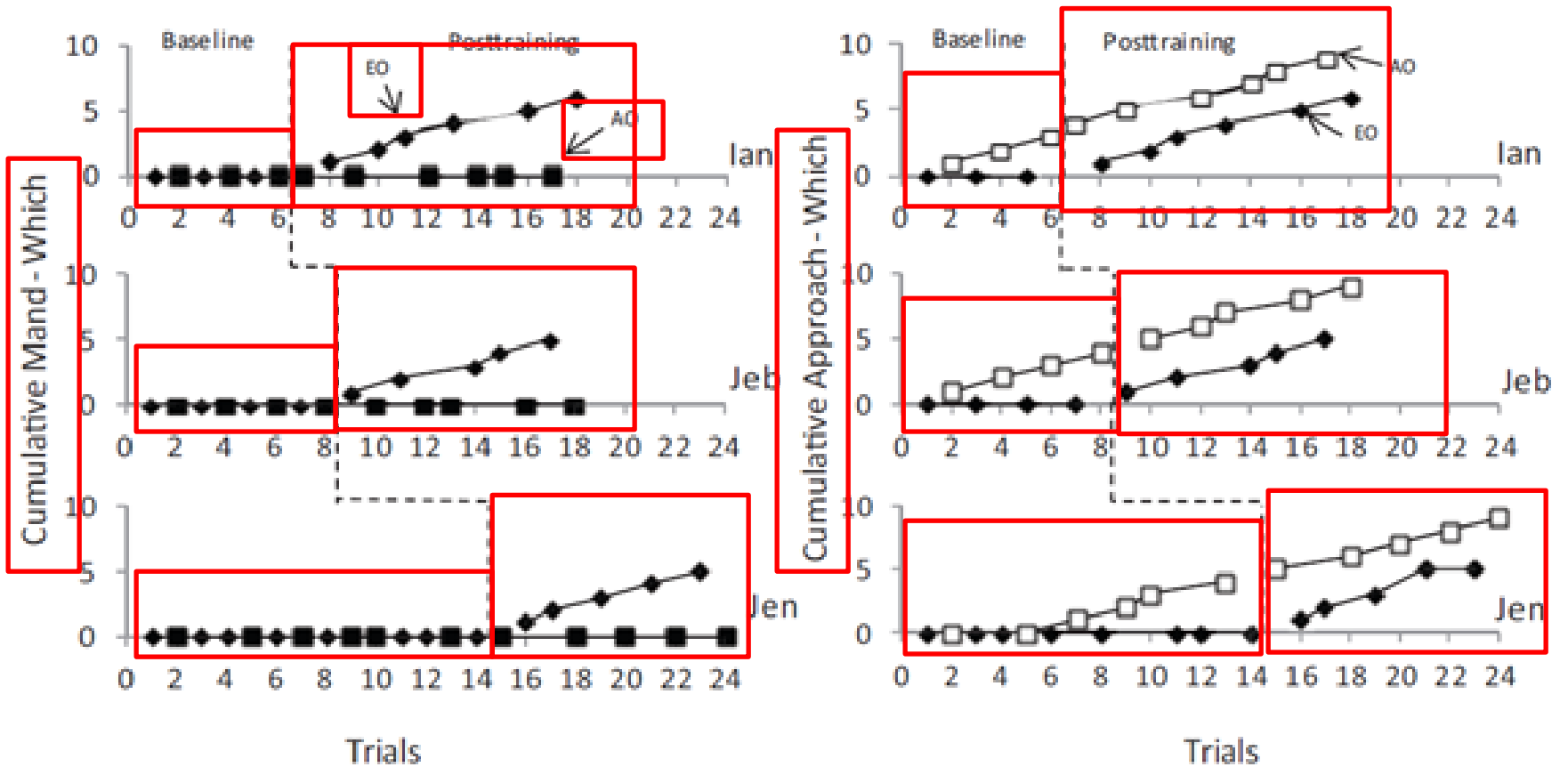
- EO Present (EO) –

Child asks for a cookie. You say, “sure, its in one of those boxes.” Contrive motivation for which box and sets the stage to prompt the mand.

- EO Absent (AO) –

Child asks for a cookie. You say, “sure, its in the yellow box.” Abolishes motivation for which box and sets the stage for direct use of the information.





Mands for Information—AAC

- Shillingsburg, Marya, Bartlett & Thompson (2019 online, JABA)



Teaching mands for information using speech generating devices: A replication and extension

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Approximately 30% of individuals diagnosed with autism spectrum disorder (ASD) fail to develop vocal communication and, therefore, use some form of augmentative or alternative communication system. The current study replicates and extends previous research on teaching “Who?” and “Which?” mands for information to 3 young children diagnosed with ASD using a speech generating device. Procedures were evaluated using a multiple baseline across participants design. All participants learned to mand for information and, subsequently, used the information to access preferred items.

Key words: augmentative and alternative communication, autism spectrum disorder, mands for information, speech generating device, “wh” questions

| | Gender | Age | VBMAPP Scores | Mand Scores | Diagnosis | Expressive Language |
|--------|---------------|------------|----------------------|--------------------|------------------|----------------------------|
| Bruce | Male | 3 | 76 | 9 | ASD | SGD |
| Emma | Female | 6 | 113 | 10.5 | ASD | SGD |
| Justin | Male | 6 | 142.5 | 14 | ASD | SGD |



< Home

 Clinic

Favorite things



People



My schedule



Work



Play



Clinic locations



Clinic Activities



Questions





< Clinic

Favorite things

I want

token

doll

cat

more

doctor kit

juice

doll

chips

all done

dough

snoo

Box

bunnies

songs



“Sure, one of your teacher’s has it.”




Favorite things

| | | | | |
|--|---|---|--|--|
| I want  | token  | doll  | cat  | more  |
| doctor kit  | juice  | iPad  | chips  | all done  |
| playdough  | snoopy  | Box  | bunnies  | songs  |





< Home

 Clinic

Favorite things



People



My schedule



Work



Play



Clinic locations



Clinic Activities



Options





< Clinic

?? Questions

- Which Cup?
- Who has it?
- When is it?
- How do I?
- Why?

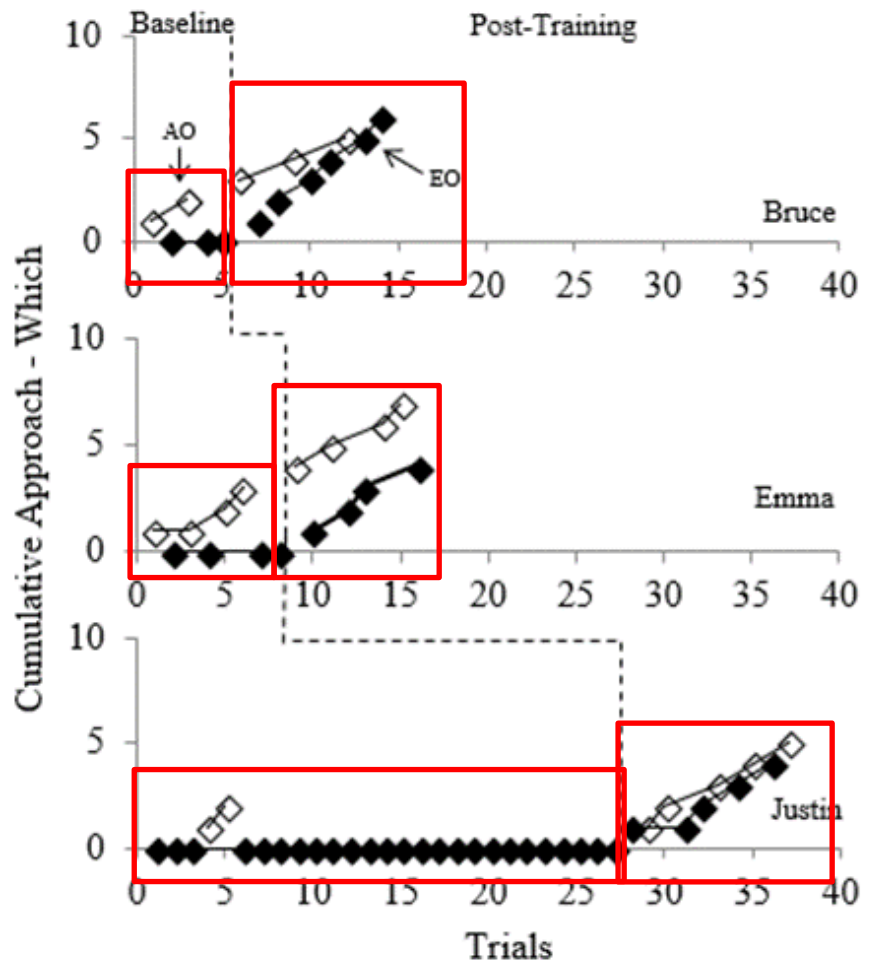
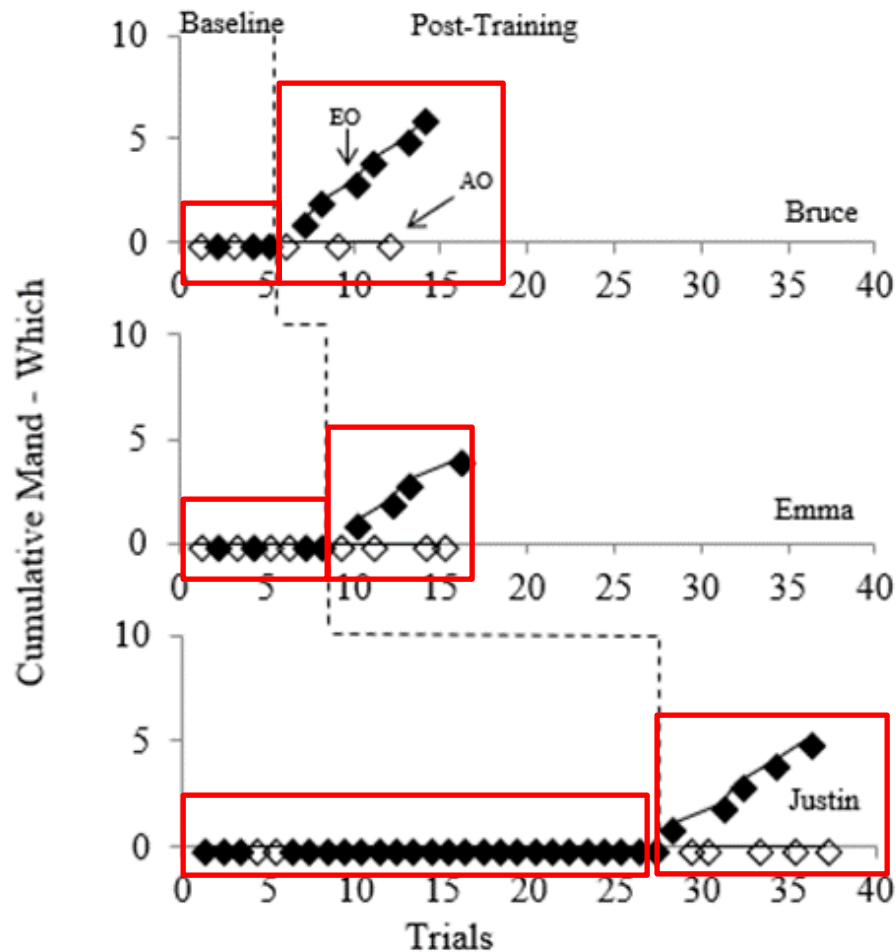


One Participant-Typing



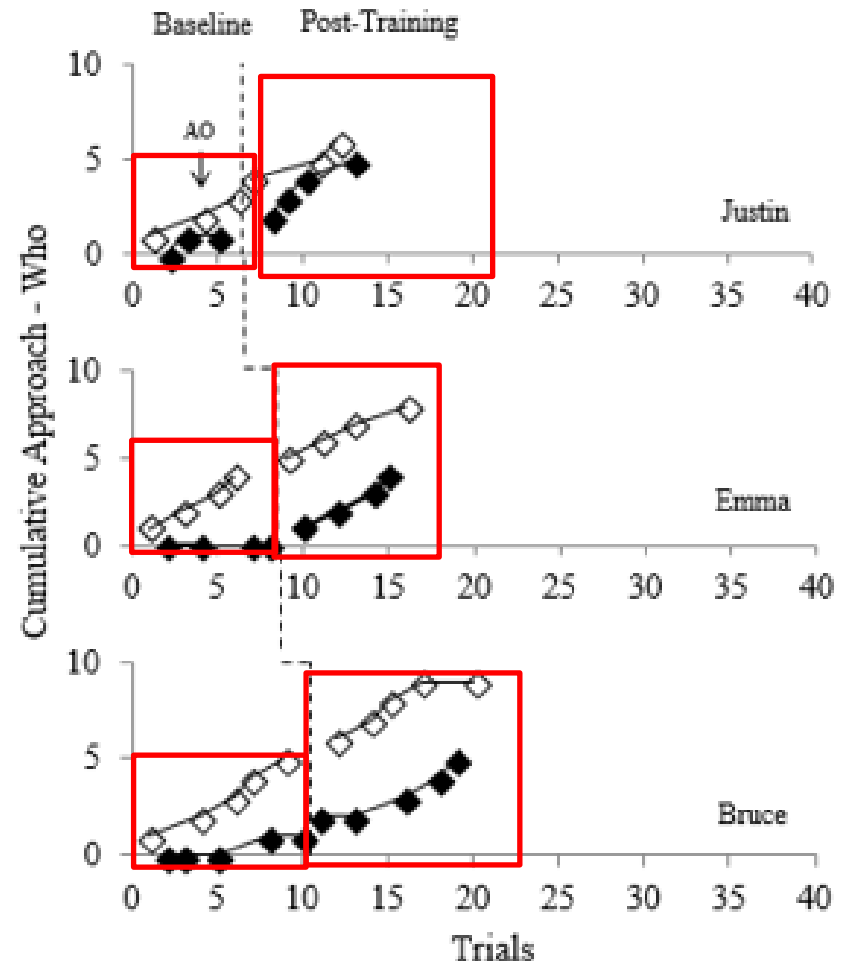
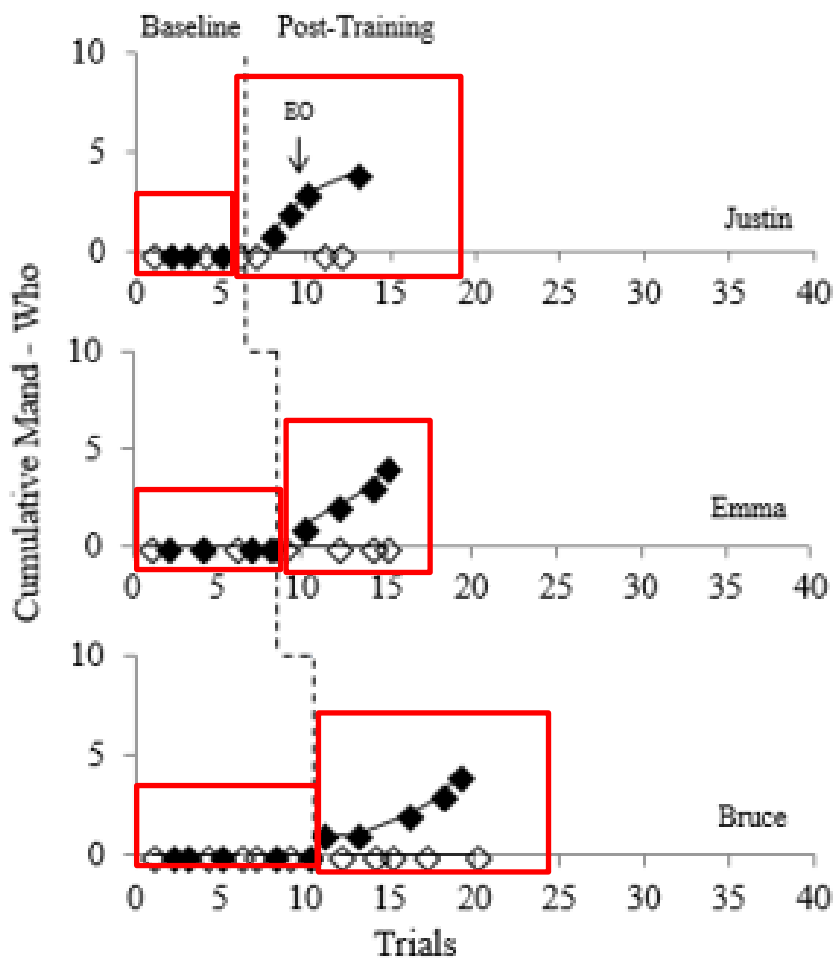
Shillingsburg, Marya, Bartlett & Thompson (2019)

JABA



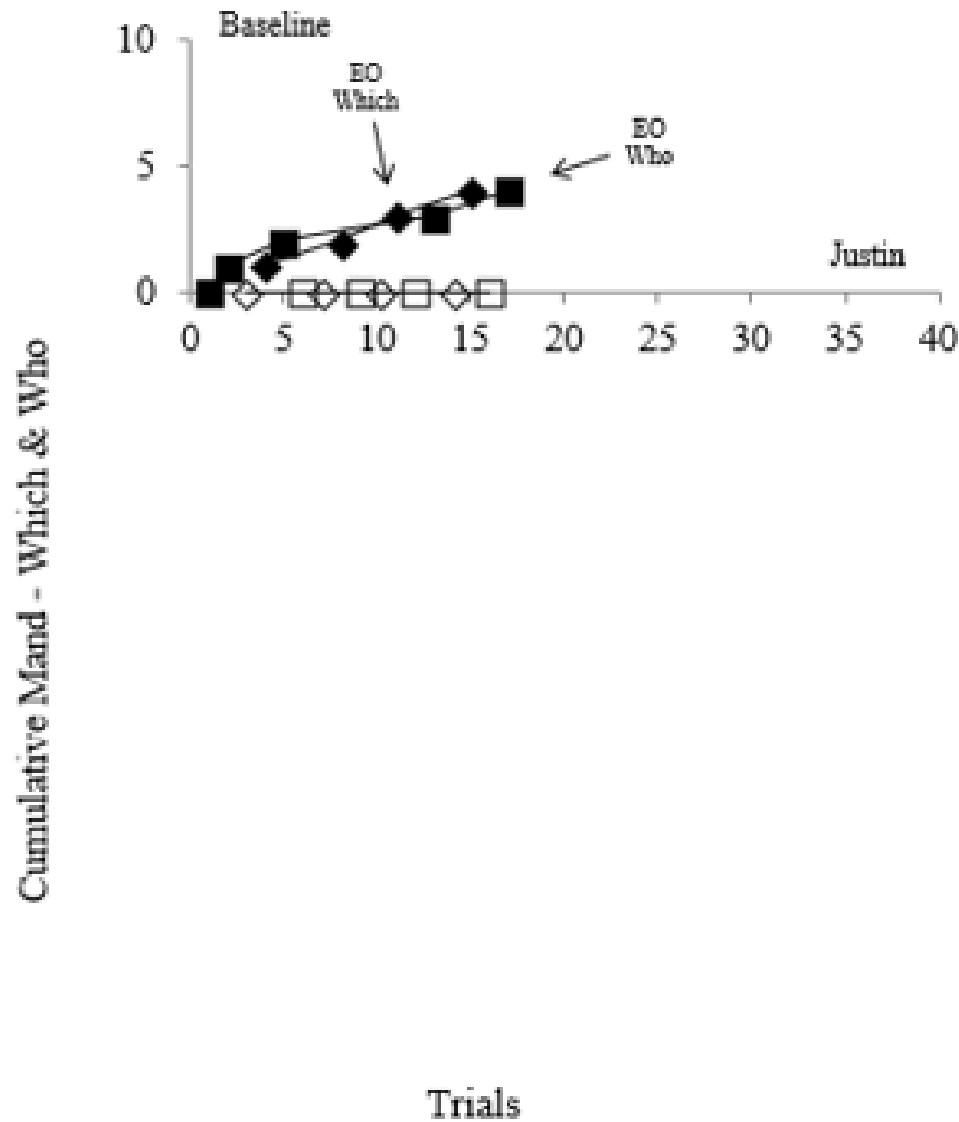
Shillingsburg, Marya, Bartlett & Thompson (2019)

JABA



Shillingsburg, Marya, Bartlett & Thompson (2019)

JABA



Conclusions

- All three participants engaged in discriminated manding
 - Manded for information when information was needed
 - Refrained from manding when information was not needed
 - Emitted the appropriate mand frame (i.e., “who” or “which”) under the correct conditions
 - Only one required teaching

Answering Questions to Report Past Behavior

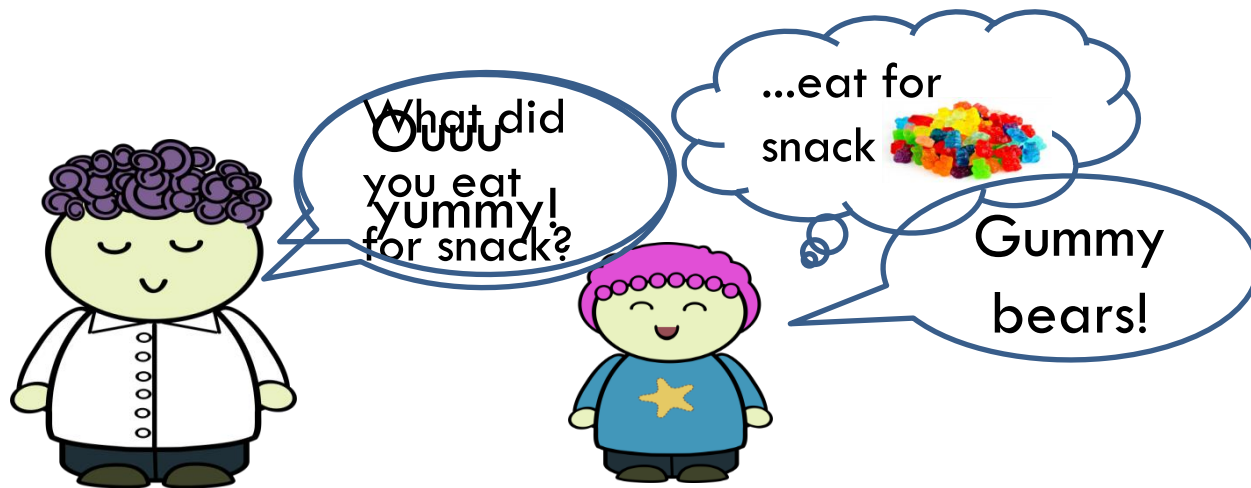


Reporting Past Behavior

- Children are expected to report past behavior
 - Did you finish your homework?
 - Who did you see at school today?
- Common caregiver concern
 - How did you get this bruise?

Development of Reporting Past Behavior

- Self-tacting
 - “...current stimuli, including events within the speaker himself **generated by the question**, in combination with a history of earlier conditioning” (Skinner, 1957, pg. 143)
- Intraverbal control (Palmer, 2016)



Development of Reporting Past Behavior

- Verbal community arranges reinforcement contingencies and provides clarifying information
 - Who did you see at school today?
 - Was Jessica there?
- This is how reporting past behavior is shaped in typical development

Reporting Past Behavior

- Deficits in accurate reporting
 - Errors in stimulus control (Skinner, 1957; White, 1985)
 - Failure of relevant stimuli to evoke response or insufficient reinforcement history
 - Social interaction may not function as a reinforcer for children with ASD (Call et al., 2013)

Correspondence

- Nonverbal and verbal behavior

Do/say correspondence = accurately reporting past behavior

Nonverbal Behavior (Do)



Antecedent Verbal
Stimulus

“What did you
eat for snack?”




Verbal Behavior
(Say)

“I ate gummy
bears.”

BRIEF REPORT

A Preliminary Analysis of Procedures to Teach Children with Autism to Report Past Behavior


M. Alice Shillingsburg^{1,2}  • Tom Cariveau^{1,2} •
Bethany Talmadge¹ • Sarah Frampton¹

The Analysis of Verbal Behavior
<https://doi.org/10.1007/s40616-019-00112-2>

 **A | B | A | I**
Association for Behavior Analysis International

BRIEF REPORT

Teaching Children With Autism Spectrum Disorder to Report Past Behavior With the Use of a Speech-Generating Device

Alice Shillingsburg^{1,2,3}  • Videsha Marya¹ • Brittany Bartlett¹ •
Taylor Thompson¹ • Dianna Walters¹



Check for
updates

Participants

- Three non-vocal children with ASD
- All used device to mand, tact, and intraverbally respond

Response Measurement

- Correct response: providing the name of activity when asked what was done in a specific location via picture selection, text selection, or typing on his or her device

Procedures

- Pre-teaching
 - Taught tacts/labels for activities and locations
- Order of locations and activity completed at each location varied quasi-randomly



Procedures

- Pre-teaching
 - Taught facts/labels for activities and locations
- Order of locations and activity completed at each location varied quasi-randomly



Baseline

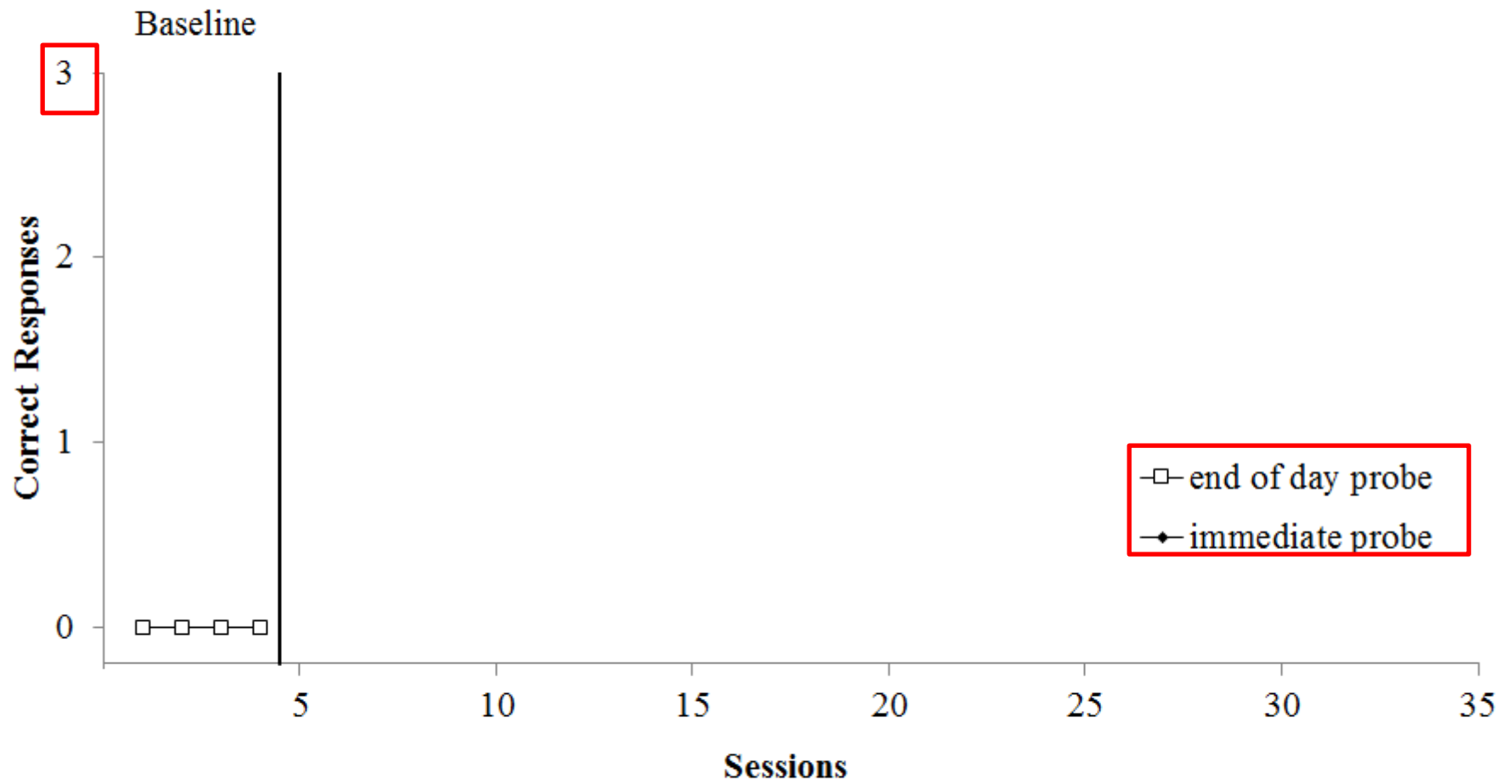


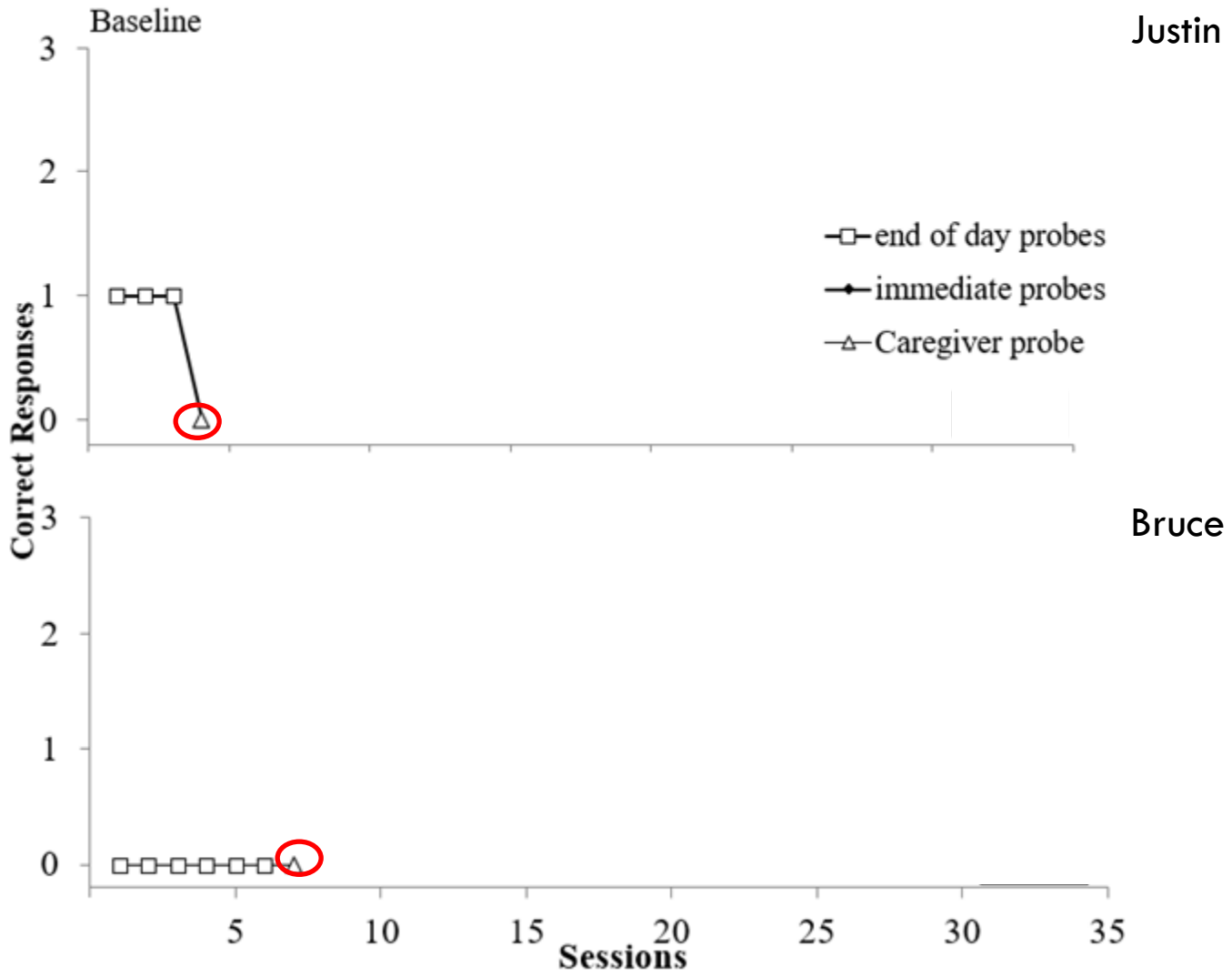
“What did you
do in _____?”

“What did you
do in _____?”

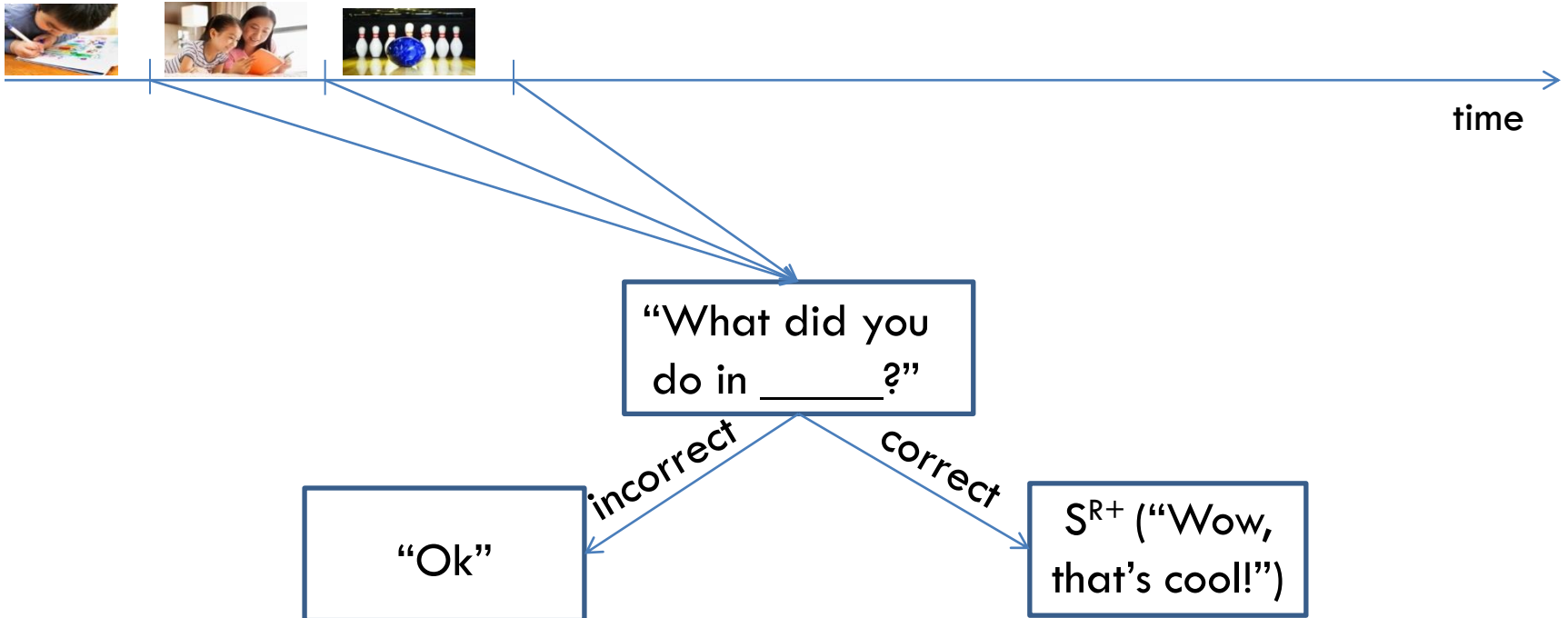
“What did you
do in _____?”

Emma





Immediate Probe



Immediate Probe



1.5 hour delay

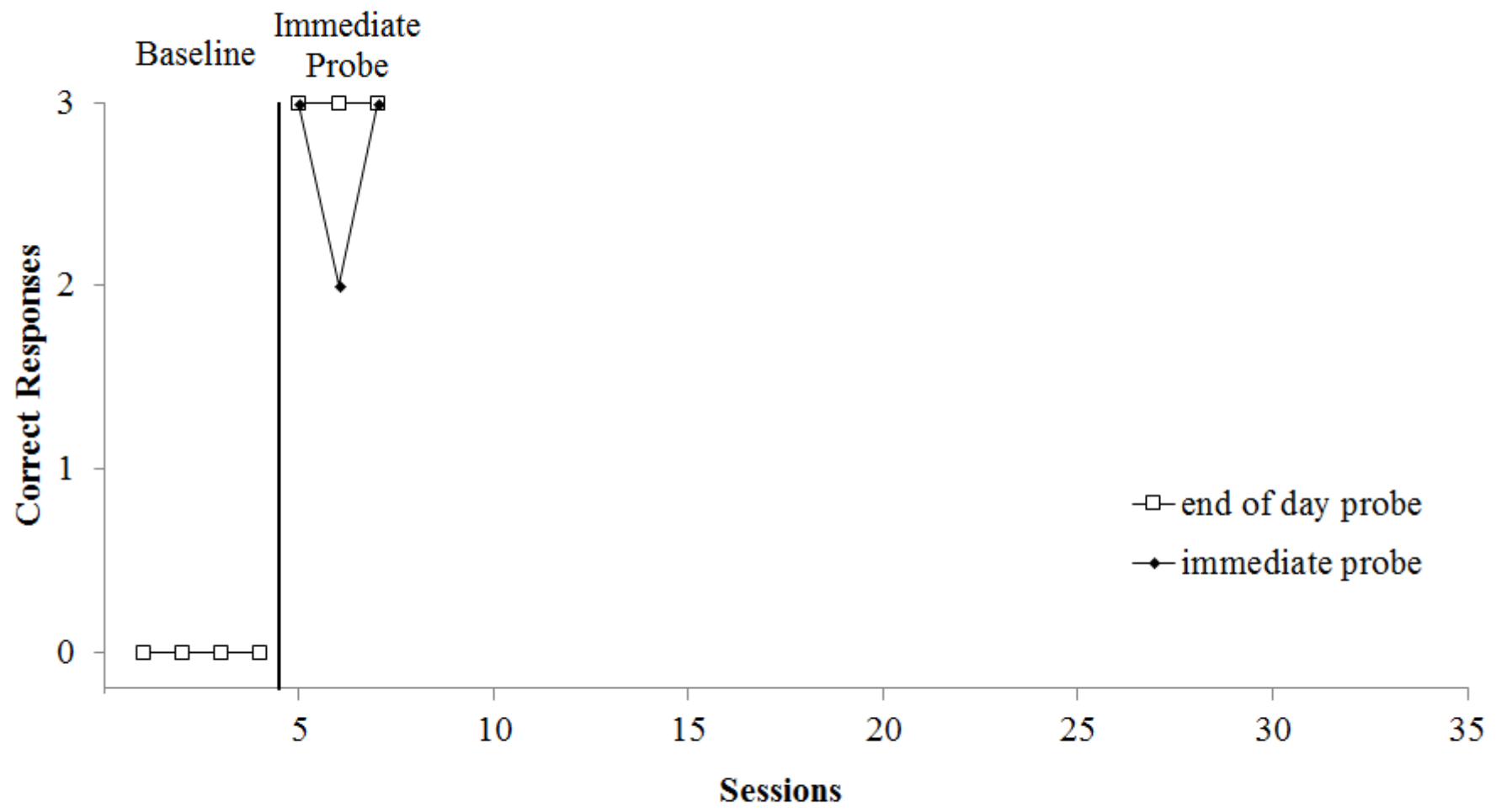
time

“What did you
do in _____?”

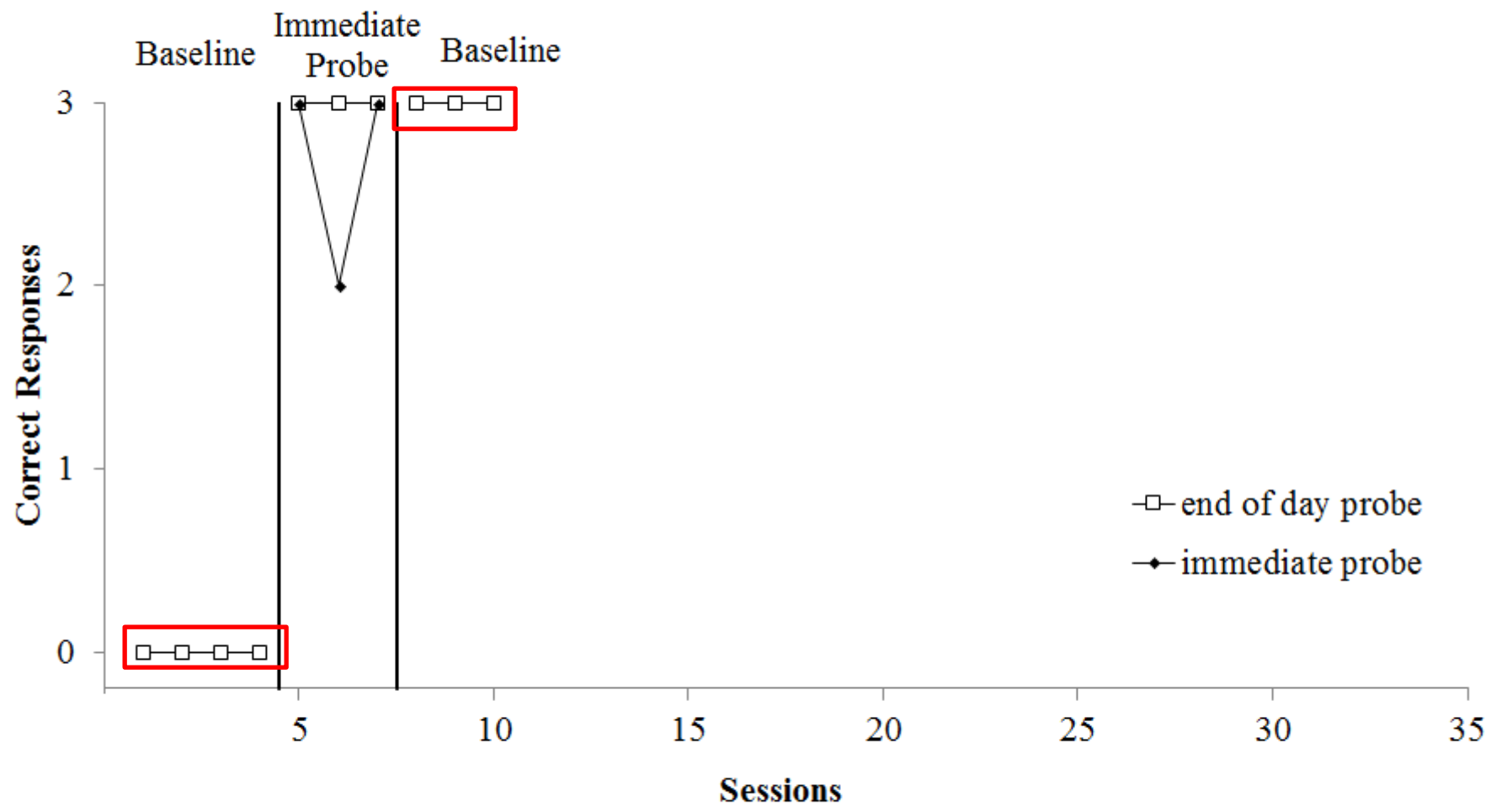
“What did you
do in _____?”

“What did you
do in _____?”

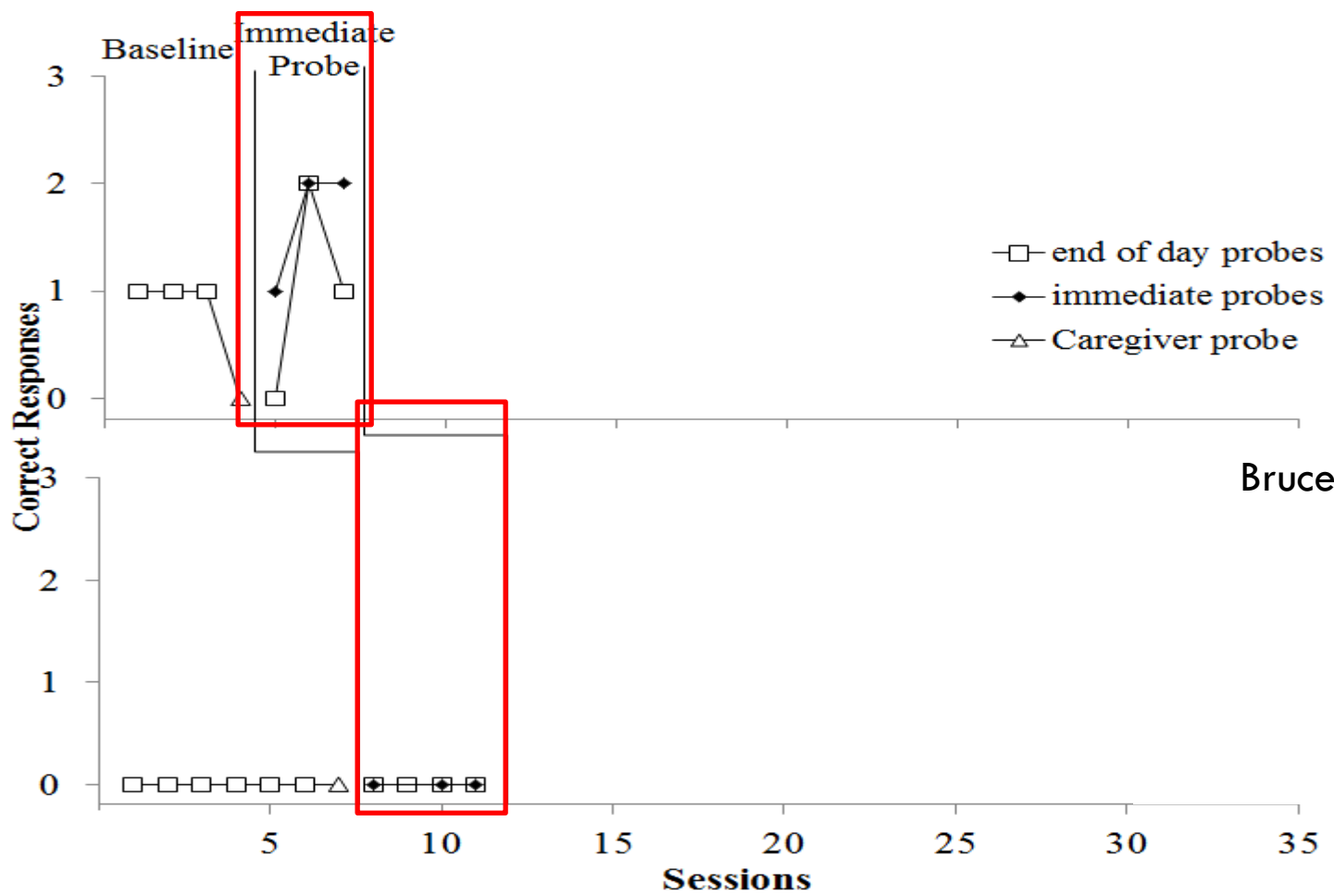
Emma



Emma

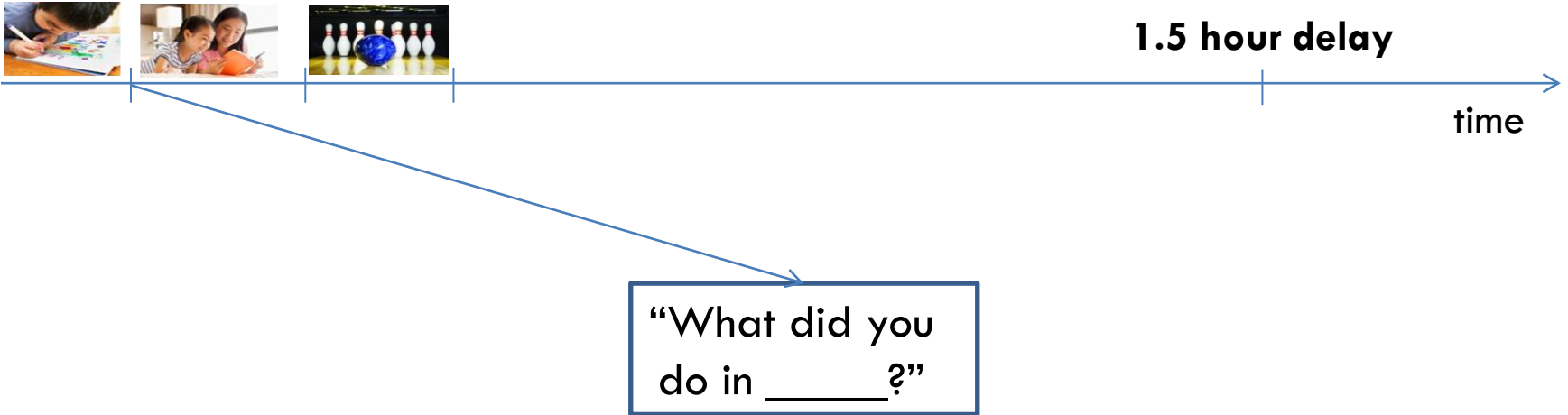


Justin

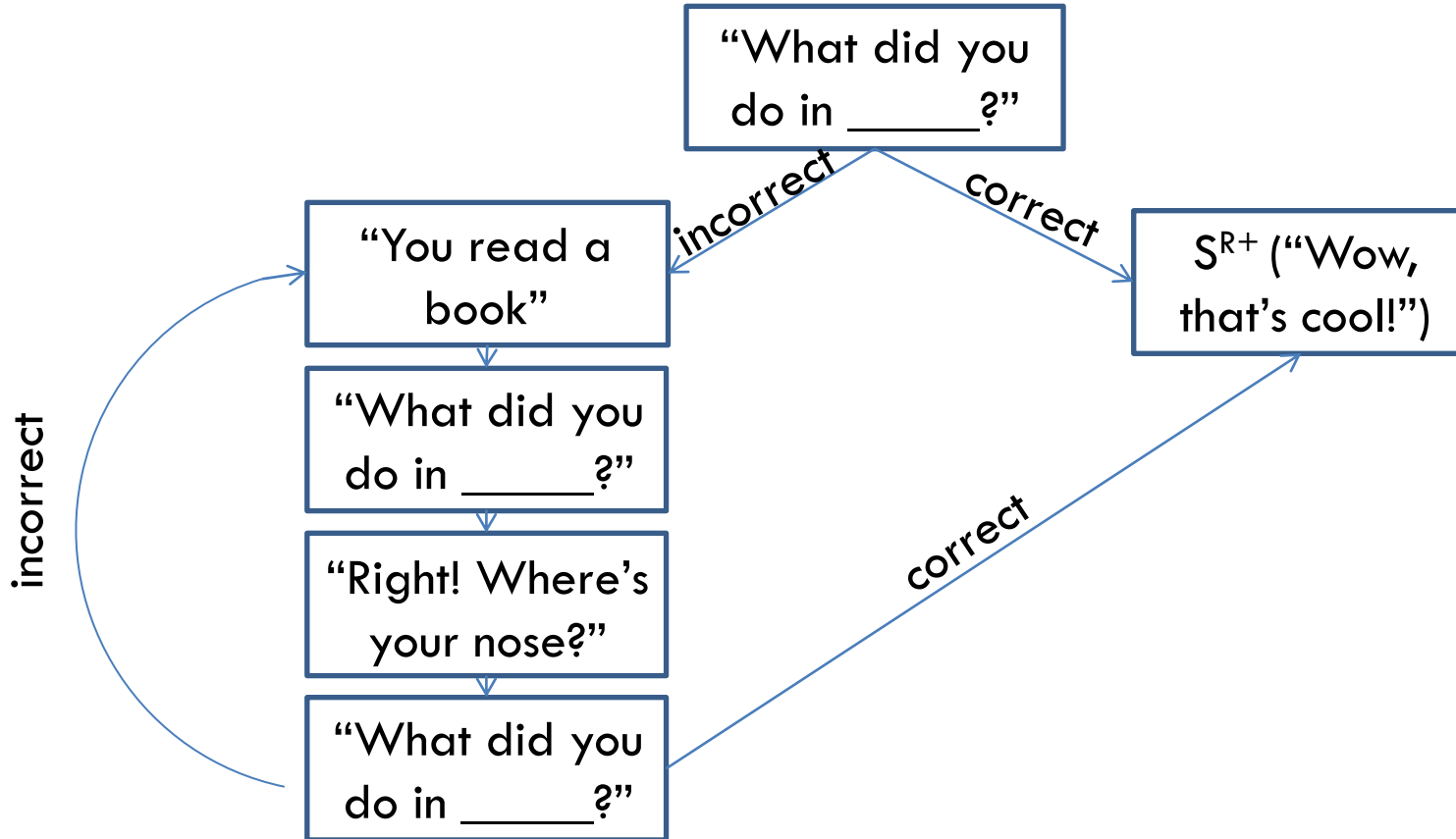


Bruce

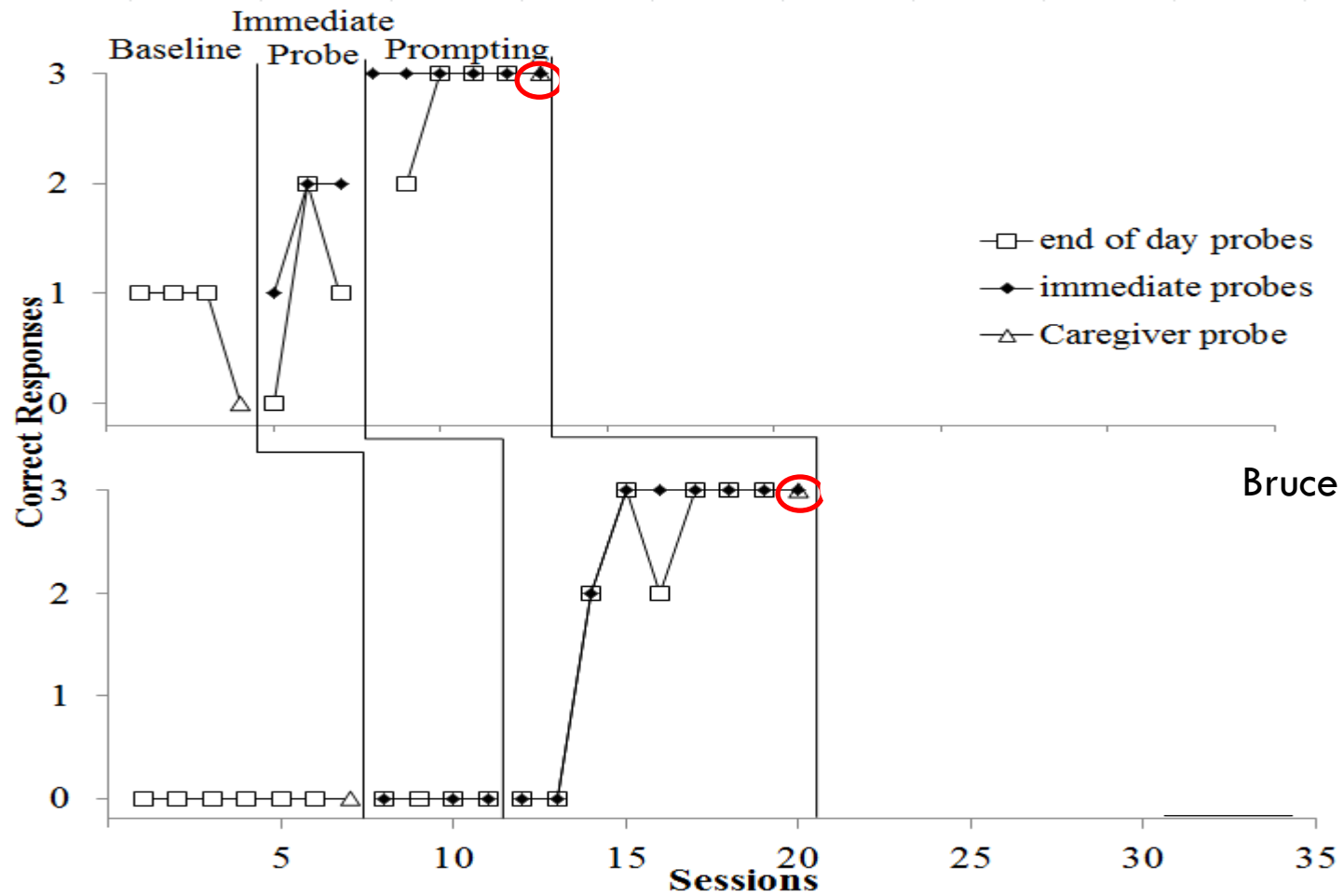
Prompting



Prompting

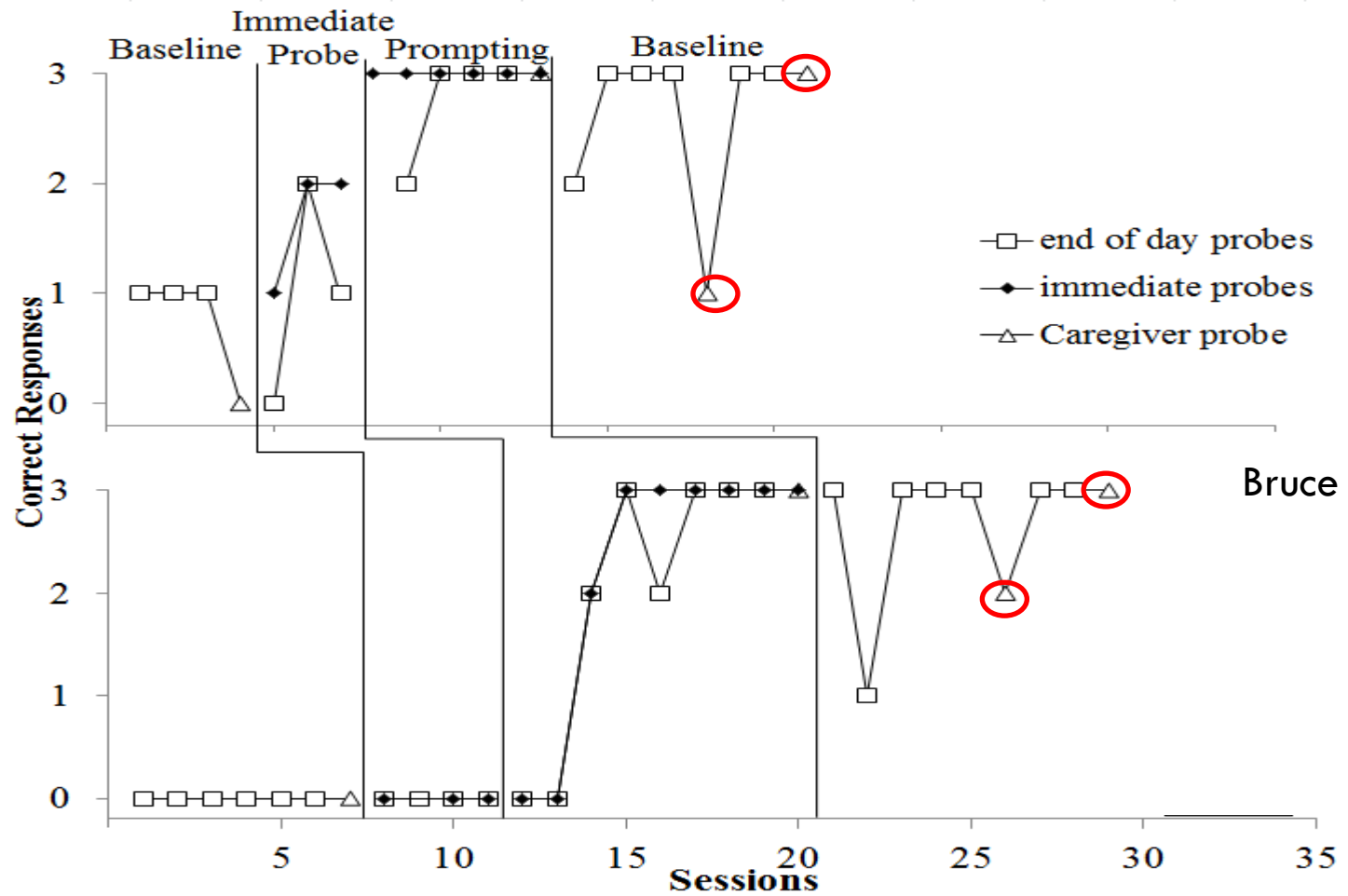


Justin



Bruce

Justin



Results

- All participants improved the accuracy of reporting past behavior at the end-of-day
 - One participant (Emma) reported accurately following only introduction of immediate probe
 - Two participants, needed prompts to report immediately
 - Once reporting immediately, 100% at end-of-day
- Correct reporting generalized to caregivers
- Future research into reporting novel activities in novel locations

Word Combinations/Generative Responding

- Do not combine words into multi-word utterances when typically developing children do (Paul, Chawarska, Klin, & Volkmar, 2007)
- Despite having similar number of single words in repertoire
- Engage in rote, inflexible responding
- Much language is directly taught
- Interventions to promote word combinations in flexible, novel ways are needed

Tact Noun-Verb Word Combinations

Journal of
Applied Behavior Analysis

JOURNAL OF APPLIED BEHAVIOR ANALYSIS

2016, 49, 1–15

NUMBER 4 (WINTER)

*THE USE OF MATRIX TRAINING TO PROMOTE GENERATIVE
LANGUAGE WITH CHILDREN WITH AUTISM*

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Matrix training consists of planning instruction by arranging components of desired skills across 2 axes. After training with diagonal targets that each combine 2 unique skill components, responses to nondiagonal targets, consisting of novel combinations of the components, may emerge. A multiple-probe design across participants was used to evaluate matrix training with known nouns (e.g., *cat*) and verbs (e.g., *jumping*) with 5 children with autism spectrum disorders (ASD). Following baseline of Matrix 1 and a generalization matrix, diagonal targets within Matrix 1 were trained as noun–verb combinations (e.g., *cat jumping*). Posttests showed recombinative generalization within Matrix 1 and the generalization matrix for 4 participants. For 1 participant, diagonal training across multiple matrices was provided until correct responding was observed in the generalization matrix. Results support the use of matrix training to promote untrained responses for learners with ASD and offer a systematic way to evaluate the extent of generalization within and across matrices.

Key words: autism, matrix training, recombinative generalization, tact

Teaching tacts on SGD

- Tacts of pictures (Kagohara et al., 2012; Lorah & Parnell, 2017; van der Meer et al., 2015)
- Tacts of objects (Lorah et al., 2014)
- Use of prompts and reinforcement
 - Effective in establishing trained skills

Need to find strategies specifically aimed at developing generativity

Tact Noun-Verb Word Combinations

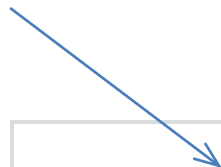
- Three Goals
 - Directly teach noun-verb combinations when tacting
 - “What’s happening?” “What do you see?”
 - Assess Recombinative Generalization
 - Assess tacts novel noun-verb combinations (generalization)
- Recombinative Generalization
 - Process in which individuals come to produce and respond to novel combinations of known components (Goldstein & Moussetis, 1989)
 - Involves teaching with overlapping stimuli
- Matrix Training
 - Systematic method to organize overlapping stimuli within a matrix

| | Verb 1 | Verb 2 | Verb 3 |
|--------|--------|--------|--------|
| Noun 1 | Train | Probe | Probe |
| Noun 2 | Probe | Train | Probe |
| Noun 3 | Probe | Probe | Train |

| | Jumping | Sleeping | Drinking |
|-------|---------|----------|----------|
| Sheep | Train | Probe | Probe |
| Bear | Probe | Train | Probe |
| Dog | Probe | Probe | Train |

| | Jumping | Sleeping | Drinking |
|-------|---------------|---------------|--------------|
| Sheep | Sheep jumping | Probe | Probe |
| Bear | Probe | Bear Sleeping | Probe |
| Dog | Probe | Probe | Dog Drinking |

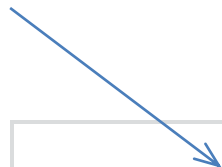
Diagonal Targets are
Directly Taught



| | Jumping | Sleeping | Drinking |
|-------|---------------|---------------|--------------|
| Sheep | Sheep jumping | Probe | Probe |
| Bear | Probe | Bear Sleeping | Probe |
| Dog | Probe | Probe | Dog Drinking |

Non-Diagonal Targets are
Probed for Recombinative
Generalization

Diagonal Targets are
Directly Taught

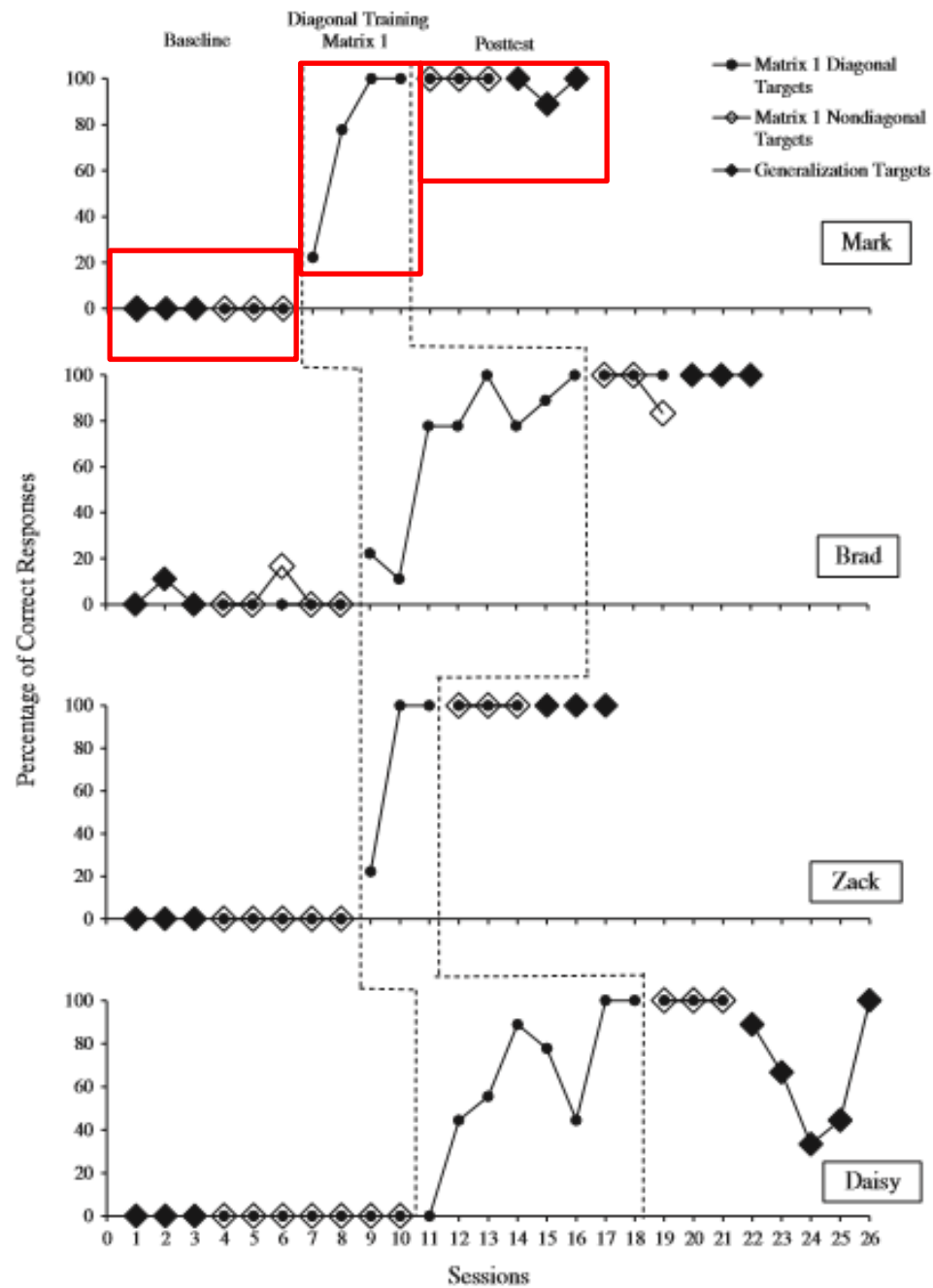


| | Jumping | Sleeping | Drinking |
|-------|---------------|----------------|----------------|
| Sheep | Sheep jumping | Sheep sleeping | Sheep drinking |
| Bear | Bear jumping | Bear Sleeping | Bear drinking |
| Dog | Dog jumping | Dog sleeping | Dog Drinking |

Non-Diagonal Targets are
Probed for Recombinative
Generalization



Probe Novel Matrix with
known components



Frampton et al. (2016)

Replication

Matrix training to teach tacts using speech generating devices: Replication and extension

Videsha Marya✉, Sarah Frampton, Alice Shillingsburg✉

First published: 05 March 2021 | <https://doi.org/10.1002/jaba.819>



Participants

- 3 participants
 - Bruce: 4-year-old male
 - Mason: 7-year-old male
 - Robin: 16-year-old male
- Diagnosis of ASD
- Received language intervention
 - 3-5 days per week, 2-3 hours a day
- Limited vocalizations

Participants

- Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) assessment
 - Significantly impaired echoic and articulation skills
 - Communicated using a SGD
 - iPad with digitized speech output
 - Fluent in device navigation (iconic and typed responses)

50 two-component
verb-noun or noun-
verb tacts/
instructions

| Name | VB-MAPP admission | Tact Milestone 9 |
|-------|-------------------|------------------|
| Bruce | 42 | 0 |
| Mason | 55 | 0 |
| Robin | 55.5 | 0 |

Settings and Materials

- All sessions conducted in a classroom within a language clinic
- Animals/toy figurines
- Accessory items (e.g. toy trampoline, toy car)
- Targets were selected for each participant based on mastery lists and results of direct probing



What's happening?




Methods

Diagonal Targets are
Directly Taught

Probe Novel Matrix with
known components

Matrix 1

Generalization Matrix

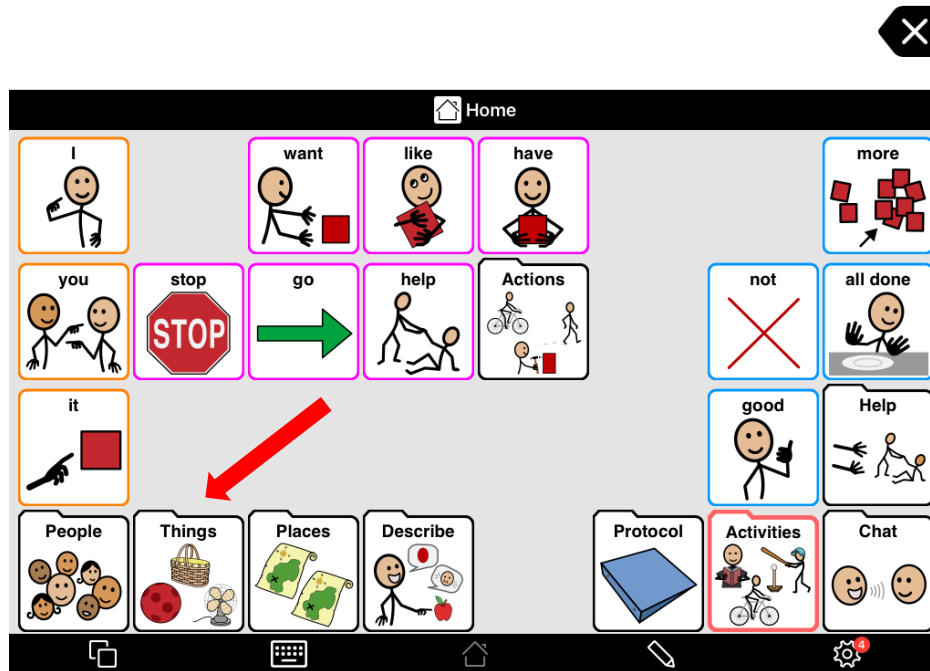


| | Jumping | Painting | Sitting |
|--------|----------------|-----------------|----------------|
| Dog | Dog Jumping | Dog Painting | Dog Sitting |
| Rabbit | Rabbit Jumping | Rabbit Painting | Rabbit Sitting |
| Pig | Pig Jumping | Pig Painting | Pig Sitting |

| | Drinking | Reading | Eating |
|-----------|--------------------|-------------------|------------------|
| Duck | Duck Drinking | Duck Reading | Duck Eating |
| Bear | Bear Drinking | Bear Reading | Bear Eating |
| Alligator | Alligator Drinking | Alligator Reading | Alligator Eating |

Non-Diagonal Targets are
Probed for Recombinative
Generalization

Methods



Methods



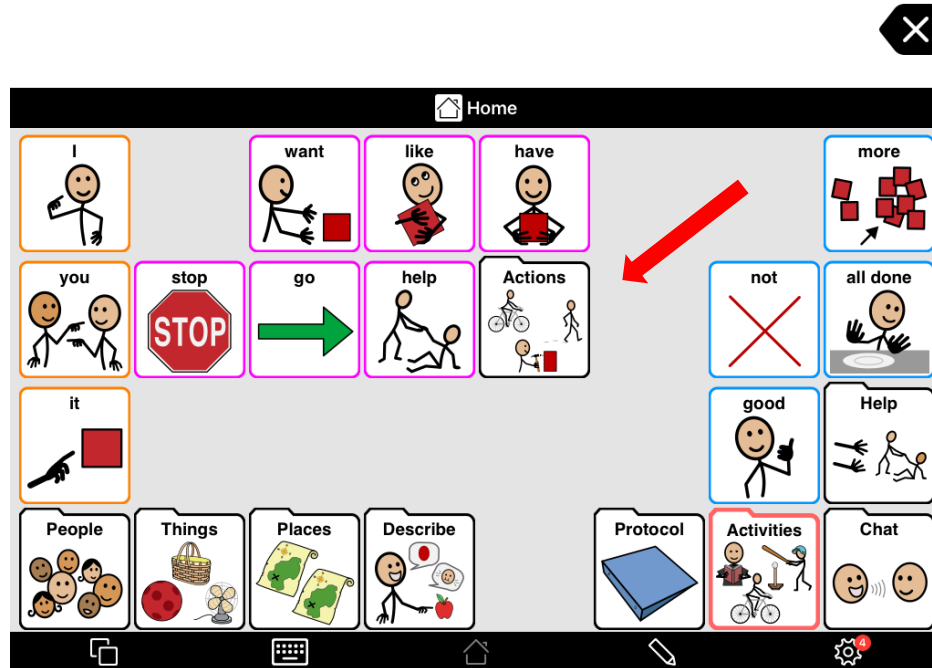
Methods

The screenshot shows a communication board interface. At the top left, there is a 'dog' icon with the word 'dog' written below it. A red arrow points from this icon to a 'dog' icon in a grid below. The grid is titled 'Animals' and contains various icons for animals and actions. A red arrow also points from the 'dog' icon in the grid to the 'dog' icon in the top left. The grid is organized as follows:

| | | | | | | | |
|-------|----------|--------|-----------|-------|---------|------|--------|
| I | is | want | like | do | animal | who | pet |
| you | bear | bird | butterfly | cat | chicken | not | cow |
| dog | elephant | fish | fly | frog | horse | lion | monkey |
| mouse | pig | rabbit | snake | tiger | turtle | More | 2 |

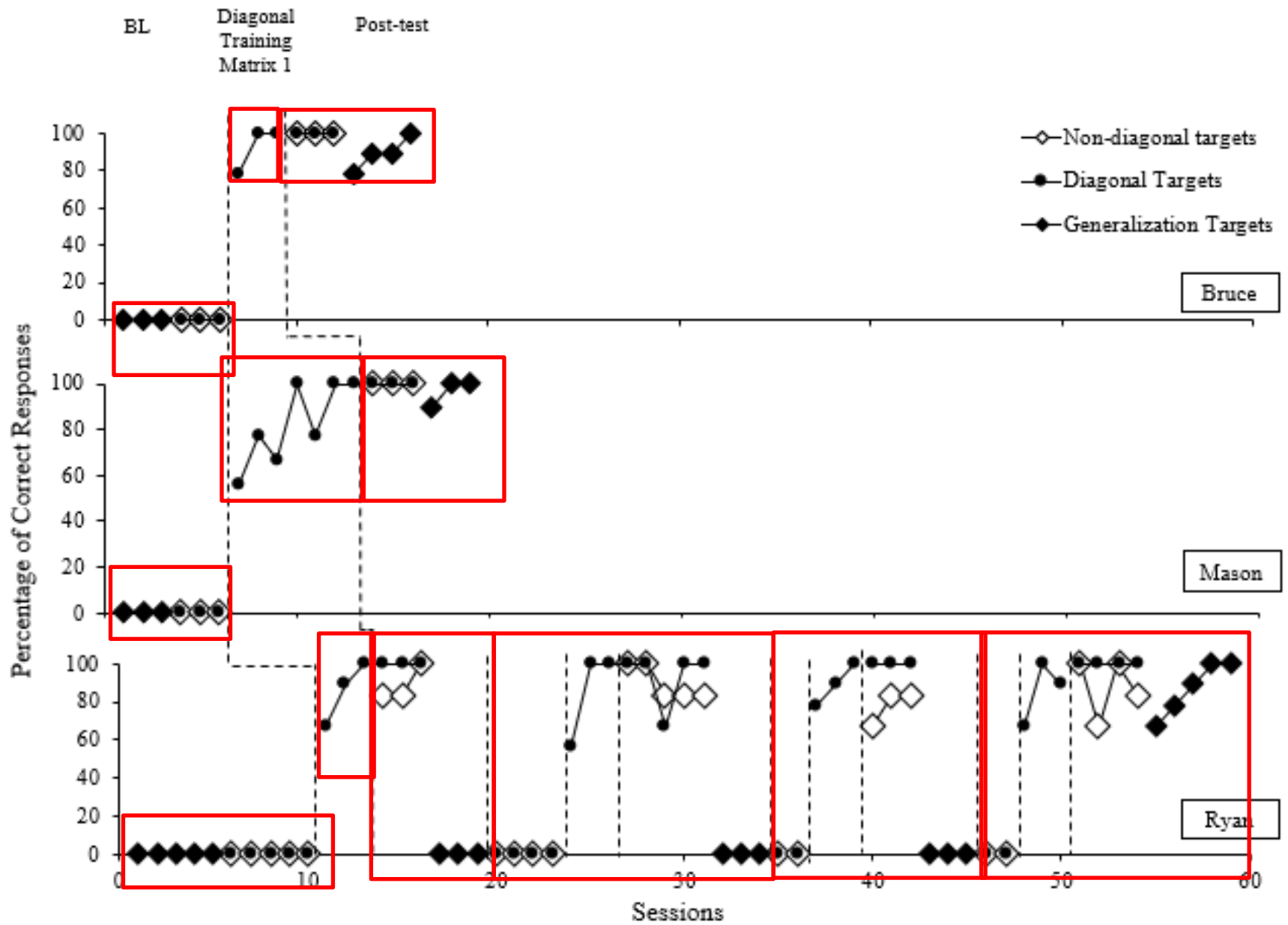
The 'More' button has a right-pointing arrow and the number '2' inside. The interface also includes a 'Things' button on the left, an 'Animals' button in the center, and a close button (X) on the right. At the bottom, there are icons for a keyboard, a home button, a pencil, and a settings gear.

Methods



Methods

The screenshot shows a communication app interface. At the top, there is a preview area with icons for 'dog' and 'jumping', and a hand icon pointing towards the 'jumping' icon. A red arrow points from this hand icon to the 'jumping' icon in the main grid. The main grid is titled 'Action words' and contains a 4x8 grid of icons. The icons are: Row 1: 'I' (stick figure), 'is' (equals sign), 'used to' (clock), 'have to' (stick figure pointing), 'do' (stick figure), 'don't' (stick figure with red X), 'opening' (stick figure opening door), 'more' (stack of red blocks). Row 2: 'you' (two stick figures), 'drinking' (stick figure with cup), 'driving' (stick figure in car), 'flying' (jet airplane), 'eating' (stick figure eating), 'cutting' (stick figure with scissors), 'not' (red X), 'all done' (stick figure with plate). Row 3: 'it' (hand pointing to red square), 'jumping' (stick figure jumping), 'sleeping' (stick figure with Z's), 'sitting' (stick figure on chair), 'kicking' (stick figure with ball), 'swimming' (stick figure in water), 'slide' (stick figure on slide), 'building' (stick figure with blocks). Row 4: 'washing hands' (hands being washed), 'reading' (stick figure with book), 'painting' (stick figure painting), 'blowing bubbles' (stick figure blowing bubbles), 'writing' (stick figure writing), 'yawning' (stick figure yawning), 'sneezing' (stick figure sneezing), 'More' (arrow with number 2). The bottom navigation bar contains icons for home, keyboard, home, pencil, and settings (with a red notification bubble).



Marya, Frampton, &
Shillingsburg

Results

- All 3 participants learned to emit noun-verb combinations when directly taught
- All 3 emitted recombined responses
- 2 of the 3 showed immediate generalization to novel combinations
- 1 participant required multiple exemplars

Conclusions

- Our goals to replicate procedures that are effective with vocal children with those using SGDs
- All studies required multi-step navigation
- Children with autism presenting as level 2 and level 3 on the VB-MAPP who are non-vocal can acquire complex communication skills using SGDs
- We need more research into the development of advanced verbal behavior using high tech Speech Generating Devices

Thank You!!!!

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