Behavior analysts who design instruction for autistic children are tasked with selecting program components to promote rapid skill acquisition. Assessment-based instruction involves systematically evaluating intervention components to determine whether they are effective and efficient for individual learners (Kodak & Halbur, 2021). Using assessments to select intervention strategies may promote faster skill acquisition and avoid selecting teaching strategies that are ineffective or inefficient. Prompts are a common component of behavioral intervention to support increased independence with skills, but not all prompts are effective for all learners (Ault et al., 1989; Cengher et al., 2018; Wolery & Gast, 1984). Stimulus prompts involve enhancing some part of the environment to increase the likelihood of a correct response. For example, fading from a solid to a dotted line for a child who is learning to trace letters. The purpose of this applied study was to use assessment-based instruction to identify effective and efficient stimulus prompt to teach matching skills to children with ASD. Tablet-based instruction was used to reduce practical barriers to using stimulus prompts.

Methodology

Review of Applications and Games

A review of children's apps and games was used to select the prompts for assessment. We reviewed 50 of the top free and paid children's apps in the Apple app store and Google Play store (see Table 1 for a list of games). The review indicated that motion and pointing were the most common stimulus prompts used in children's apps and games (Table 2). We selected these two prompts to evaluate in teaching matching skills.

Tablet-Readiness Assessment

Before we began the prompt assessment, we designed and conducted an assessment to determine whether a child may be successful with tablet-based instruction. Five children aged 3-6 years, all with a diagnosis of ASD, completed the tablet-readiness assessment during their individual treatment time at a university-based autism clinic. Children were recommended for the study by their clinical team based on a) a need to learn picture-picture or word-picture matching skills and b) a need to identify effective and efficient prompts to teach those skills. All children completed the assessment during their individual instruction time while enrolled in behavioral intervention services. The tablet-readiness assessment involved evaluating whether the child could perform previously mastered matching tasks when images and audio were presented by the tablet, rather than a technician.

Prompt Assessment

Due to some children discharging from services and changes in child goals and priorities, only three of the five children participated in the prompt assessment. We compared the efficacy and efficiency of stimulus prompts using an adapted-alternating treatments design, meaning we switched between each teaching condition and assigned unique learning targets to each condition (Sindelar et al., 1985). Teaching conditions included: extra-stimulus prompt (point), within-stimulus prompt (motion), and no-treatment control.

All images and words were presented on a tablet using Microsoft PowerPoint. The experimenter presented the tablet on the table in front of the child and swiped through the slides to present matching trials with embedded prompts. The prompts were introduced immediately at first and faded to 3 s to give the child a chance to respond on their own.. The mastery criterion

for the prompt assessment was two consecutive sessions with 100% correct independent responding.

Outcomes

Four children mastered the tablet-readiness assessment without additional instruction. June required additional training to touch images on the screen. She mastered the assessment after learning how to perform this skill.

Three children are participating in the stimulus-prompt assessment—June, Miles, and Silas. All three children had learned matching tasks with response prompts (e.g., pointing, modeling) and printed picture flashcards. June's assessment was conducted using a visual matching task (Figure 1). No acquisition was observed in the stimulus-prompt assessment, even when additional modifications like error correction were added. We concluded that neither stimulus prompt was effective to teach visual matching, and we are currently using a point prompt to see if she will learn matching on the tablet. If she does not, we will see if she will learn the targets when printed and placed on the table. This information will help determine if she is a good candidate for future tablet-based instruction.

Miles' assessment was conducted using an auditory-visual matching task (Figure 2). This assessment is ongoing; however, both stimulus prompts have produced increases in correct independent responding with procedural modifications (e.g., error correction). Currently, extra-stimulus prompts have resulted in more consistently accurate responding. A third participant, Silas, has recently completed the tablet-readiness assessment and is set to begin the prompt assessment in the next week. Silas' assessment will be conducted using an auditory-visual matching task.

Practical Findings

The outcomes of this study are informative for clinical programming for participants and other children for whom stimulus prompts and tablet-based instruction may be appropriate. The tablet-readiness assessment indicated that all clients could participate in tablet-based instruction that involves previously mastered matching tasks. The same assessment and component skills training program could be used by practitioners who are considering using tablet-based instruction. More evaluation is needed to determine whether success with this assessment is indicative of success with learning new or different (e.g., labeling) skills on the tablet.

The prompt assessment will determine whether participants are likely to be successful acquiring new matching skills on the tablet when stimulus prompts are used. The methodology in this study provides an example of how to use assessment-based instruction to identify effective and efficient teaching procedures, such as prompts. The results of the assessment can be incorporated into individualized programs. For June, the prompt assessment indicates that stimulus prompts are unlikely to result in independent skill acquisition. If she can acquire the matching task using response prompts on the tablet, the tablet may still be a feasible option for stimulus presentation for future programs. If not, then it could be that June is not a good candidate for tablet-based instruction.. Miles' assessment results currently suggest that extra-stimulus prompts may be effective prompts to teach auditory-visual matching when paired with other procedural modifications (i.e., differential reinforcement and modified error correction). As data continue being collected for Miles and Silas, consistent outcomes across prompt

assessments may be beneficial for clinicians who do not have the resources to conduct their own assessments. Findings can be applied to other learners with similar incoming skills and goals.

Implications

The present study presents data to suggest that stimulus prompts are used often in children's apps and games to teach them what to do without instructions (written or spoken) or adult assistance. Motion and pointing prompts were the most used stimulus prompts. These data can inform selection of prompts for future assessments and serve as a model for reviewing digital resources, and selecting prompts that are similar to those that children may contact in the natural environment (i.e., ecologically valid).

This study also provides the field of applied behavior analysis with the beginnings of a methodology for evaluating whether a child may be able to participate in tablet-based instruction. Identification and dissemination of the skills that a child needs in order to benefit from tablet-based instruction could help practitioners explore options for more children to learn on tablets. Future research can evaluate whether the assessment designed here is indicative of success with tablet-based instruction with other learners and other types of programs. If an assessment is unsuccessful, this study also provides a path forward to teach component skills that may support success with this learning modality.

This study also extends the literature on assessment-based instruction to stimulus-prompt assessments to develop individualized instruction for children with ASD. Other practitioners may use this assessment methodology to evaluate stimulus prompts for their learners. The lack of acquisition with the initial prompt-fading procedure indicates that future assessments should consider modifying this procedure and consider other modifications depending on their learner's error patterns. If stimulus prompts are found to be effective for any participant, this study will provide data to suggest ones that may be effective for other learners or similar programs and create the possibility for them to be implemented feasibly in applied practice.

STIMULUS PROMPTS

Table 1

Operating System	Retailer	Application Name	Publisher	Price
Apple iOS	Apple App Store	Toca Life World: Build Stories	Toca Boca AB	$0
Apple iOS	Apple App Store	Ryan's Lab	p.w games	$0
Apple iOS	Apple App Store	Paw Patrol Rescue World	Budge Studios	$0
Apple iOS	Apple App Store	World of Peppa Pig: Playtime	Entertainment One	$0
Apple iOS	Apple App Store	Barbie DreamHouse Adventures	Budge Studios	$0
Apple iOS	Apple App Store	Subway surfers	Sybo Games ApS	$0
Apple iOS	Apple App Store	Toca Hair Salon 4	Toca Boca AB	$0
Apple iOS	Apple App Store	Sago Mini World: Kids Games	Sago Mini	$0
Apple iOS	Apple App Store	PBS KIDS Games	PBS KIDS	$0
Apple iOS	Apple App Store	Disney Coloring World	StoryToys Entertainment Limited	$0
Apple iOS	Apple App Store	Toca Life: Hospital	Toca Boca AB	$3.99
Apple iOS	Apple App Store	Toca Kitchen 2	Toca Boca AB	$3.99
Apple iOS	Apple App Store	Toca Life: Vacation	Toca Boca AB	$3.99
Apple iOS	Apple App Store	Paw Patrol: Adventure Bay!	Nickelodeon	$2.99
Apple iOS	Apple App Store	Stack the States	Freecloud Design, Inc.	$2.99
Apple iOS	Apple App Store	Math Bingo	ABCya.com	$2.99
Apple iOS	Apple App Store	Stack the Countries	Freecloud Design, Inc.	$2.99
Apple iOS	Apple App Store	Wild Kratts Rescue Run	PBS KIDS	$2.99
Apple iOS	Apple App Store	LEGO Ninjago	Warner Bros.	$4.99
Apple iOS	Apple App Store	Teach Your Monster to Read	Teach Your Monster	$4.99
Apple iOS	Apple App Store	My PlayHome	PlayHome Software Ltd	$3.99
Apple iOS	Apple App Store	Sight Words Ninja- Slicing Game to Learn to Read	Innovative Investments Limited	$1.99
Apple iOS	Apple App Store	Talking Carl	Tayasui.com	$0.99
Apple iOS	Apple App Store	My Town: School	My Town Games LTD	$2.99
Apple iOS	Apple App Store	Monkey Preschool Lunchbox	THUP Games	$1.99
Android	Google Play Store	Shapes and Colors Educational Games for Kids	Elka games	$0
Android	Google Play Store	English Playground- Easy Learning for kids	22MEDIA	$0
Android	Google Play Store	Crayola Scribble Scrubbie Pets	Crayola LLC	$0
Android	Google Play Store	Train Driver- driving games	Yateland- Learning games for Kids	$0
Android	Google Play Store	Puzzle Kids- Animals Shapes and Jigsaw Puzzles	RV AppStudios	$0
Android	Google Play Store	ABC Kids- Tracing & Phonics	RV AppStudios	$0
Android	Google Play Store	Coloring Games: Coloring book , painting, glow draw	RV AppStudios	$0
Android	Google Play Store	Learning games for toddlers age 3	Bimi Boo Kids Learning Games for Toddlers FZ-LLC	$0
Android	Google Play Store	Sesame Street Alphabet Kitchen	Sesame Workshop	$0
Android	Google Play Store	Learning & Coloring Game for Kids & Preschoolers	FooFoo Kids	$0
Android	Google Play Store	inbento	Afterburn	$2.99
Android	Google Play Store	Thinkrolls Space	Avokiddo	$3.99
Android	Google Play Store	Thinkrolls Logic Puzzles	Avokiddo	$3.99
Android	Google Play Store	Thinkrolls Kings & Queens- Full	Avokiddo	$5.99
Android	Google Play Store	Thinkrolls 2 - Logic Puzzles	Avokiddo	$3.99
Android	Google Play Store	Hat Monkey by Chris Haughton	Fox & Sheep	$0.99
Android	Google Play Store	Sago Mini Hat Maker	Sago Mini	$3.99
Android	Google Play Store	Kids Learn Shapes 2	Intellijoy Educational Games for Kids	$1.99
Android	Google Play Store	Kids Trains Pro	3583 Bytes	$1.49
Android	Google Play Store	Just Go to Bed- Little Critter	Oceanhouse Media, Inc.	$1.99
Android	Google Play Store	Code Adventures: Coding Puzzles for Kids	Cyborc Games	$3.99
Android	Google Play Store	Lightbot: Programming Puzzles	SpriteBox LLC	$2.99
Android	Google Play Store	Slice Fractions 2	Ulula	$3.99
Android	Google Play Store	Pettson's Inventions 2	Filimundus AB	$4.99
Android	Google Play Store	Cosmic Express	Draknek	$4.99

Table 2

Number of Prompts Used in Children's Apps by Type and Category

	Within-Stimulus			Extra-Stimulus			
	Motion	Size	Intensity	Point	Light	Surround	Icon/Shape Added
	41	39	15	78	39	8	21
Total		89			115		

Figure 1

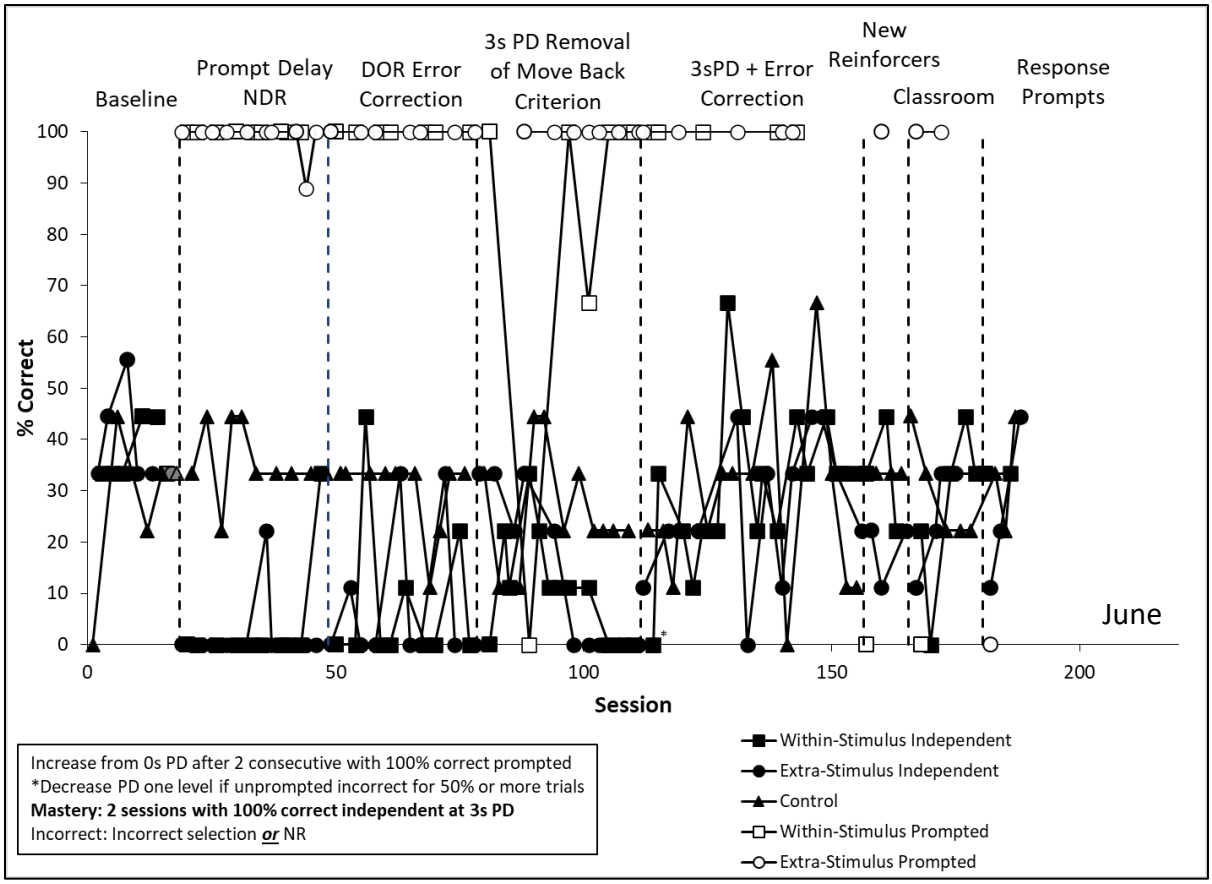
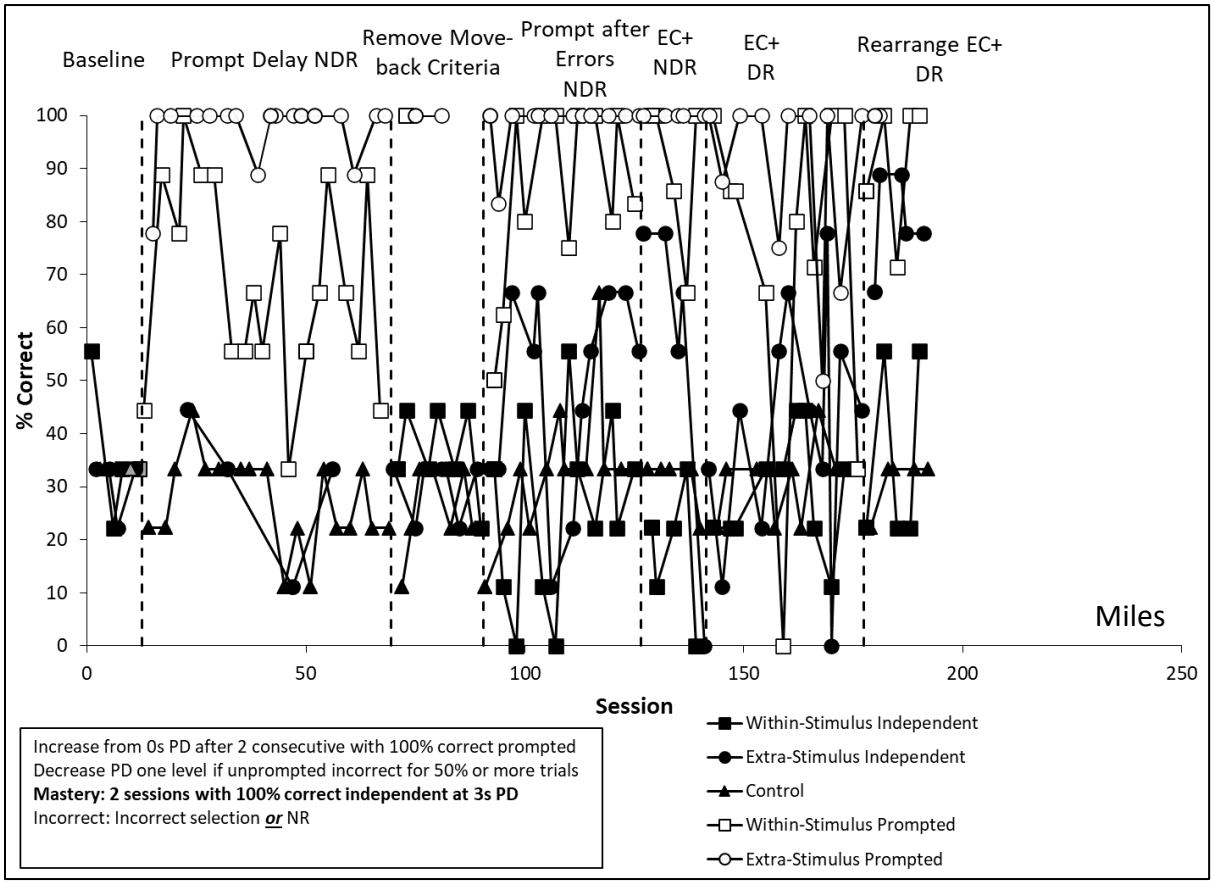

Baseline
Prompt Delay NDR
DOR Error Correction
3s PD Removal of Move Back Criterion
3sPD + Error Correction
New Reinforcers
Classroom
Response Prompts
% Correct
Session
June
Increase from 0s PD after 2 consecutive with 100% correct prompted
*Decrease PD one level if unprompted incorrect for 50% or more trials
Mastery: 2 sessions with 100% correct independent at 3s PD
Incorrect: Incorrect selection or NR
Within-Stimulus Independent
Extra-Stimulus Independent
Control
Within-Stimulus Prompted
Extra-Stimulus Prompted

Figure 2


Baseline
Prompt Delay NDR
Remove Move-back Criteria
Prompt after Errors NDR
EC+ NDR
EC+ DR
Rearrange EC+ DR
% Correct
Session
Miles
Increase from 0s PD after 2 consecutive with 100% correct prompted
Decrease PD one level if unprompted incorrect for 50% or more trials
Mastery: 2 sessions with 100% correct independent at 3s PD
Incorrect: Incorrect selection or NR
Within-Stimulus Independent
Extra-Stimulus Independent
Control
Within-Stimulus Prompted
Extra-Stimulus Prompted

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