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Teaching Receptive Identification to Children Who Were Unsuccessful with a Standard Training Program

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TEACHING RECEPTIVE IDENTIFICATION TO CHILDREN WHO WERE UNSUCCESSFUL WITH A STANDARD TRAINING PROGRAM

by

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Kaylee R. Tomak, Ph.D.

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This research strongly suggests that essentially all children with the skill of generalized matching can learn receptive identification, even if they have failed to do so, using the standard least-to-most prompting procedure. The effective alternative procedures were antecedent picture prompting (Stone & Malott, 2010), consequence picture prompting (Carp et al., 2012), and receptive-exclusion training (McIlvane et al., 1984). In addition, these procedures generally produced high levels of maintenance, and they also typically produced a high level of generalization to novel stimulus sets. However, no single alternative procedure was more effective or more efficient across all of the children. In this research, only two of eight children failed to learn receptive identification, but neither of them had the opportunity for receptive-exclusion training.

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INTRODUCTION

Responding appropriately to another person's spoken instruction is referred to as receptive language. It is critical for the development of spoken language and allows the child to engage in a variety of important learning opportunities, such as following directions and identifying pictures in a book (Grow & LeBlanc, 2013). Children with developmental disabilities often need interventions to teach receptive language, as they frequently do not respond to the instructions or cues that are effective in evoking the desired response for typically developing children (Green, 2001).

To minimize errors and decrease the likelihood of prompt dependence, an effective prompting and prompt-fading strategy should be identified. Some prompting methods that have been used include physical and picture prompts (Carp et al., 2012; Fisher et al., 2007; Jones & Zarcone, 2014; Vedora & Barry, 2016). A variety of prompt-fading strategies have been identified including most-to-least prompting, time delays, graduated guidance, stimulus fading, and stimulus shaping (MacDuff et al., 2001).

Stimulus fading involves overemphasizing a physical dimension of a stimulus as a prompt for the learner to engage in the correct response and then fading that overemphasized physical dimension to facilitate the transfer of stimulus control from the prompt to the desired controlling stimulus (Green, 2001; MacDuff et al., 2001). Stone and Malott (2010) used an antecedent picture prompt to teach a child to receptively identify pictures. To fade the picture prompts so that the response came under the control of the auditory sample stimulus, stimulus fading was used.

Vedora and Barry (2016) evaluated the use of picture prompts to teach receptive identification. Picture prompts used with a progressive-time delay were effective for teaching receptive identification, though one participant required a procedural alteration in the form of an echoic differential observing response.

A few studies have used an identity-matching task (or picture prompts) within their error correction to teach receptive identification (Carp et al., 2012; Fisher et al., 2007; Jones & Zarcone, 2014). Carp et al. (2012) evaluated methods for teaching receptive identification using three conditions: picture prompt, pointing prompt, and a control condition. In the picture prompt condition, they used an identity-matching task within their error correction. The pointing prompt condition started with a pointing prompt and moved to a physical prompt if the point was unsuccessful. The picture prompt condition was more successful than the pointing prompt condition for all four participants in increasing the number of correct responses in the receptive identification procedure.

This research began as a replication of the study conducted by Carp et al. (2012) with the addition of an antecedent picture prompt (Stone & Malott, 2010). Additional modifications were then made, and other teaching strategies were explored based on the children's performance.

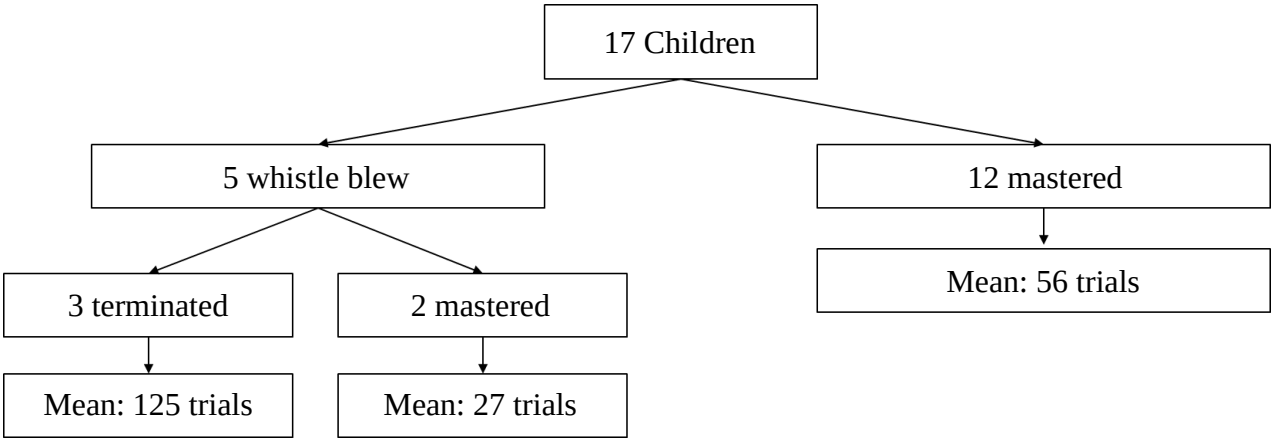
BACKGROUND INFORMATION: HISTORICAL CLASSROOM DATA

In Kalamazoo Regional Educational Service Agency's (KRESA) Early Childhood Special Education Classroom, receptive identification is frequently targeted. The classroom training procedure uses a least-to-most (LTM) hierarchy of physical guidance as error correction, and no reinforcers are given for corrected responses. Classroom data for 17 children, from September 2016 to August 2018, were reviewed.

Twelve of those 17 children mastered phase 1 of this procedure (identified three objects or pictures) in a mean 56 discrete trials (range, 23 to 179). The remaining five children met the whistle-blow criterion (showed a lack of progress) in phase 1. The whistle-blow criterion was met if the child had five consecutive sessions at or below 50% correct or 20 sessions without meeting the mastery criterion for that phase. Two of those five children continued in phase 1 and met the mastery criterion after a mean of 271 trials (range, 252 to 289), with some modifications of the original procedure. The remaining three children did not complete phase 1 after a mean of 125 trials (range, 110 to 146), presumably because it was concluded that they lacked the prerequisite skills, and the procedure was terminated due to their lack of progress. (See Figure 1 below and Table A1 and Figure A1 in Appendix A.)

Figure 1

Results of the Receptive Identification Procedure in a Preschool Classroom



GENERAL METHOD

Setting

All children attended a Kalamazoo Regional Educational Service Agency (KRESA) preschool classroom for three hours per day, five days per week. Sessions took place in the child's work area.

Participants

Eight children diagnosed with autism spectrum disorder participated in this study. Their ages ranged from 2-4 years old. They were selected due to lack of progress on the classroom's receptive-identification procedure, which used an LTM physical prompting hierarchy. In order to be included in the study, the children were required to have mastered the classroom's identity-matching procedure and have met whistle-blow criterion on the classroom receptive-identification procedure. Table 1 contains information for each child including their age and months in the classroom at the start of the study. The Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) (Sundberg, 2008) was used to assess the skills of each child; the results from the most recent assessments are reported in Table 1.

Materials

Preferred edible and tangible items were used to reinforce correct responses. Each condition used a different set of visual stimuli, consisting of four laminated (5.6 cm by 7.6 cm) picture cards. A stimulus board was used to present the comparison stimuli. For the two conditions involving a picture prompt, the researcher had an additional set of identical picture cards, at varying intensities (see Stimulus Fading below). A counterbalanced datasheet based on

Grow and LeBlanc's (2013) recommendation was used to indicate the target stimulus for each trial and comparison-stimuli placement (see Appendix B). A camera was used to record sessions.

Sample/Comparison Presentation Order

Petursdottir and Aguilar (2016) studied the acquisition of receptive identification and compared whether presenting the comparison stimuli first was more efficient than presenting the sample stimulus first. They found that participants required fewer trials to mastery when the sample stimulus was presented first. Carp et al. (2012) presented the sample stimulus before presenting the array of comparison stimuli. However, for the present research, procedures began with the presentation of the comparison stimuli first, as the antecedent picture prompt involved a prompt presented with the auditory sample stimulus. But, for some children, we switched the presentation order; the sample stimulus was presented before the comparison stimuli in order to prevent responding prior to the auditory sample stimulus (see Table 2).

Table 1

Participant Information

Study	Child information			Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP)[1]			
	Name	Age[2]	Time in classroom[1]	Time since last assessment	Milestones[3]	EESA[4]	Barriers[5]
1	Jonas	3 years	12 months	5 months, 26 days	Total: 34.5/170 Listener: 1.5/15 VP/MTS: 6/15	4.5/100	Total: 48/96 MTS: 2/4 Listener: 2/4 Conditional discrimination: 4/4
2	Jadah	3 years	2 months	1 month, 24 days	Total: 27.5/170 Listener: 2/15 VP/MTS: 4/15	3.5/100	Total: 39/96 MTS: 4/4 Listener: 4/4 Conditional discrimination: N/A
	Aubrey	2 years	4 months	3 months, 17 days	Total: 6/170 Listener: 0/15 VP/MTS: 1/15	0/100	Not reported
3	Natalie[6]	4 years	21 months	6 months, 25 days	Total: 28/170 Listener: 2/15 VP/MTS: 9/15	0/100	Total: 47/96 MTS: 0/4 Listener: 4/4 Conditional discrimination: 1/4
	Christian	4 years	5 months	3 weeks, 4 days	Total: 60.5/170 Listener: 2.5/15 VP/MTS: 8/15	Not reported	Total: 36/96 MTS: 0/4 Listener: 4/4 Conditional discrimination: 0/4

Table 1—Continued

	Child information			Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP)[1]			
Study	Name	Age[2]	Time in classroom[1]	Time since last assessment	Milestones[3]	EESA[4]	Barriers[5]
4	Gunner	3 years	9 months	3 months, 5 days	Total: 18.5/170 Listener: 0.5/15 VP/MTS: 6/15	0/100	Total: 32/96 MTS: 0/4 Listener: 0/4 Conditional discrimination: 0/4
5	Mason	3 years	5 months	4 months, 12 days	Total: 16.5/170 Listener: 0.5/15 VP/MTS: 7.5/15	0/100	Not reported
	Abrahm	3 years	5 months	2 months, 24 days	Total: 42/170 Listener: 2/15 VP/MTS: 7.5/15	Not reported	Not reported

Note. The VB-MAPP are presented as follows (obtained score)/(total possible score).

[1]Sundberg (2008).

[2]At the start of the study.

[3]Milestones reported: listener responding (listener) and visual perceptual/match-to-sample (VP/MTS).

[4]Early Echoic Skills Assessment (Esch, 2008).

[5]Barrierrs reported: defective match-to-sample (MTS), defective listener responding, and defective conditional discrimination.

[6]Psydonym used to protect participant's privacy.

Table 2

Sample/Comparison Presentation Order

Participant	Set	Presentation order
Jonas	1	Comparison stimuli first
	2	Comparison stimuli first
Jadah	1	Comparison stimuli first
	2	Comparison stimuli first
Aubrey	1	Sample stimulus first[1]
Natalie	1	Sample stimulus first[1]
Christian	1	Sample stimulus first[1]
Gunner	1	Sample stimulus first[1]
	2	Comparison stimuli first
	3	Comparison stimuli first
Mason	1	Comparison stimuli first
	2	Comparison stimuli first
Abrahm	1	Comparison stimuli first
	2	Comparison stimuli first

[1]Training began with the comparison stimuli being presented first and then switched to the sample stimulus being presented first, partway through the intervention.

Experimental Design

Studies 1, 2, 3, and 4[1] used an alternating treatments design to assess the effectiveness of three prompting strategies for teaching receptive identification. The design controlled for variability across days by exposing the children to each condition in a given day[2] and randomizing the order of conditions. The dependent variable was the percentage of correct receptive-identification responses, and the independent variable was the type of prompting strategy used: the antecedent picture prompt, the consequence picture prompt, and the pointing prompt.

Study 5 used a multiple treatment reversal design. This design allowed us to demonstrate a functional relation between the independent variable and the dependent variable by returning to baseline with new stimuli after the first set of stimuli were mastered, and then reintroducing the intervention for the new stimuli. The dependent variable was the percentage of correct responses and the independent variable was the antecedent picture prompt procedure.

Interobserver Agreement and Treatment Integrity

During sessions, correct and incorrect responses, and nonresponses were recorded. Echoic and emotional responses were also recorded. Trial-by-trial, interobserver-agreement (IOA) and treatment integrity data were collected on correct and incorrect responses. Incorrect responses included responses containing errors and nonresponses. An independent observer scored IOA in-vivo or later by watching a video of the session. For six of the participants, IOA was conducted for a mean of 56.79% (range, 35.29% to 73.98%) of sessions across all

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[1] Study 4 started with an alternating treatments design, but further modifications were needed to teach the skill.

[2] Due to time constraints, occasionally all conditions were not able to be conducted each day.

conditions, with a mean agreement of 99.92% (range, 88% to 100%). Treatment integrity was measured based on a task analysis for each condition. Using the task analysis, an independent observer recorded the percentage of steps implemented correctly. For six participants, treatment integrity was conducted for a mean of 53.06% (range, 23.92% to 69.64%) of sessions with a mean agreement of 99.84% (range, 90% to 100%). IOA and treatment integrity were not conducted for two participants due to resource constraints.

STUDY 1 – PILOT: A COMPARISON OF PROMPTING METHODS FOR TEACHING RECEPTIVE IDENTIFICATION

The following study was conducted with one pilot child who had not made progress in the classroom receptive identification procedure.

Method

Participant

Jonas was 3 years old the beginning of the study and made minimal echoic responses. For additional information, refer to Table 1 above.

Procedure

Instructional Arrangement

Three conditions were used: (a) antecedent picture prompt, (b) consequence picture prompt, and (c) pointing prompt, frequently referred to as a LTM physical prompt. All three conditions were conducted in a randomized order each day, typically five days a week[3]. A balanced design was used, i.e., each session consisted of four comparison stimuli and 16 trials, and each comparison stimulus was the positive comparison stimulus for four trials. A trial consisted of the presentation of the comparison stimuli on a stimulus board, followed by the presentation of the auditory sample stimulus for the target (e.g., "shoe"). The auditory sample stimulus was repeated every 2 s for up to 5 s if a response was not made. A preferred item and praise were provided if Jonas selected the positive comparison stimulus within 5 s.

[3] Due to time constraints, occasionally all conditions were not able to be conducted each day.

Error correction involved a hierarchy of LTM physical guidance. If he made an incorrect response or did not respond within 5 s, the researcher repeated the auditory sample stimulus and provided a gestural prompt (for the pointing prompt and antecedent picture prompt conditions) or a picture prompt (for the consequence picture prompt condition) to respond to the positive comparison stimulus. If he did not select the positive comparison stimulus within 5 s of the gestural or picture prompt, the researcher repeated the auditory sample stimulus, and he was physically guided to select the positive comparison stimulus. No praise or preferred items were provided for responding after the error correction. Responses were recorded as correct if he selected the positive comparison stimulus within 5 s of the presentation of the auditory sample stimulus, as incorrect if he selected a comparison stimulus that did not correspond to the auditory sample stimulus, and as a nonresponse if he did not select any comparison stimulus within 5 s. Echoic responses were noted if the child echoed or made an echoic approximation of the auditory sample stimulus. Emotional responses, such as crying, screaming, or swiping the instructional materials were also recorded. Sessions were conducted until the mastery criterion was met for a condition. The mastery criterion was three out of five consecutive sessions with at least 88% of the responses correct in each session.

Pretest

A pretest of 24 stimuli was conducted to determine if Jonas could receptively identify any of the stimuli to be used in the study. The pretest involved presenting an array of four pictures on a stimulus board and the presentation of the auditory sample stimulus referring to one of the pictures. An incorrect response was recorded when he selected the wrong comparison stimulus or did not select any comparison stimulus. After a selection was made or 5 s elapsed without a selection, the researcher removed the comparison stimuli and ended the trial without

consequating the response. Stimuli that Jonas correctly selected two out of three times during the three pretest sessions were not used in the study. Twelve of the remaining stimuli were selected (see Appendix C). A speech-language pathologist was consulted to ensure that the vocal stimuli assigned to each condition were age-appropriate and easily discriminated auditorily. Previously mastered tasks from other training procedures were presented, and correct responses were reinforced every 2-3 trials to maintain compliance and avoid problem behavior due to lack of reinforcement.

Pointing Prompt

In the pointing prompt condition, incorrect or nonresponses resulted in a LTM error-correction hierarchy, with a gestural prompt being the first prompt in the hierarchy.

Consequence Picture Prompt

In the consequence picture prompt condition, incorrect or nonresponses resulted in a LTM error-correction hierarchy, with a picture prompt being the first prompt in the hierarchy.

Antecedent Picture Prompt

In the antecedent picture prompt condition, a picture identical to the positive comparison stimulus was presented simultaneously with the auditory sample stimulus and the picture remained visible throughout the trial.

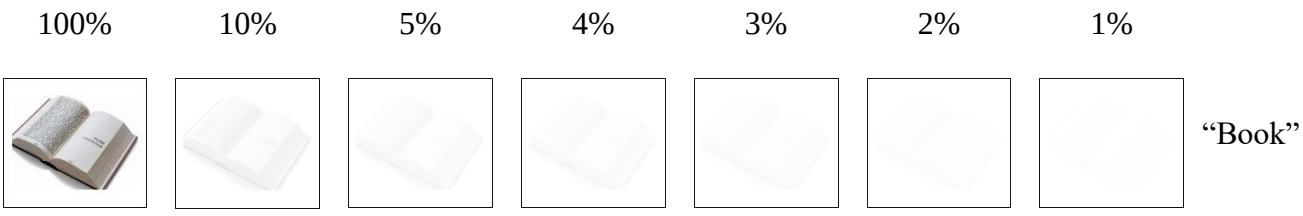
Probe. After the mastery criterion was met, during the antecedent picture prompt condition, the researcher conducted a probe session. Probe sessions involved the presentation of the auditory sample stimuli without the picture prompts. Sixteen trials were conducted in probe sessions, where each stimulus was the positive comparison stimulus for four trials. The researcher delivered a preferred item and praise following correct responses. No error correction was used following incorrect responses. During probe sessions, if Jonas responded correctly to

14 or more of the 16 trials, only the auditory sample stimulus was provided for the remaining sessions, without the use of picture prompts. Otherwise, the researcher began stimulus fading.

Stimulus fading. If Jonas did not meet the mastery criterion in the initial probe session, subphases were introduced where the picture prompts were faded in intensity. The picture prompts were first reduced to 10% intensity, then to 5%, 4%, 3%, 2%, and 1% (see Figure 2 for visual representation of picture prompt intensities and Figure D1 in Appendix D for a description of how the various levels of stimulus fading were determined). A subphase was considered mastered, if Jonas scored at or above 88% correct in three of five consecutive sessions, unless he responded correctly to the first eight trials of the first session. If this occurred, the researcher proceeded to the next subphase. With the exception of the picture prompts at 10% intensity, after the criterion for change was met in a subphase, a probe session was conducted to determine if he would respond to the auditory sample stimulus, without the use of picture prompts. After the mastery criterion was met with the 1% picture prompts, another probe was conducted. If he responded correctly to 14 or more of the 16 trials, the condition was considered mastered.

Figure 2

Picture Prompt Intensities Used Within Stimulus Fading Sessions



Generalization Probe

A generalization probe was conducted after all conditions were mastered. These probes involved four novel examples of stimuli used in the study.

Generalization-Maintenance Probe

Maintenance probes were conducted three months after the generalization probes. They were similar to the generalization probe and tested for responding to four novel examples of stimuli used in the study.

Results and Discussion

Set 1

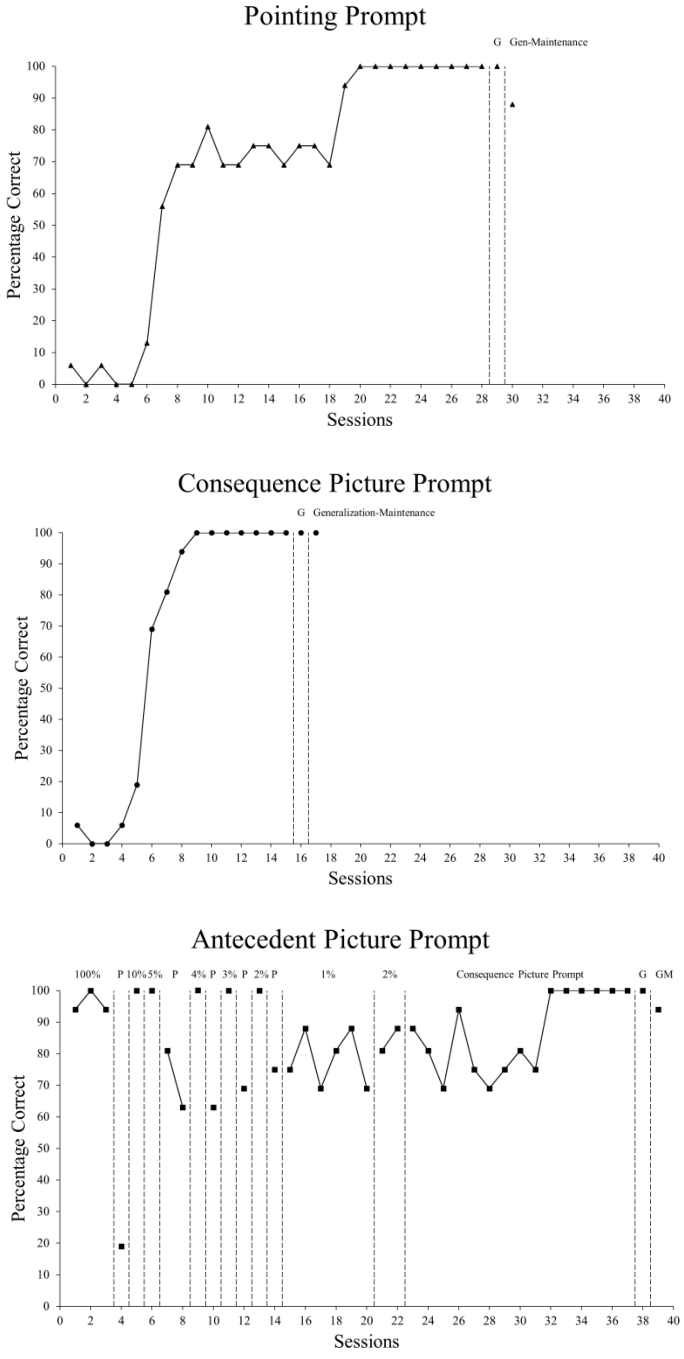
Jonas met the mastery criterion for responding to the auditory sample stimulus after 10 sessions in the consequence picture prompt condition, and after 24 sessions in the pointing prompt condition, but mastery criterion was not met in the antecedent picture prompt condition by 20 training sessions; therefore, procedural alterations were made for the antecedent picture prompt condition (see Figure 3 and Table 3). In that condition, after session 4, he made errors to only two of the stimuli (juice and chair) and made no errors to the other two stimuli (book and spoon). When he did make an error to “juice,” it was essentially always that he would select chair and vice versa when he made an error to “chair.” Then at the start of the correction trial, he would immediately select the correct comparison stimulus. After six sessions with no progress with the 1% intensity picture prompts, the researcher conducted two sessions where the 2% intensity picture prompts were used, as he had previously responded 100% correctly with the 2% intensity. After two sessions without meeting the mastery criterion, at this intensity, the researcher terminated the antecedent picture prompt condition and instead conducted the consequence picture prompt condition for those stimuli. Generalization to novel examples of

trained stimuli was obtained and responses maintained at the three-month follow-up. For Jonas, it appeared that the consequence picture prompt condition was the most effective and efficient method for teaching receptive identification.

For research purposes, the antecedent picture prompt condition involved probe sessions following each mastered subphase, resulting in a total of 96 trials where error correction and training were not conducted which may have decreased the efficacy of the antecedent picture prompt condition. This is what influenced changes in Study 2 where within-session prompt fading was used and there were no probes between prompt-fading sessions. Also, the criterion for prompt fading was decreased from 100% correct for the first 8 trials to 100% correct for either the first or second 8 trials, thereby allowing for more frequent prompt fading.

Figure 3

Jonas's Results for Set 1



Note. The results of the antecedent picture prompt, consequence picture prompt, and pointing prompt conditions. For all conditions, *G* refers to the generalization probe and *Gen-Maintenance/GM* refers to the generalization-maintenance probe. For the antecedent picture prompt condition, the percentage refers to the intensity of the picture prompts and *P* refers to the probes conducted between the stimulus fading conditions.

Table 3

Trials to Mastery

Participant	Stimulus set	Prompting conditions		
		Pointing prompt	Consequence picture prompt	Antecedent picture prompt[1]
Jonas	1	336	160 192[2]	320
	2	64	64	64
Jadah	1	320	304	288 64[3]
	2	96	80	64 64[3]
Aubrey	1	288 48[4]	464	368
Natalie	1	Not mastered	Not mastered	Not mastered
Christian	1	Not mastered	Not mastered	Not mastered
Gunner	1	Not mastered	Not mastered	Not mastered
	2	Not tested	Not tested	Not mastered[6]
	3	240[7]	Not tested	Not tested
Mason[6]	1	Not tested	Not tested	264
	2	Not tested	Not tested	64
Abrahm[6]	1	Not tested	Not tested	144
	2	Not tested	Not tested	160

[1]Probe trials are included in the number of trials to mastery.

[2]Number of trials conducted with the same stimulus set Jonas had used in the antecedent picture prompt condition, after he had failed to master it during that condition.

[3]Number of trials conducted with the same stimulus set Jadah had used in the pointing prompt condition, after she had failed to master it during that condition. Note that she mastered 2 different stimulus sets in the minimal 64 trials each, using the antecedent picture prompt.

[4]Number of trials conducted with the same stimulus set Aubrey had used in the antecedent picture prompt condition, after she had failed to master it during that condition.

[6]Only the antecedent picture prompt condition was conducted.

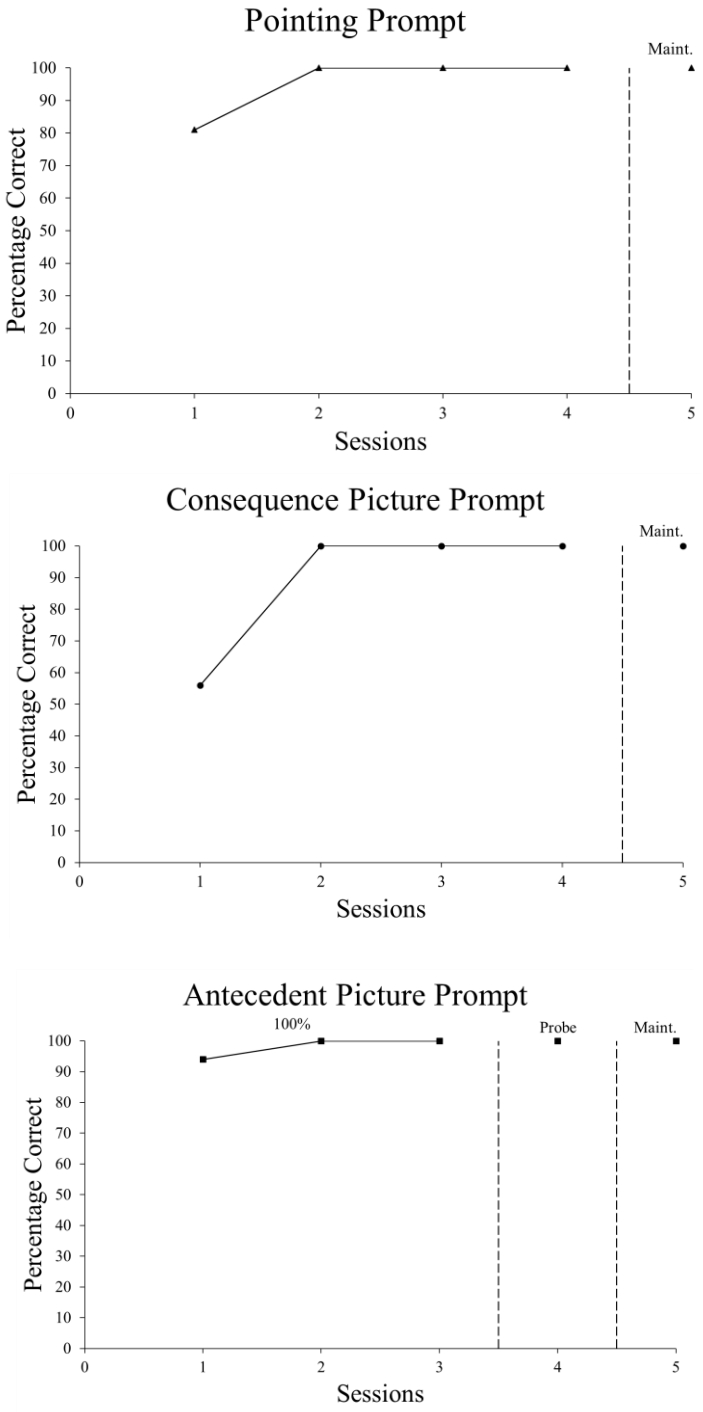
[7]Number of trials conducted with receptive-exclusion training.

Set 2

After the first set of stimuli was mastered, the three conditions were replicated with a novel set of stimuli. He acquired the receptive-identification skill so well, that he mastered the second three sets of four stimuli in just four sessions; in fact, after the first session of 16 trials, with each set of stimuli and the three different prompting methods, he made no errors on the remaining sessions, with any of those stimuli, regardless of the prompting methods (see Figure 4 and Table 3). Responses maintained at the one-month follow-up.

Figure 4

Jonas's Results for Set 2



Note. The results of the antecedent picture prompt, consequence picture prompt, and pointing prompt conditions. *Maint*. refers to the maintenance probe. For the antecedent picture prompt condition, the percentage refers to the intensity of the picture prompts.

STUDY 2: A COMPARISON OF PROMPTING METHODS FOR TEACHING RECEPTIVE IDENTIFICATION

After Study 1 was conducted, some slight modifications were made to the procedures to further facilitate teaching receptive identification to children who met the whistle-blow criterion (described above).

Method

Participants

Jadah was 3 years old and Aubrey was 2 years old at the beginning of Study 2. For additional information, refer to Table 1 above.

Procedure

The procedures were similar to Study 1, with three prompting methods being compared: pointing prompt, consequence picture prompt, and antecedent picture prompt. Modifications to the antecedent picture prompt condition were made: probe sessions were not conducted after the mastery criterion was met with each intensity and within-session stimulus fading was conducted. This meant that if the first or second eight-trial blocks of a session was 100% correct, the following eight trials would use picture prompts at a lower intensity (see Figure 2). If there were four or more errors within a block of eight trials, the following eight trials would use picture prompts at a higher intensity.

Results and Discussion

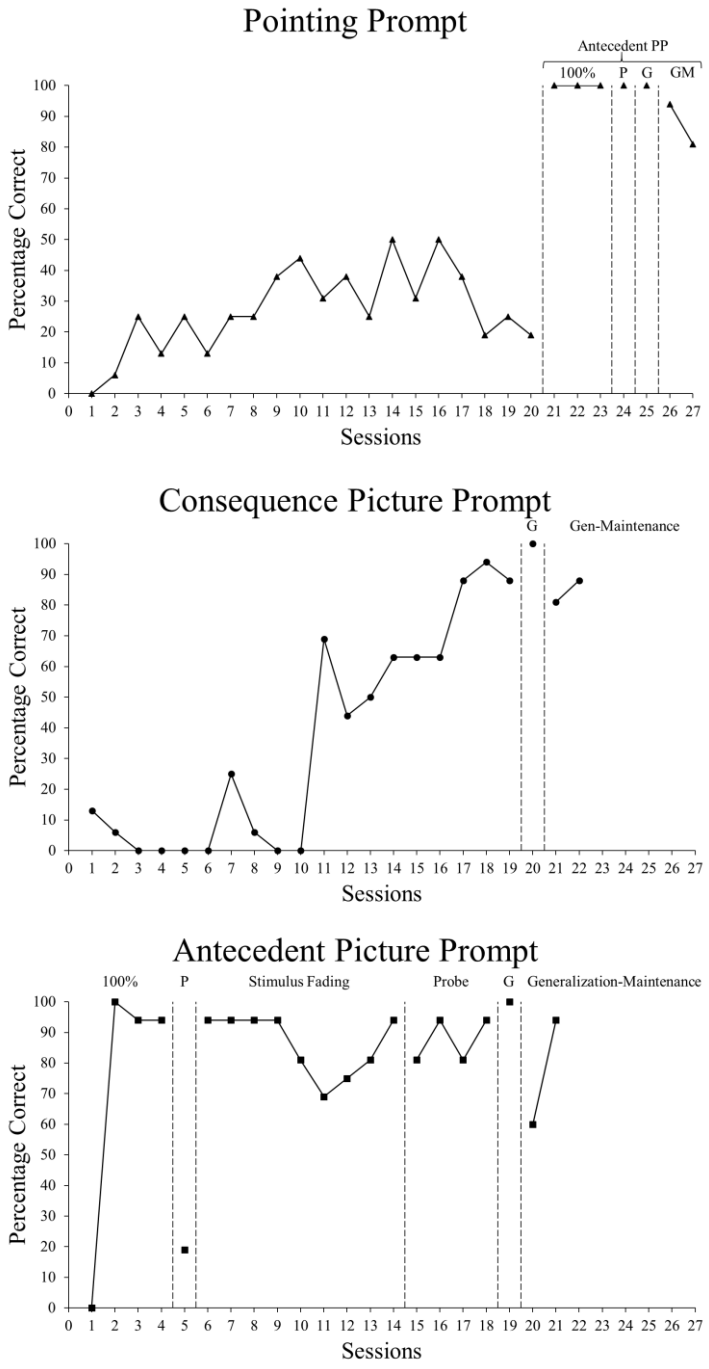
Jadah

Set 1

Jadah met the mastery criterion for responding to the auditory sample stimulus after 18 sessions in the antecedent picture prompt condition, after 19 sessions in the consequence picture prompt condition, and the mastery criterion was not met in the pointing prompt condition; so procedural alterations were made (see Figure 5 and Table 3). The researcher terminated the pointing prompt condition and instead conducted the antecedent picture prompt condition for those stimuli. Generalization to novel examples of trained stimuli was obtained and responses maintained at the one-to-two-month follow-up.

Figure 5

Jadah's Results for Set 1



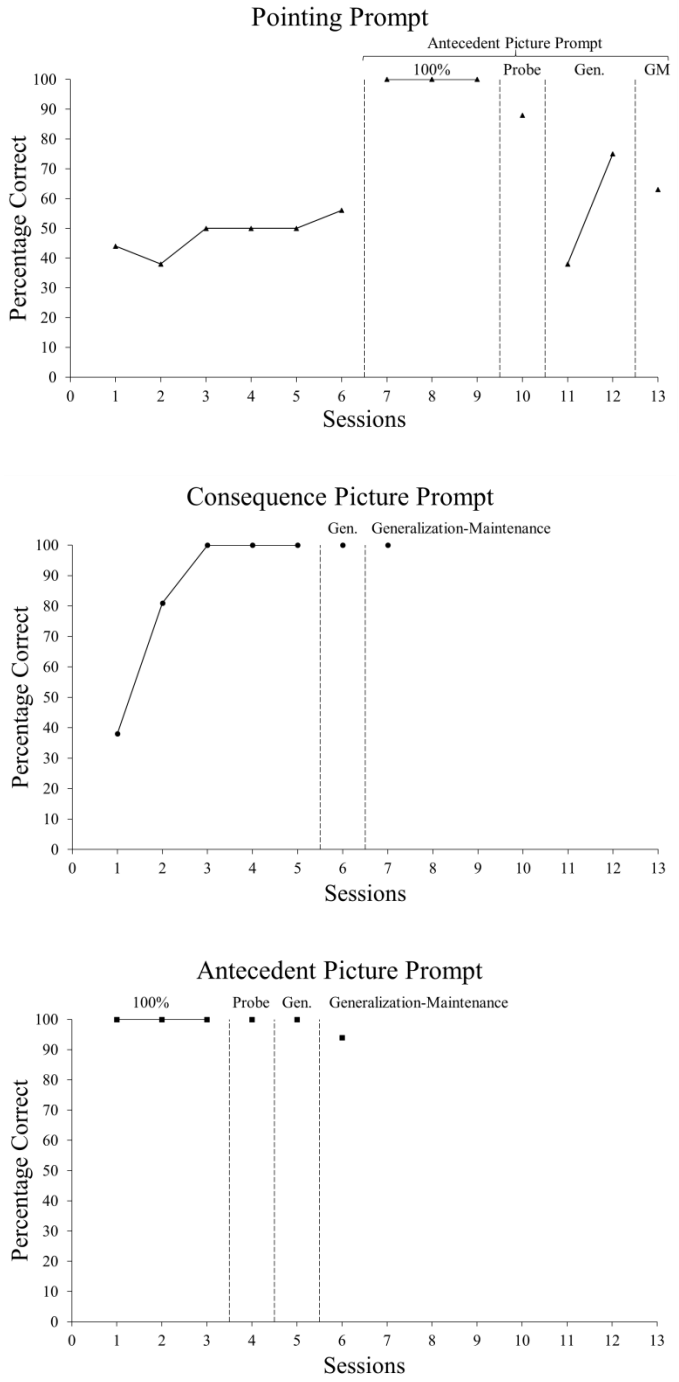
Note. The results of the antecedent picture prompt, consequence picture prompt, and pointing prompt conditions. For all conditions, *G* refers to the generalization probe and *GM/Gen- Maintenance* refers to the generalization-maintenance probe. For the antecedent picture prompt condition, the percentage refers to the intensity of the picture prompts, and *P* refers to the probes conducted before and after the stimulus fading sessions.

Set 2

Following the mastery of Set 1, a second set of stimuli was chosen. Jadah met the mastery criterion for responding to the auditory sample stimulus after four sessions in the antecedent picture prompt condition, after five sessions in the consequence picture prompt condition, but the mastery criterion was not met in the pointing prompt condition; so procedural alterations were made (see Figure 6 and Table 3). In addition, after poor performance for 96 trials with the pointing prompt, the researcher switched to the antecedent picture prompt with the same four stimuli and Jadah made no errors, in the first session and only two errors out of 16 trials during the fourth session, the probe session. Generalization to novel examples of trained stimuli was obtained and responses maintained at one-month follow-up. For Jadah, it appeared that the antecedent picture prompt condition was the most effective and efficient method for teaching receptive identification.

Figure 6

Jadah's Results for Set 2



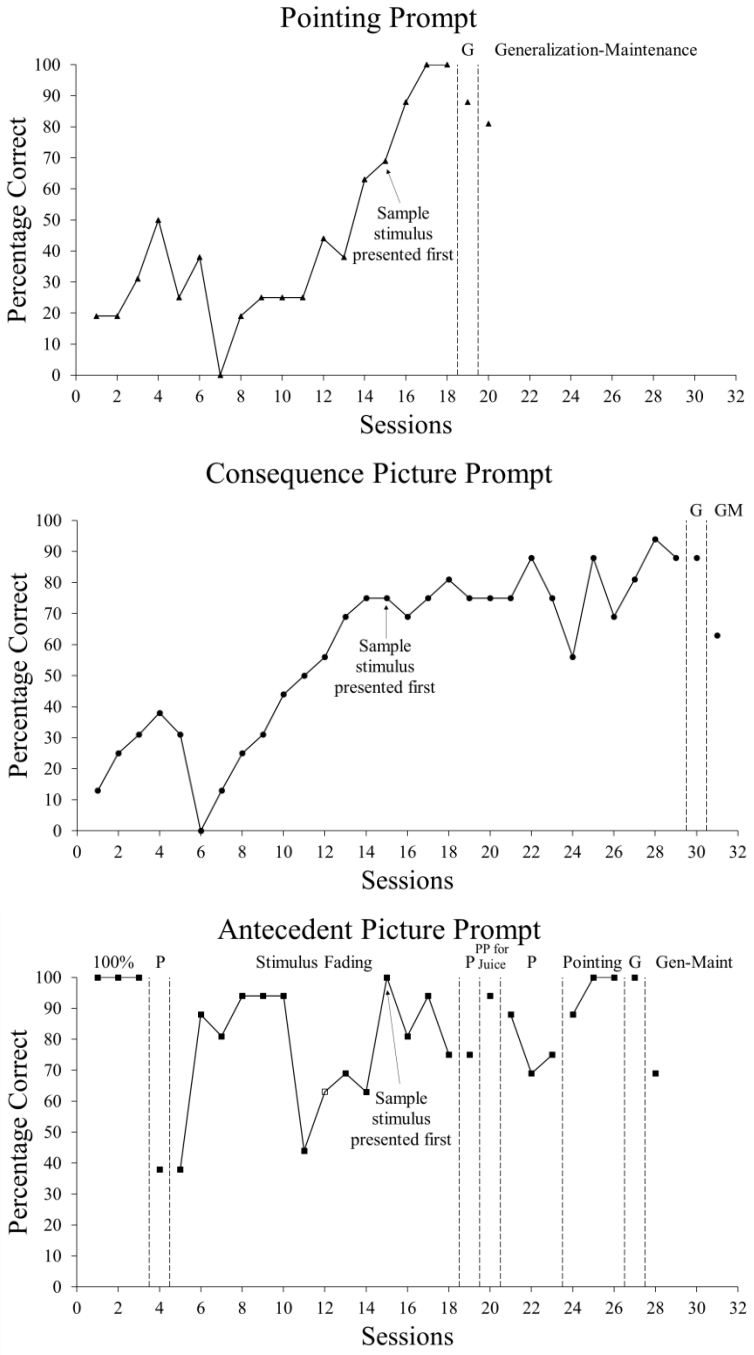
Note. The results of the antecedent picture prompt, consequence picture prompt, and pointing prompt conditions. For all conditions, *Gen* refers to the generalization probe and *GM/Generalization-Maintenance* refers to the generalization-maintenance probe. For the antecedent picture prompt condition, the percentage refers to the intensity of the picture prompts.

Aubrey

Aubrey met the mastery criterion for responding to the auditory sample stimulus after 18 sessions in the pointing prompt condition, after 29 sessions in the consequence picture prompt condition, and the mastery criterion was not met in the antecedent picture prompt condition; therefore, procedural alterations were made (see Figure 7 and Table 3). At session 20, the researcher stopped using the picture prompts for “book,” “chair,” and “shirt” trials, only using a picture prompt for “juice” trials due to errors being made for juice during the probe at session 19. After variable responding for 23 sessions with the antecedent picture prompt condition, the researcher switched to the pointing prompt condition for the same four stimuli, and Aubrey made only two errors, mastering the stimuli in three sessions, the minimum number of sessions required to demonstrate mastery. Generalization to novel examples of trained stimuli was obtained. Although responses did not meet the criterion at the three-month follow-up, additional training and maintenance sessions were not able to be conducted due to time constraints and child absences.

Figure 7

Aubrey's Results



Note. The results of the antecedent picture prompt, consequence picture prompt, and pointing prompt conditions. For all conditions, *G* refers to the generalization probe and *GM/Gen. Maint.* refers to the generalization-maintenance probe. For the antecedent picture prompt condition, the percentage refers to the intensity of the picture prompts, and *P* refers to the probes conducted before and after the stimulus fading sessions. The wrong intensity was used during session 12 in the antecedent picture prompt condition, indicated by the unfilled datapoint.

STUDY 3: FAILED ATTEMPTS AT TEACHING RECEPTIVE IDENTIFICATION

Two children were unsuccessful with the modifications made in Study 2, so further modifications were made, as described below.

Method

Participants

Two 4-year-old children, Natalie and Christian, participated in Study 3. For additional information, refer to Table 1 above.

Procedure

The initial procedures were similar to Study 2, with three prompting methods being compared: pointing prompt, consequence picture prompt, and antecedent picture prompt. Natalie and Christian needed modifications to the procedures in Study 2. In the antecedent picture prompt condition, each child had one stimulus that had more incorrect responses, so that stimulus was faded separately from the other stimuli. For Natalie, after 13 sessions with one stimulus being faded separately, that stimulus was removed from the array and training continued with the remaining three stimuli. For Christian and Natalie, respectively, after 36 and 38 sessions with no progress in the pointing prompt and consequence picture prompt conditions, those conditions were terminated and the researcher only conducted the antecedent picture prompt condition.

Results and Discussion

Natalie

Natalie did not meet the mastery criterion in any of the conditions and many modifications were made to the procedures (see Figure E1 in Appendix E). Even after 97

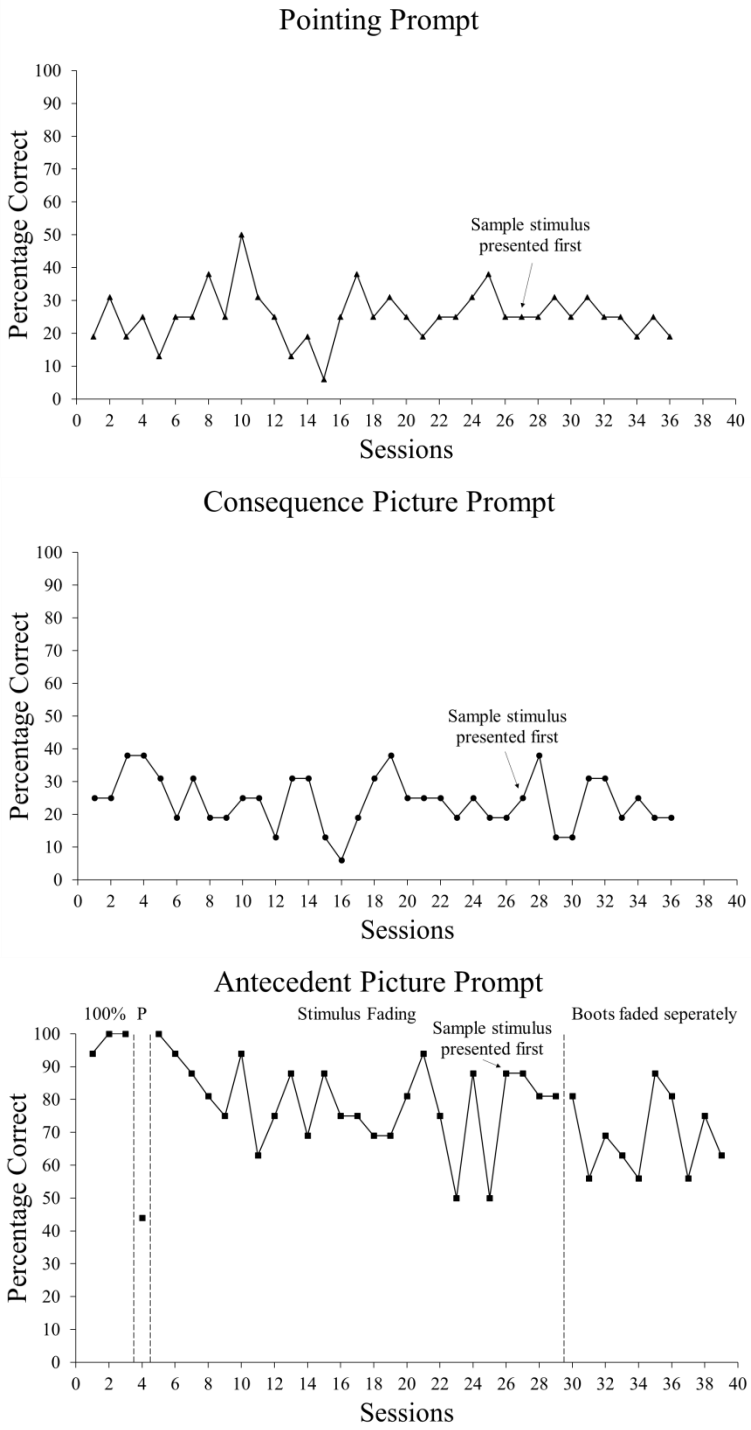
sessions and additional modifications, she was unsuccessful and left the classroom. For additional information, see Appendix E.

Christian

Christian did not meet the mastery criterion in any of the conditions; therefore, some alterations were made to the procedures (see Figure 8). The researcher terminated the pointing prompt and consequence picture prompt conditions after 36 sessions without progress. In the antecedent picture prompt condition, at session 30, boots was faded independent of milk, cup, and pen. The antecedent picture prompt condition was terminated after 39 sessions due to lack of progress. The researcher determined that Christian was missing the prerequisite skills, such as attending to auditory stimuli.

Figure 8

Christian's Results



Note. The results of the antecedent picture prompt, consequence picture prompt, and pointing prompt conditions. For the antecedent picture prompt condition, the percentage refers to the intensity of the picture prompts.

STUDY 4: TEACHING RECEPTIVE IDENTIFICATION WITH ADDITIONAL MODIFICATIONS

One child was unsuccessful with the modifications made in Study 2, so further modifications were made to facilitate the acquisition of a receptive identification repertoire. These modifications will be discussed with the results.

Method

Participant

One 3-year-old child, Gunner, participated in Study 4. For additional information, refer to Table 1 above.

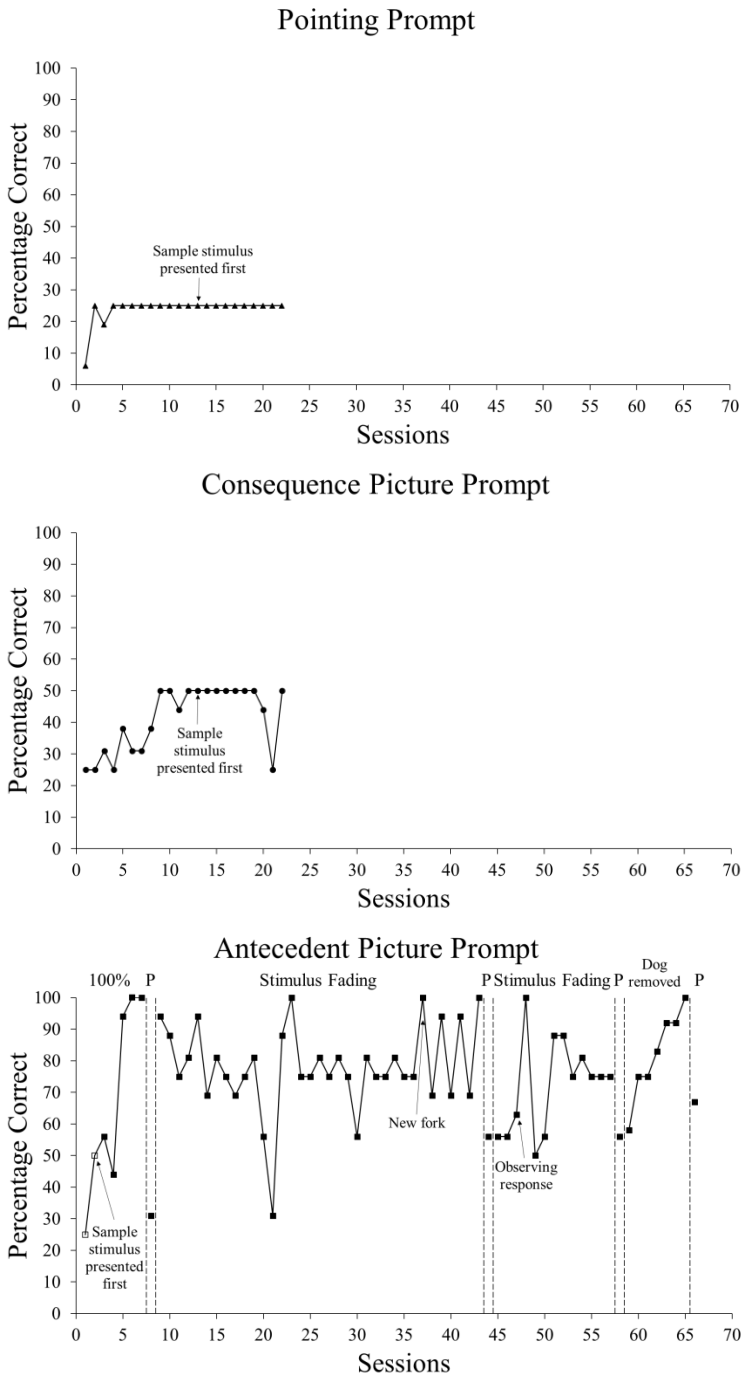
Procedure, Results, and Discussion

Set 1

The procedure began similarly to Study 2, with three prompting methods being compared: pointing prompt, consequence picture prompt, and antecedent picture prompt (see Figure 9). After 22 sessions with no progress in the pointing prompt and consequence picture prompt conditions, those conditions were terminated, and the researcher only conducted the antecedent picture prompt condition. After 66 sessions and additional modifications, two stimuli, dog and plane, were considered mastered from Set 1. For additional information, see Appendix F.

Figure 9

Gunner's Results for Set 1



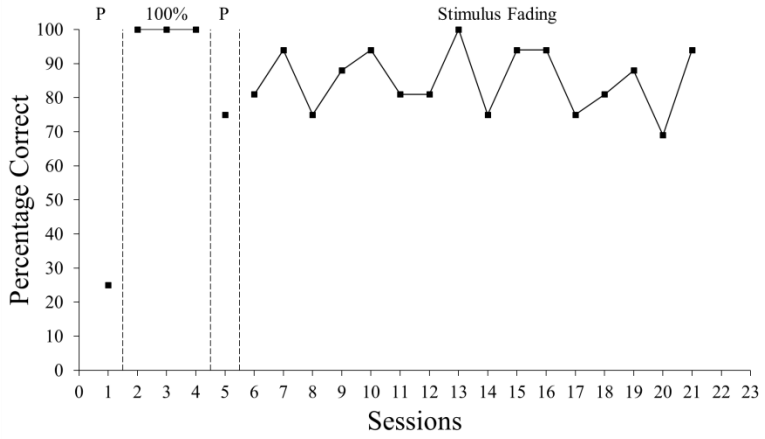
Note. The results of the antecedent picture prompt, consequence picture prompt, and pointing prompt conditions. For the antecedent picture prompt condition, partway through sessions 1 and 2 the researcher switched the presentation order from the comparison stimuli being presented first to the sample stimulus being presented first, indicated by the unfilled datapoint.

Set 2

The antecedent picture prompt condition was replicated with a novel set of stimuli: sock, lamp, plate, and box. A probe session was conducted followed by three sessions with the picture prompts at 100% intensity, the mastery criterion was not met during the probe session; so, stimulus fading was implemented at session 6 (see Figure 10). After 16 stimulus fading sessions with varying picture prompt intensities, the sessions with the stimuli were terminated. During "box" and "sock" trials, errors may have been made due to the similarity of the words, making it more difficult for Gunner to auditorily discriminate them. However, two stimuli, plate and lamp, were mastered.

Figure 10

Gunner's Results for Set 2



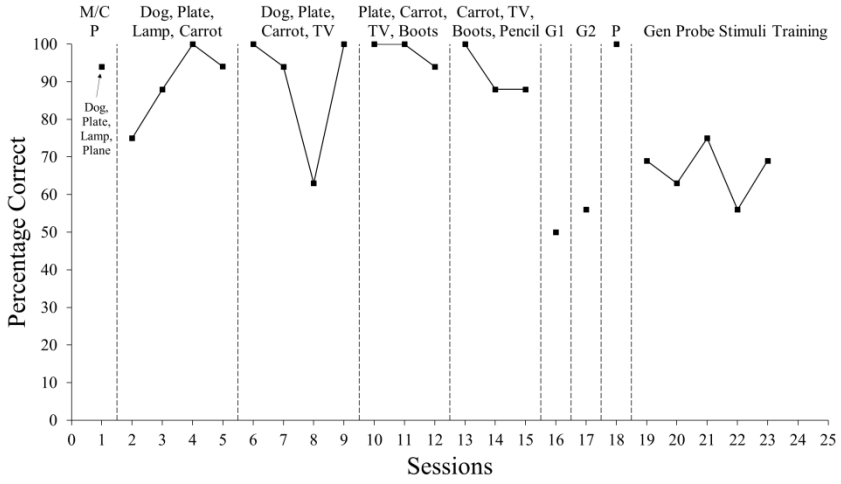
Note. The results of the antecedent picture prompt conditions. The percentage refers to the percentage of the picture prompts.

Set 3

Receptive exclusion training (McIlvane et al., 1984) was implemented to teach Gunner to receptively identify additional stimuli: carrot, TV, pencil, and boots. In receptive exclusion training, a novel stimulus is added to a set of mastered stimuli to train that novel stimulus. For Gunner, the two mastered stimuli from Set 1, dog and plane, and the two mastered stimuli from Set 2, plate and lamp, were combined to make Set 3. A probe session was conducted for the four mastered stimuli to ensure maintenance (see Figure 11). Starting with session two, plane was replaced with the novel stimulus, carrot. The mastery criterion to replace a previously mastered stimulus with a novel stimulus was three of five consecutive sessions at 88% or above. This continued until the originally mastered stimuli were all replaced with novel stimuli, in session 13. Following mastery of the four novel stimuli, generalization probes were conducted, where novel examples of the same stimuli were used. Because Gunner did not perform well on the generalization probes, in session 18, we conducted a probe with the original stimuli mastered during Set 3 where he performed at 100% correct. Starting with session 19, in an attempt to train for generalization, the stimuli from the generalization probes and the originally mastered versions of those stimuli from Set 3 were alternated: Trials 1-4 were the original stimuli, trials 5-8 were the first generalization-probe stimuli, trials 8-12 were the original stimuli, and trials 13-16 were the second generalization-probe stimuli. Correct responses were reinforced and incorrect responses resulted in an LTM error-correction hierarchy. His performance with the generalization-probe stimuli remained low; so, after five sessions with no progress, it was determined that Gunner may not have had the necessary prerequisite skills. Therefore, receptive identification training was terminated, and an auditory-matching program was implemented (not part of this research).

Figure 11

Gunner's Results for Set 3



Note. The results of training by exclusion. The *M/C P* refers to a probe with the originally mastered stimuli: dog, plate, lamp, and plane, *G1* refers to the first generalization probe, *G2* refers to the second generalization probe and *Gen Probe Stimuli Training* refers to the generalization probe stimuli training sessions.

STUDY 5: TEACHING RECEPTIVE IDENTIFICATION WITH ANTECEDENT PICTURE PROMPTS AND STIMULUS FADING

Because of limited availability of the participants, only the antecedent picture prompt condition was conducted for two children.

Method

Participants

Two 3-year-old children, Mason and Abrahm, participated in Study 5. For additional information, refer to Table 1 above.

Procedure

The antecedent picture prompt condition, described above, was implemented with each child. Because only the antecedent picture prompt condition was conducted, the pretest sessions included 12 stimuli, rather than 24. In addition, baseline sessions were conducted after the pretest sessions, to measure responding to the auditory sample stimulus. Baseline sessions were similar to the pretest sessions, though only the targeted stimuli were used.

Results and Discussion

Mason

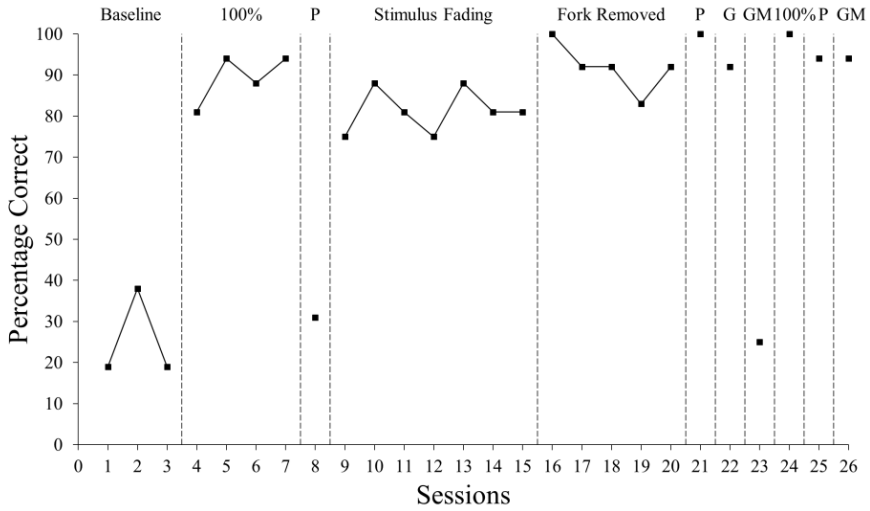
Set 1

Mason met the mastery criterion for responding to the auditory sample stimulus after 21 sessions (see Figure 12 and Table 3). During stimulus fading, sessions 9-15, responding to fork was 50% correct or below; so, the fork stimulus was removed. Generalization to novel examples of the remaining three stimuli was obtained. Generalization did not maintain at the two-month follow-up, session 23, which again included the fork stimulus; so, a training session with the full

colored picture prompts was conducted, session 24, before probing again, session 25. Responding during the probe was 94% correct and maintained during the generalization-maintenance probe conducted one week later.

Figure 12

Mason's Results for Set 1



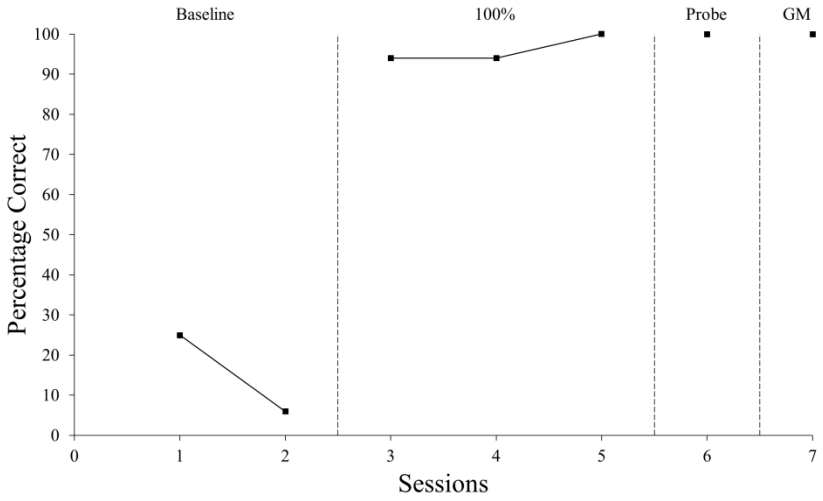
Note. The results of using an antecedent picture prompt and stimulus fading for Set 1 for Mason. The percentage refers to the intensity of the picture prompts, the *P* refers to a probe conducted before and after stimulus fading sessions, *G* refers to the generalization probe and *GM* refers to the generalization-maintenance probe.

Set 2

Following the mastery of Set 1, the second set of stimuli, juice, flower, pen, and glue, were chosen from the initial pretest session; so, only two baseline sessions were conducted in order to determine that the stimuli needed to be trained (see Figure 13 and Table 3). The criterion to conduct a probe was met after three sessions with the full colored picture prompts and the mastery criterion was met in the probe. Responding maintained during the generalization-maintenance probe conducted one month later.

Figure 13

Mason's Results for Set 2



Note. The results of using an antecedent picture prompt and stimulus fading for Set 2 for Mason. The percentage refers to the intensity of the picture prompts and *Gen. Maint.* refers to the generalization-maintenance probe.

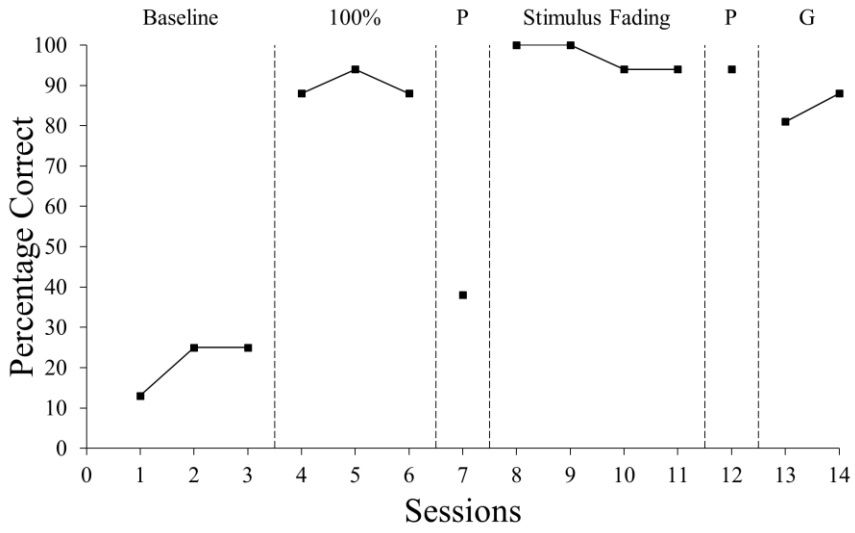
Abrahm

Set 1

The criterion to conduct a probe was met after three sessions with the full colored picture prompts (see Figure 14 and Table 3). Responding in the probe session did not meet the criterion; so, stimulus fading was implemented. After four stimulus fading sessions, the criterion was met, another probe was conducted, and the stimuli were mastered. Generalization to novel examples of the trained stimuli was obtained. A generalization-maintenance probe was not conducted because the school was closed due to COVID-19.

Figure 14

Abrahm's Results for Set 1



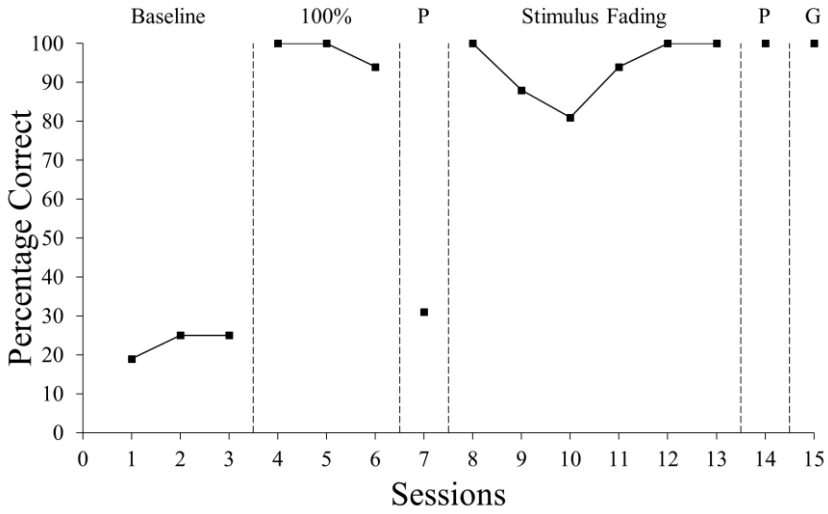
Note. The results of using an antecedent picture prompt and stimulus fading for Set 1 for Abrahm. The percentage refers to the intensity of the picture prompts, the *P* refers to a probe conducted before and after stimulus fading sessions, and *G* refers to the generalization probe.

Set 2

Following the mastery of Set 1, a second set of stimuli were targeted. For the second set of stimuli, the criterion to conduct a probe was met after three sessions with the full colored picture prompts (see Figure 15 and Table 3). Responding in the probe did not meet the criterion; so, stimulus fading was implemented. After six stimulus fading sessions, the criterion was met, another probe was conducted, and the mastery criterion was met. Generalization to novel examples of trained stimuli was obtained. A generalization-maintenance probe was not conducted because the school was closed due to COVID-19.

Figure 15

Abrahm's Results for Set 2



Note. The results of using an antecedent picture prompt and stimulus fading for Set 2 for Abrahm. The percentage refers to the intensity of the picture prompts, the *P* refers to a probe conducted before and after stimulus fading sessions, and *G* refers to the generalization probe.

GENERAL DISCUSSION

In order to participate in this project, children were required to have a generalized matching repertoire. They had been trained using the matching procedure from the classroom curriculum, which involved presenting the comparison stimuli and then presenting the sample stimulus while saying the target name, rather than "match," similar to the antecedent picture prompt condition for training receptive identification. But, although this may have increased the likelihood that children would attend to the auditory sample stimulus as well as the visual sample stimulus, the children in the present research had not mastered receptive identification, using the standard classroom procedure.

To be successful in receptive identification, children need basic auditory discrimination skills, in addition to visual discrimination skills. Some children might be able to acquire those basic auditory discrimination skills while learning receptive identification, though others might not, as was assumed with Christian. This issue requires further research.

Efficiency and Effectiveness of Different Receptive Identification Methods

No prompting method was consistently the most efficient or effective to teach all stimulus sets, in studies 1 through 4. The smallest number of trials to mastery occurred in the antecedent picture prompt condition for two of the stimulus sets, in the consequence picture prompt condition for one stimulus set, and in the pointing prompt condition for one stimulus set. One child, Jonas, had the same number of trials to mastery across all conditions for one set of stimuli and three children were not successful in any condition (see Table 3).

In order to participate in this research, the children needed to show a lack of progress on the classroom receptive identification procedure, by meeting the "whistle-blow" criterion. This criterion was five consecutive sessions at or below 50% correct or 20 sessions without meeting the mastery criterion for that phase. During this research, six children met the whistle-blow criterion at some point (see Table 4).The whistle-blow criterion was met less frequently in the antecedent picture prompt condition, due to the prompt presented prior to the response, making it less likely that responding would be below 50% correct.

Table 4

Participants Who Met the Whistle-blow Criterion

Participant	Set and conditions
Jonas	Set 1: Pointing Prompt & Consequence Picture Prompt
Jadah	Set 1: Pointing Prompt & Consequence Picture Prompt Set 2: Pointing Prompt
Aubrey	Set 1: Pointing Prompt, Consequence Picture Prompt, & Antecedent Picture Prompt
Christian	Set 1: Pointing Prompt, Consequence Picture Prompt, & Antecedent Picture Prompt
Natalie	Set 1: Pointing Prompt, Consequence Picture Prompt, & Antecedent Picture Prompt
Gunner	Set 1: Pointing Prompt, Consequence Picture Prompt, & Antecedent Picture Prompt Set 2: Antecedent Picture Prompt

For studies 1-4, where prompting methods were compared, there were variable results across participants (see Table 5). Within-subject comparisons might have decreased the participants' ability to master receptive identification, because learning that skill with only four stimuli at a time might be easier than learning the skill with three concurrent sets of stimuli. On the other hand, mastering one set of stimuli with one prompting procedure might have

concurrently facilitated the mastery with a different prompting procedure, making it more difficult to determine which procedures are more effective. Furthermore, the participants' performance might have differed among themselves as to the extent that their performances were influenced by one or the other of these confoundings. All of these possibilities might be the subject of further research.

Table 5

Best Condition Per Participant

Participant	Best condition
Jonas	Consequence Picture Prompt[2]
Jadah	Antecedent Picture Prompt
Aubrey	Pointing Prompt
Natalie	Did not master in any condition
Christian	Did not master in any condition
Gunner	Alternative Procedure Used
Mason[1]	Antecedent Picture Prompt
Abrahm[1]	Antecedent Picture Prompt

[1]This was the best condition for Set 1, though all conditions were equal for Set 2.
[2]Only the antecedent picture prompt condition was conducted.

However, regardless of the possibilities of these confoundings, it is also conceivable that, for children struggling with receptive identification, there is no single procedure that is most efficient and/or effective for all such children. It is quite possible that the practitioner will need to test each procedure with each child until they find one that works for that child.

Advantages and Disadvantages

There were some disadvantages of the antecedent picture prompt condition. Some of the stimuli faded differently than others. For example, the grey fork and spoon stimuli resulted in more errors during stimulus fading sessions, possibly due to the grey being harder to discriminate from the white background as the picture was faded. Future practice should consider avoiding pictures that are grey. In addition, the antecedent picture prompt condition required more work prior to starting the intervention, as the stimulus fading sets needed to be created. An advantage of the antecedent picture prompt condition was that there were fewer errors and more frequent access to reinforcers than with the other two prompting conditions (see Table 6). MacDuff et al. (2001) outline the importance of using procedures that produce the least amount of errors (p. 45), stating that errors could:

- Interfere with skill acquisition, generalization, and maintenance
- Evoke emotional responses
- Decrease the time available for instruction
- Increase the probability of additional errors

Because of these disadvantages, it is important to consider using errorless-teaching procedures, like the antecedent picture prompt condition.

Table 6

Number of Errors

Participant	Stimulus set	Prompting conditions		
		Pointing prompt	Consequence picture prompt	Antecedent picture prompt
Jonas	1	149 (44.35%)	84 (52.50%) 31 (16.15%)[1]	65 (20.31%)
	2	3 (4.69%)	7 (10.94%)	1 (1.56%)
Jadah	1	234 (60.94%)	197 (64.80%)	59 (20.49%)
	2	50 (52.08%)	13 (16.25%)	0 2 (3.13%)[2]
Aubrey	1	164 (59.94%) 2 (4.17%)[3]	198 (42.67%)	78 (21.20%)
Natalie	1	460 (75.66%)	462 (75.99%)	393 (27.37%)
Christian	1	429 (74.48%)	438 (76.04%)	144 (23.08%)
Gunner	1	268 (76.14%)	207 (58.81%)	262 (25.59%)
	2	Not tested	Not tested	54 (16.07%)[4]
	3	20 (8.33%)[5]	Not tested	Not tested
Mason[4]	1	Not tested	Not tested	44 (16.67%)
	2	Not tested	Not tested	2 (3.13%)
Abrahm[4]	1	Not tested	Not tested	18 (12.50%)
	2	Not tested	Not tested	18 (11.25%)

[1]Number of errors made with the same stimulus set Jonas had used in the antecedent picture prompt condition, after he had failed to master it during that condition.

[2]Number of errors made with the same stimulus set Jadah had used in the pointing prompt condition, after she had failed to master it during that condition.

[3]Number of errors made with the same stimulus set Aubrey had used in the antecedent picture prompt condition, after she had failed to master it during that condition.

[4]Only the antecedent picture prompt condition was conducted.

[5]Number of errors made during receptive-exclusion training.

A disadvantage of the consequence picture prompt and pointing prompt conditions were that the prompt was not provided until an error was made. However, an advantage of the

consequence picture prompt condition was that it was easier to administer and prepare for than the antecedent picture prompt condition, because fewer materials were required. It may also be preferred over the pointing prompt condition, because it uses fewer physical prompts, which are more intrusive than picture prompts. Overall, it appears that a picture prompt may be a beneficial prompting method for some children, as it requires the child to attend to the relevant dimension of the stimulus being trained, while a gestural or physical prompt does not.

Negative Emotional Responding

A negative emotional response was scored if the child screamed, cried, swiped procedural materials, or engaged in some other form of undesirable behavior. This was measured because it was presumed that there would be fewer errors and more frequent access to reinforcers in the antecedent picture prompt condition (see Table 7). Although there were fewer errors in that condition, there were not fewer emotional responses.

Table 7

Negative Emotional Responses

Participant	Stimulus set	Prompting conditions		
		Pointing prompt	Consequence picture prompt	Antecedent picture prompt
Jonas	1	8 (2.38%)	0	1 (0.31%)
	2	0	0	0
Jadah	1	14 (4.38%)	1 (0.33%)	2 (0.69%)
	2	3 (3.13%)	2 (2.50%)	3 (4.69%) 2 (3.13%)[1]
Aubrey	1	0	12 (2.59%)	0
Natalie	1	2 (0.33%)	12 (1.97%)	21 (1.46%)
Christian	1	0	0	0
Gunner	1	0	3 (0.85%)	7 (0.68%)
	2	Not tested	Not tested	3 (0.89%)[2]
	3	2 (0.83%)[3]	Not tested	Not tested
Mason[2]	1	Not tested	Not tested	0
	2	Not tested	Not tested	0
Abrahm[2]	1	Not tested	Not tested	0
	2	Not tested	Not tested	0

[1]Number of emotional responses made with the same stimulus set Jadah had used in the pointing prompt condition, after she had failed to master it during that condition.

[2]Only the antecedent picture prompt condition was conducted.

[3]Number of emotional responses made during receptive-exclusion training.

Echoic Responding

Some auditory discrimination is required for a child to echo, so it could be presumed that if a child has an echoic repertoire, they may be better able to acquire receptive identification, which also requires auditory discrimination. Therefore, echoic responding was measured if the child echoed the auditory sample stimulus or made an echoic approximation. No clear

relationship between echoic responding and receptive identification mastery was shown (see Table 8). However, interestingly, the percentage of trials with an echoic response substantially increased from Set 1 to Set 2 for both Jonas and Jadah.

Table 8

Echoic Responses

Participant	Stimulus set	Prompting conditions		
		Pointing prompt	Consequence picture prompt	Antecedent picture prompt
Jonas	1	24 (7.14%)	21 (13.13%) 33 (17.19)[1]	15 (4.69%)
	2	43 (67.19%)	41 (64.06%)	54 (84.38%)
Jadah	1	40 (12.50%)	26 (8.55%)	18 (6.25%) 4 (6.25%)[2]
	2	45 (46.88%)	44 (55.00%)	28 (43.75%) 8 (12.50%)[3]
Aubrey	1	163 (56.60%) 47 (97.92%)[4]	364 (78.45%)	229 (62.23%)
Natalie	1	0	0	0
Christian	1	32 (5.56%)	16 (2.78%)	10 (1.60%)
Gunner	1	0	0	0
	2	Not tested	Not tested	0[5]
	3	0[6]	Not tested	Not tested
Mason[5]	1	Not tested	Not tested	15 (5.68%)
	2	Not tested	Not tested	1 (1.56%)
Abrahm[5]	1	Not tested	Not tested	12 (8.33%)
	2	Not tested	Not tested	18 (11.25%)

[1]Number of echoic responses made with the same stimulus set Jonas had used in the antecedent picture prompt condition, after he had failed to master it during that condition.

[2]Number of echoic responses made with the same stimulus set Jadah had used in the pointing prompt condition, after she had failed to master it during that condition.

[3]Number of echoic responses made with the same stimulus set Jadah had used in the pointing prompt condition, after she had failed to master it during that condition.

[4]Number of echoic responses made with the same stimulus set Aubrey had used in the antecedent picture prompt condition, after she had failed to master it during that condition.

[5]Only the antecedent picture prompt condition was conducted

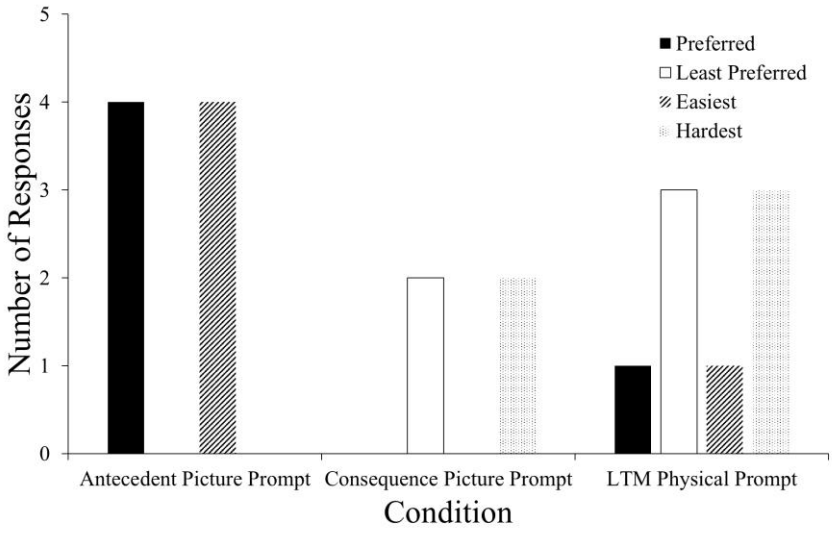
[6]Number of echoic responses made during receptive-exclusion training.

Social Acceptability

Social acceptability was assessed with five researchers (see Figure 16). They were asked which condition was most preferred, least preferred, easiest to implement, and most difficult to implement. Overall, most researchers found that the antecedent picture prompt condition was most preferred and easiest to implement.

Figure 16

Social Acceptability Survey Results



Note. Five researchers (research assistants and the main researcher) were surveyed.

Conclusions

This research strongly suggests that essentially all children with the skill of generalized matching can learn receptive identification, even if they have failed to do so, using the standard least-to-most prompting procedure. The effective alternative procedures were antecedent picture prompting (Stone & Malott, 2010), consequence picture prompting (Carp et al., 2012), and receptive-exclusion training (McIlvane et al., 1984). In addition, these procedures generally

produced high levels of maintenance, and they also typically produced a high level of generalization to novel stimulus sets. However, no single alternative procedure was more effective or more efficient across all of the children. In this research, only two of eight children failed to learn receptive identification, but neither of them had the opportunity for receptive-exclusion training.

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Appendix A

Historical Classroom Data

Table A1

Classroom Receptive Identification Procedure Data for 17 Children (Sept. 2016 –Aug. 2018)

Children Who Met Whistle-Blow Criterion and had the Procedure Terminated		
Child	Trials	Errors
1	110	76
2	120	114
3	146	142
Mean	125.33	110.67
Median	120	114

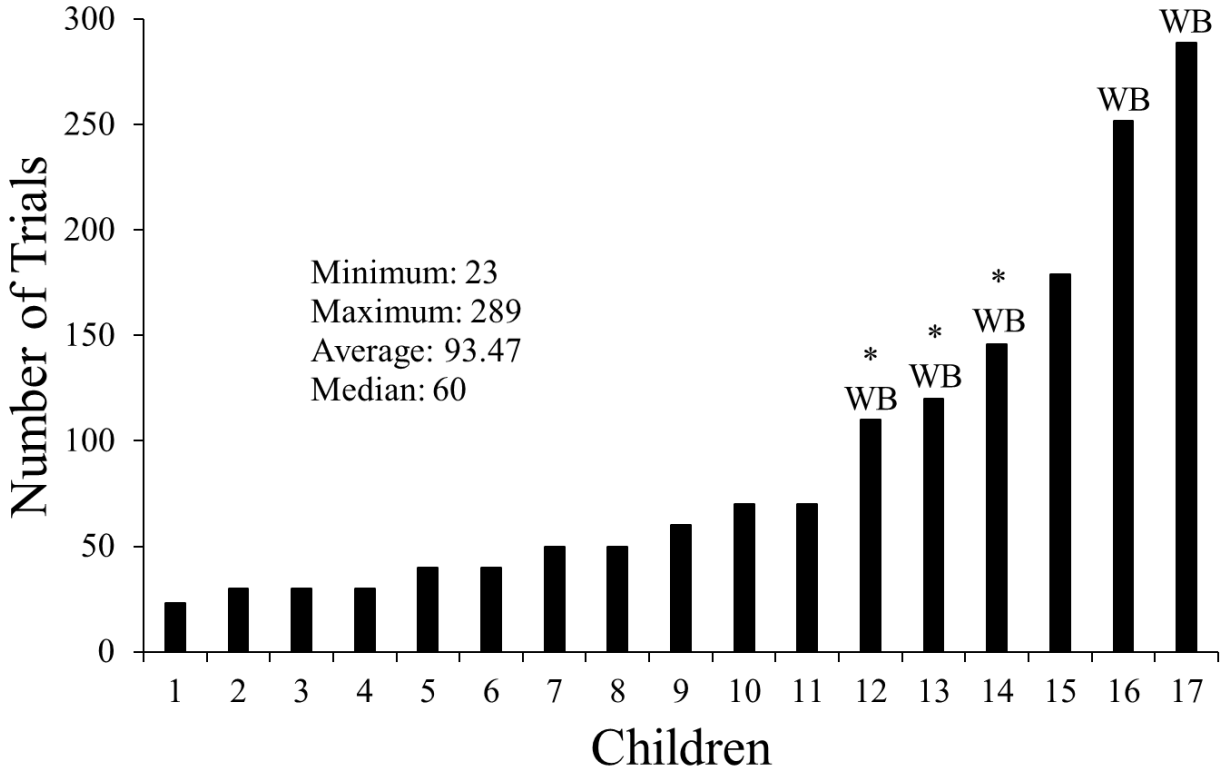
Children Who Met Whistle-Blow Criterion and Mastered Phase 1		
Child	Trials	Errors
1	252	151
2	289	109
Mean & Median	270.50	130

Children Who Mastered Phase 1 and Did Not Meet Whistle-Blow Criterion		
Child	Trials	Errors
1	23	1
2	30	2
3	30	5
4	30	6
5	40	5
6	40	7
7	50	11
8	50	13
9	60	26
10	70	14
11	70	16
12	179	56
Mean	56	13.50
Median	45	8

Note: The data includes the number of trials spent on the first phase for each child as well as the number of errors that were made on the first phase.

Figure A1

Number of Trials it Took to Master Phase 1 of Classroom Receptive Identification Procedure (n=17)



Note. The stars (*) indicate children who had the procedure terminated prior to mastering the procedure and WB indicates the children who met the whistle-blow criterion.

Appendix B

Counterbalanced Datasheet Example

Receptive ID Comparison

Name:

SD: Stimulus name

Additional sheet: Sheet #

Condition:					**Date:**	**Initials:**
Trial	**Target**				**Data**	**Notes:**
Stimuli:	A	B	C	D		
1	A	B	C	D		
2	B	C	D	A		
3	C	D	A	B		
4	D	A	B	C		
5	A	B	C	D		
6	B	C	D	A		
7	C	D	A	B		
8	D	A	B	C		
9	A	B	C	D		
10	B	C	D	A		
11	C	D	A	B		
12	D	A	B	C		
13	A	B	C	D		
14	B	C	D	A		
15	C	D	A	B		
16	D	A	B	C		
	A	B	C	D	%	

Condition:					**Date:**	**Initials:**
Trial	**Target**				**Data**	**Notes:**
Stimuli:	A	B	C	D		
1	B	C	D	A		
2	C	D	A	B		
3	D	A	B	C		
4	A	B	C	D		
5	B	C	D	A		
6	C	D	A	B		
7	D	A	B	C		
8	A	B	C	D		
9	B	C	D	A		
10	C	D	A	B		
11	D	A	B	C		
12	A	B	C	D		
13	B	C	D	A		
14	C	D	A	B		
15	D	A	B	C		
16	A	B	C	D		
	A	B	C	D	%	

Condition:					**Date:**	**Initials:**
Trial	**Target**				**Data**	**Notes:**
Stimuli:	A	B	C	D		
1	C	D	A	B		
2	D	A	B	C		
3	A	B	C	D		
4	B	C	D	A		
5	C	D	A	B		
6	D	A	B	C		
7	A	B	C	D		
8	B	C	D	A		
9	C	D	A	B		
10	D	A	B	C		
11	A	B	C	D		
12	B	C	D	A		
13	C	D	A	B		
14	D	A	B	C		
15	A	B	C	D		
16	B	C	D	A		
	A	B	C	D	%	

Notes:

E: Echoic response **Em +/-:** emotional response | **Incorrect response position:** *Circle the stimulus/position that was selected*

Prompts key: **Pic:** picture **G:** gestural **FP:** full-physical

1/16: 6% **2/16:** 13% **3/16:** 19% **4/16:** 25% **5/16:** 31% **6/16:** 38% **7/16:** 44% **8/16:** 50% **9/16:** 56% **10/16:** 63% **11/16:** 69% **12/16:** 75% **13/16:** 81% **14/16:** 88% **15/16:** 94%

Adapted from: Grow, L., & LeBlanc, L. (2013). Teaching receptive language skills: Recommendations for instructors. *Behavior Analysis in Practice, 6* (1), 56-75.

Appendix C

Stimuli Assigned to Conditions for Each Participant

Stimuli Assigned to Conditions for Each Participant

Child	Prompting conditions		
	Pointing Prompt	Consequence Picture Prompt	Antecedent Picture Prompt
Jonas	Set 1: Bus, pen, fork, & shoe Set 2: Luigi, Ariel, Tommy, & Sonic	Set 1: Phone, sock, brush, & plate Set 2: Belle, Dumbo, Genie, & Timon	Set 1: Juice, chair, spoon, & book Set 2: Alice, Bambi, Link, & Toad
Jadah	Set 1: Bus, pen, coat, & milk Set 2: Clock, table, bird, & frog	Set 1: Boot, phone, truck, & cup Set 2: Flower, keys, dog, & chips	Set 1: Juice, chair, spoon, & ball Set 2: Glue, tree, soap, & cat
Aubrey	Coat, bed, shorts, & truck	Milk, spoon, cup, & brush	Juice, book, chair, & shirt
Natalie	Bus, pen, coat, & milk	Boot, phone, truck, & cup	Juice, chair, spoon, & ball
Christian	Shorts, bowl, hat, & truck	Chair, spoon, blocks, & shirt	Milk, boots, cup, & pen
Gunner	Set 1: Pants, slinky, lamp, & box Set 3[2]: Carrot, TV, pencil, & boots	Set 1: Lion, shoe, sock, & plate	Set 1: Dog, fork, plane, & scissors Set 2: Sock, lamp, plate, & box
Mason[1]			Set 1: Boots, plane, fork, & cookie Set 2: Juice, flower, pen, & glue
Abrahm[1]			Set 1: Broom, fork, coat, & scissors Set 2: Spoon, chair, shorts, & pen

[1]Only the antecedent picture prompt condition was conducted.

[2]Set 3 was taught by exclusion (McIlvane, et al., 1984) and used an LTM error-correction hierarchy .

Appendix D

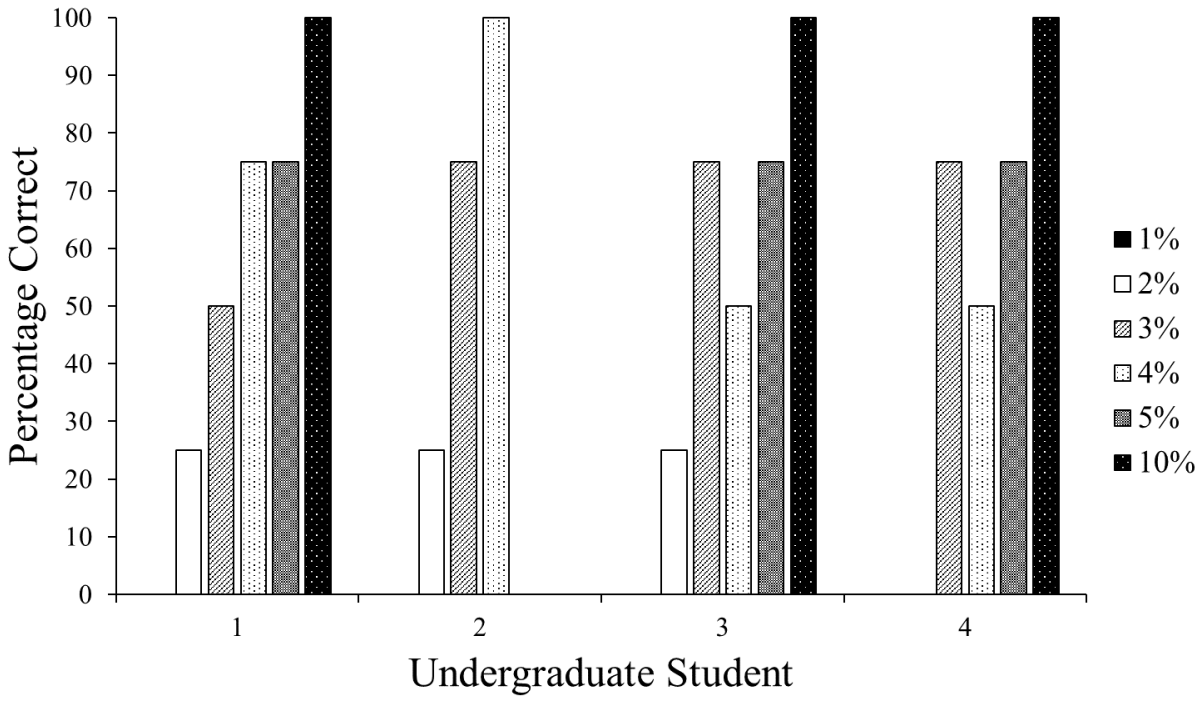
Determining Picture Prompt Intensities

Determining Picture Prompt Intensities

In order to determine which intensities to fade the picture prompts to, the researcher presented the picture prompts to four undergraduate students at Western Michigan University, starting at 1% intensity, and asked the undergraduate students to tact which pictures they could see. After the undergraduate student tacted the pictures that they could see, the same pictures were presented at 2% intensity. This continued until the undergraduate student was able to tact all of the pictures and the intensities presented were as follows: 1%, 2%, 3%, 4%, 5%, and 10%.

Figure D1

Stimulus Intensity Testing Results



Note. The percentage refers to the intensity of the stimuli that were presented.

Appendix E

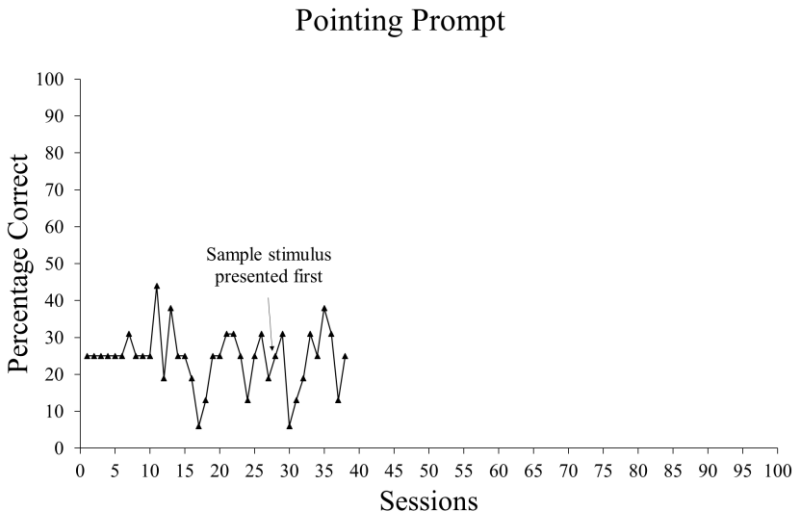
Natalie's Results Explained

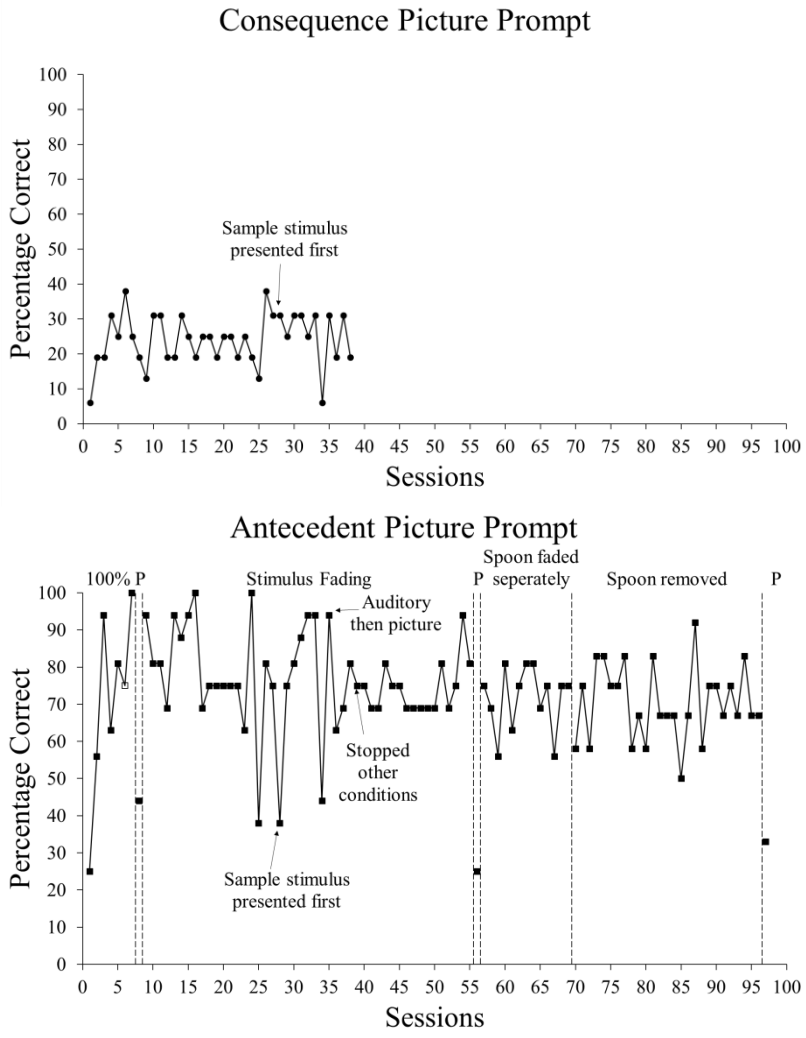
Natalie's Results Explained

The researcher terminated the pointing prompt and consequence picture prompt conditions after 38 sessions without progress. In the antecedent picture prompt condition, at session 57, spoon was faded independent of chair, juice, and ball. At session 70, spoon was removed, and the number of trials decreased to 12—4 each of chair, juice, and ball. The antecedent picture prompt condition was terminated after 97 sessions due to lack of progress and the child leaving the classroom.

Figure E1

Natalie's Results





Note. The results of the antecedent picture prompt, consequence picture prompt, and pointing prompt conditions. For the antecedent picture prompt condition, the percentage refers to the intensity of the picture prompts. The wrong intensity was used during session 6 in the antecedent picture prompt condition, indicated by the unfilled datapoint.

Appendix F

Gunner's Results Explained

Gunner's Results Explained

Aside from session 30, the only incorrect responses from session 23 to 36, were to the fork stimulus. Based on researcher observation, the fork stimulus was lighter than the other three stimuli, which made it more difficult to see and decreased the likelihood that the picture prompt was actually functioning as a prompt. The fork stimulus was switched to a new, darker, fork stimulus at session 37. At session 47 the researcher started requiring an observing response where Gunner had to tap the picture prompts before selecting a comparison stimulus. During the probe at session 58, he responded correctly to the dog stimulus; so, that stimulus was removed from the set of targets, though it was kept in the array of comparison stimuli. A probe session was conducted at session 66, where the mastery criterion was not met, and sessions with the stimuli were terminated. During this probe, Gunner responded to plane only when it was the sample stimulus, though he responded to scissors when both scissors and fork were the sample stimulus; so, we cannot be confident that scissors was mastered.

Appendix G

Human Subjects Institutional Review Board
Letter of Approval

WESTERN MICHIGAN UNIVERSITY

Institutional Review Board
FWA00007042
IRB00000254

Date: August 15, 2018

To: Richard Malott, Principal Investigator
Kaylee Tomak, Student Investigator for thesis
Kelly Kohner, Co-Principal Investigator

From: Amy Naugle, Ph.D., Chair

Re: IRB Project Number 18-08-06

This letter will serve as confirmation that your research project titled "Using Picture Prompts to Teach Receptive Identification to Children with Autisum" has been **approved** under the **exempt** category of review by the Western Michigan University Institutional Review Board (IRB). The conditions and duration of this approval are specified in the policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes to this project (e.g., ***you must request a post-approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study"***). Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the IRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: **August 14, 2019**

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Research Compliance Office
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WEBSITE: wmich.edu/research/compliance/hsirb

CAMPUS SITE: 251 W. Walwood Hall