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Using Commercially Available Picture Activity Schedules and System of Least Prompts to Teach Lego Assembly

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USING COMMERCIALY AVAILABLE PICTURE ACTIVITY SCHEDULES AND
SYSTEM OF LEAST PROMPTS TO TEACH LEGO ASSEMBLY

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Education
at the University of Kentucky

By

Lauren Ashley Sherrow

Lexington, Kentucky

Director: Dr. Amy Spriggs, Professor of Special Education

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2015

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ABSTRACT OF THESIS

USING COMMERCIALY AVAILABLE PICTURE ACTIVITY SCHEDULES AND SYSTEM OF LEAST PROMPTS TO TEACH LEGO ASSEMBLY

This study investigated effects of commercially available picture activity schedules (PAS) and system of least prompts (SLP) to teach recreation skills to four high school students with Autism Spectrum Disorders and intellectual disabilities using Lego sets. Results were evaluated through a multiple probe across participants design and indicate that a combination of PAS and SLP was effective for teaching the students to build Lego sets. All students improved their ability to build and were able to generalize the skill to novel sets after the completion of intervention. Limitations and implications for future practioners are discussed.

KEYWORDS: Autism Spectrum Disorders, Picture Activity Schedules,
System of Least Prompts, Recreation Skills, Lego

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July 24, 2015

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Section 1: Introduction

According to the Centers for Disease Control's Autism and Developmental Disabilities Monitoring Network (2014), the prevalence of Autism Spectrum Disorder (ASD) diagnoses jumped from 1:150 in 2000 to 1:68 in 2010. With the increasing number of ASD diagnoses, there is a growing focus on the quality of life (QOL) for individuals with ASD and other intellectual disabilities (ID). The World Health Organization (1997) describes QOL as an individual's perception of position in life in relation to their goals, standards, expectations and concerns. Quality of life is a broad concept that encompasses physical and mental health, levels of independence, interactions with their environment, and social relationships. Outside of our basic needs of food, shelter, and safety, QOL addresses other basic needs, such as the inclusion in community, leisure, and social areas that are based upon the person's interests (Schalock & Parmenter, 2000). Plimley (2007) wrote that QOL "encompasses the important things about the human experience and factors related to well-being" (p. 206).

There are many factors that negatively affect the QOL for individuals with ASD and ID. Garcia-Villasimar, Dattilo, and Matson (2013) showed a negative correlation between the challenging behaviors and QOL levels reported by adults with ASD who demonstrated challenging behaviors and their caregivers. Additionally, individuals with ASD frequently become fixated on potentially stigmatizing age-inappropriate activities. The American Psychological Association (APA, 2013) cites an abnormal intensity or focus on highly restricted and fixated interests as one defining trait of ASD. These restricted interests and social impairments further alienate and decrease engagement with typically developing peers (Blum-Dimaya, Reeve, Reeve, & Hoch, 2010). By decreasing

these unwanted behaviors and providing a person with new age-appropriate skills, levels of wellbeing can increase. Stereotyped behaviors create some of the biggest barriers for people with ASD. Research has demonstrated that aggressive, self-injurious, disruptive, and stereotyped behaviors decreased in participants with ID after learning recreational skills (Berkson & Davenport, 1962). Garcia-Villasmar and Dattilo (2010, 2011) examined the effects of a yearlong leisure program on adults with ASD. In the two studies, they used the QOL Questionnaire (QOL; Schalock & Keith, 1993) and the Stress Survey Schedule for Persons with Autism and Other Pervasive Developmental Disabilities (SSS; Groden et al., 2001) to evaluate the pre and post-tests of 68 participants compared to a control group of other adults with ASD. The leisure program sought to facilitate exercise, interaction with media, game playing, arts and crafts, attending events in the community, and participation in other recreation activities. In addition to stress levels, the authors measured four QOL indicators: satisfaction, independence, competence, and social interaction. In both studies, participants who received the leisure program intervention reported a decrease in overall stress levels. They also showed significant increases in the four QOL indicators, while the control group did not show significant changes in either area. Singh and Millichamp (1987) showed that after receiving instruction in recreation and leisure skills, students with ID were more likely to engage in social play. Participants also demonstrated maintenance of recreation skills 10 weeks and 1 year after intervention.

Common recreation activities may lack natural supports and embedded opportunities for people with disabilities to participate. The need for direct instruction to learn new skills presents a large hurdle for children with ASD and ID. McConnell (2002)

wrote that methods for teaching recreation skills to children with disabilities is both understudied and lacks evidence based packages for teaching the skills. There are numerous evidence based intervention components, but the onus of creating an effective and feasible method of teaching recreation skills in a classroom falls upon teachers (McConnell, 2002; Wolery & Garfinkle, 2002).

Previous research focusing on teaching recreation and leisure skills used task analyses and verbal cues to teach recreations skills (Jerome, Fratino, & Sturmey, 2007; Schleien, Wehman, & Kiernan, 1981). Use of task analyses increases the prompt dependency on adults. Rather than relying upon assistance and prompting from others, supports and modifications should be in place to increase independence and autonomy (Spriggs, Gast, & Ayres, 2007; Wolery, Ault, & Doyle, 1992). In order to maximize the effectiveness of naturalistic supports, they must be presented in a format that is easy to comprehend. Wolery et al. (1992) identified four types of prompts: physical, gestural, auditory, and visual. The type of prompt needed varies according to the unique needs of the individual. It is the responsibility of the educator to determine the least intrusive prompt and work towards that through systematic instruction.

There are a variety of evidence-based errorless systematic instructional procedures that have been effective for teaching students with moderate to severe disabilities (Collins, 2012). One type of prompting procedure is System of Least Prompts (SLP). In SLP, the student moves through a hierarchy of prompts, from least to most intrusive, giving the student the opportunity to demonstrate the skills with the least restrictive prompt levels (Collins, 2012). Physical prompting is the most intrusive prompt and requires complete dependence on others to complete a task. The use of gestural

prompts is less intrusive, but creates reliance upon another person. Auditory prompts are less intrusive than physical and gestural prompts, however, people with ASD demonstrate receptive language delays, which makes processing auditory prompts more difficult. Roth, Muchnik, Shabtai, and Hildesheimer (2012) evaluated the brainstem responses in 40 children undergoing evaluation for suspected ASD and 26 children with language delays. After the presentation of auditory stimulus, participants with ASD showed higher rates of extended latencies in the brainstem responses. In a study by Boddaert et al. (2004), the cerebral blood flow of ten children with ASD and six children with ID were evaluated while resting and while listening to speech-like sounds. The participants with ASD had significantly decreased levels of activation in areas of the brain that process auditory stimuli. With the prolonged brainstem responses to auditory input and the momentary nature of presentation of auditory information, auditory comprehension levels are significantly decreased. The research supporting receptive auditory comprehension deficits and the evidence of increased receptive language delays suggest that auditory prompts are not an ideal prompt to achieve the highest levels of success for individuals with ASD.

The least intrusive prompt is through presentation of visual information. Visual prompts provide prolonged exposure to the presentation of information and allow the user to refer back to the information as needed during the completion of the task (Heflin & Simpson, 1998). Hermelin and O'Connor (1970) found that children with ASD processed visuospatial information more easily than auditory information. Participants performed better on tasks where the stimuli remained observable throughout the task. When evaluated on a variety of tasks, children with ASD performed better on tasks such as

matching, discrimination of forms, analyzing patterns, block design, and assembly, all skills that used a fixed stimuli throughout the task completion (DeMyer, 1975; Harris, Handleman, & Burton, 1990; Lincoln, Courchesne, Kilman, Elmasian, & Allen, 1988; Siegel, Minshew, & Goldstein, 1996). When stimuli remain present, the individual has the opportunity to simultaneously process the information, whereas auditory stimuli require sequential processing (Quill, 1997). Hodgdon's (1995) research supported the theory that children with ASD were more likely to comprehend information when presented in a visual format. In 1943, Kanner published his first accounts of children with a newly observed disorder that he would later coin as autism. He observed that the children preferred interacting with pictures or objects rather than people. Social-communication interactions require rapidly changing events such as shifting attention, spontaneous verbal communication, oral comprehension, sequential auditory processing, and recall of information (Quill, 1997). When viewing a picture, the individual is able to sustain their attention, recall cued information, and simultaneously process information without time and societal constraints. Due to the least intrusive nature of visual prompts, people with ASD and ID have an increased opportunity learn new skills in a variety of environments, thereby improve their QOL. Picture activity schedules (PAS) are one way to visually present information.

In PAS, picture or text directions are presented sequentially to cue the steps of a chained behavior (Knight, Sartini, & Spriggs, 2015; McClannahan & Krantz, 1997; Stromer, Kimball, Kinney & Taylor 2006). PAS provide a more naturalistic and structured method of instruction using clear directions, which may decrease the necessity of external prompts. When using PAS, stimulus control is transferred from the adult to

the picture, increasing independence (Copeland & Huges, 2000; McClannahan & Krantz, 1997). In a review of 23 previous studies on the effectiveness of PAS, Koyama and Wang (2011) found that PAS were an evidence-based practice for self-management and promoting independence in students with ASD and ID. In a review of the literature, Knight et al. (2015) showed that PAS were an evidence-based instructional method for increasing on-task, on-schedule, and transition behaviors in children with ASD. PAS have also been shown to decrease undesirable behaviors and increase social interactions (MacDuff, Krantz, & McClannahan, 1993; Schmit, Alper, Raschke, & Ryndak, 2000). The effectiveness of PAS has been demonstrated across a variety of settings and activities for people of all ages and skill levels (e.g., Bryan & Gast, 2000; MacDuff et al., 1993). Spriggs et al. (2007) used PAS to increase on-task and on-schedule behaviors of four participants with moderate ID during novel tasks across a variety of settings and schedules. In a systematic replication of the Spriggs et al. study, Whatley, Gast, & Hammond (2009) used PAS during recreation and leisure skill instruction to increase on-task behaviors and independent transitions in all four participants. After using PAS to learn to build a structure using Lincoln Logs, four boys with ASD maintained their ability to complete it after the PAS was faded (MacDuff et al., 1993). When participants were presented with a novel PAS that included a new sequence and new skills, they were able to complete the build and perform the new skills, despite not receiving training on the skills prior to intervention. This generalization of skills shows that the participants were not relying on rote memory of the behavior chain to complete the task, but were deliberately responding to the pictures.

With evidence that PAS can reduce challenging behaviors, ease transitions, increase independence and acquisition of skills, PAS provide a promising practice that can positively affect numerous QOL indicators. The importance of teaching recreation skills and the research base showing the effectiveness of using SLP and PAS, these skills and teaching methods can be successfully combined to enhance the lives of people with ASD and ID.

With the body of evidence-based research showing different methods of teaching recreation skills to improve the QOL for people with ASD and ID, it is essential to use those instructional methods to teach high interest and age-appropriate recreation skills. Attwood (2000) recommended using an individual's stereotyped behaviors and obsessive interests to develop communication, social, and play skills. It is thought that if the child's specific interest was used as a reward system, the child would show higher levels of motivation in order to access the preferred item (Koegel & Koegel, 1995). LeGoff (2004) believed that Lego provided an ideal medium for play therapy due to the structured and systematic nature of the commonly used toys. Baron-Cohen (2002) theorized about the systemization of the brains of males with ASD. "Systemizing is the drive to analyze the variables in a system to derive the underlying rules that govern the behavior of a system. Systemizing also refers to the drive to construct systems. Systemizing allows you to predict the behavior of a system and to control it," (2002, p.248). Lego are easily systemized and follow a specific formula for assembly. Research suggests that children with ASD have better task discrimination, matching, block design, object assembly, and pattern analysis skills than neurotypical peers (DeMyer, 1975; Harris et al.; 1990; Lincoln et al., 1988; Siegel et al., 1996). Assembling Lego incorporates all of those skills. Lego

sets can be disassembled and rebuilt. This repetition and familiarity can facilitate the understanding of the rules for building, predict the behavior within the system, and how to further manipulate the blocks as a self-directed recreation activity. Unlike other games and group activities, Lego do not have specific or arbitrary rules, removing barriers for play that may hinder engagement.

Building on the previous base of literature showing the effectiveness of SLP and PAS, this study sought to answer two questions. Would there be a change in level and trend of independently building Lego sets when individuals with ASD and ID are taught using a combination of SLP and commercially available PAS? It also sought to determine if the participants would be able to generalize the skills to novel sets of Lego after intervention is complete.

Section 2: Methods

Participants

Four male students with a medical diagnosis of ASD or mental retardation participated in this study. See Table 2.1 for participant descriptions. Participants received instruction in core content areas in a self-contained special education classroom at a suburban high school in a southern state. They attended elective classes in the general education setting. They were all ambulatory and independently accessed familiar environments. Each participant demonstrated marked deficits in communication and self-help skills such as requesting help or clarification, limited appropriate or spontaneous social initiations, and age-appropriate social skills. Patrick and Keith had previous experience with Lego, but parents reported that it had been over 5 years since they had been exposed to them. All participants had previous experience using PAS to learn academic and daily living skills. The current school year marked the sixth year that Ray, Patrick, and Wayne had been with the classroom teacher. It was Keith's first year in high school and with the classroom teacher.

Patrick was diagnosed with Pervasive Developmental Disorder- Not Otherwise Specified at the age of four and received a final diagnosis of Asperger's Syndrome at age 18. Patrick was a very friendly, helpful, and courteous student. He enjoyed interacting with both staff and peers but had difficulty interacting appropriately. Patrick offered compliments, initiated greetings, called people by name, engaged in eye contact, and enjoyed helping others. He won the school-wide "Student of the Month" award for his kindness and friendly demeanor. He showed difficulty with interrupting, excessive talking, determining appropriate topics of conversation, and interpreting nonverbal cues.

When Patrick did not understand a task, he attempted to solve the problem prior to asking for help. If a teacher was not immediately available, he would make his best guess to complete the task, which frequently resulted in subsequent steps being completed incorrectly or damage to materials. During recreation time at school, he preferred to play games on the iPad, read, draw, or solve puzzles. For recreation time at home, he enjoyed watching crime television shows and going to weekly outdoor music events.

Table 2.1

Participant Descriptions

Participant	Age Ethnicity	Diagnosis	IQ	Adaptive behavior composite scores
Patrick	20 Caucasian	Asperger's ADHD	WISC-IV ^a : 50	Vineland-II ^b : 63
Wayne	20 African American	Mental retardation	WISC-IV ^a :44	Vineland-II ^b : 56
Ray	20 Caucasian	Autism, Sensory Integration Disorder	UNIT ^c : 51	Vineland-II ^b : 50 GARS ^d : 93 CARS ^e : 38
Keith	15 Caucasian	Autism Diabetes	UNIT ^c :72	CARS ^d : 47 Vineland-II ^b : 58

Note: ADHD=attention deficit hyperactive disorder.

^a Weschler Intelligence Scale for Children- Fourth edition (Weschler, 2003).

^b Vineland Adaptive Behavior Scales- Second edition (Sparrow, Balla, & Cicchetti, 1984).

^c Universal Nonverbal Intelligence Test (Bracken & McCallum, 1998).

^d Gilliam Autism Rating Scale- Second edition (Gilliam, 2006).

^e Childhood Autism Rating Scale-Second edition (Schopler, Reichler, & Renner, 1986).

Wayne received a medical diagnosis of mental retardation at age 3. In middle school, he communicated verbally with an appropriate voice level. Once he reached high

school, he exhibited selective mutism at school, despite continuing to communicate at previous levels at home and in the community. He nodded, shook his head, scowled, and pointed to communicate his wants and needs. During his third year in high school, he became good friends with another student and his personality and communication changed drastically. He began speaking in small phrases with a quiet voice and began smiling. In the past three years, his language, reading, communication, and social skills improved drastically. He engaged in an extended conversation in 1:1 settings, provided details, answered questions, and read aloud in class. Despite his improved social and verbal skills, he still demonstrated low levels of initiating social interactions and asking for help. If he needed help, he would sit until he made eye contact with the teacher. His preferred recreation activities at school were completing puzzles and looking at cartoons on the computer. At home, he enjoyed playing on his Play Station and watching the Disney channel.

Ray received a diagnosis of ASD and Sensory Integration Disorder at age 5. He demonstrated difficulty completing tasks that were not highly motivating. Ray experienced anxiety related to food, fire drills, looking at the clock, and looking out the window. Ray initiated interactions with adults, typically for reassurance about areas of uncertainty or to confirm upcoming events. While Ray occasionally said “I need help,” if he was having difficulty with a preferred task, he typically sought the teacher’s attention in inappropriate ways such as touching their face or pulling them toward him. He benefited from the use of PAS and social stories. During classroom recreation time, he played bowling on the Nintendo Wii. At home, his mother reported that he enjoyed using the computer to watch small clips of videos and reading picture books.

Keith received his diagnosis of autism at 19 months of age. In the previous school year, he received a diagnosis of diabetes, which was managed through blood sugar monitoring and insulin shots. He had limited verbal communication, which was often difficult to decipher. He exhibited severe aggressive behavior towards staff and property as an escape maintained behavior. Keith had a behavior intervention plan to address the aggressive behavior. While hitting, kicking, biting, and destruction of property were still an issue occasionally, he made significant progress throughout the school year. If he needed help, he would sit and look at a teacher, but not make a verbal request for assistance. During recreation time, he enjoyed looking at yearbooks from his previous schools, playing Wii, looking at the PBS website, and playing with a slinky.

Staff included one female classroom teacher, two male paraeducators, one female paraeducator, and one female student teacher. The teacher was certified to teach students with moderate to severe disabilities and had 7 years of experience teaching in a high school setting. The classroom teacher acted as the lead researcher in this study and the main data collector. The paraeducators and student teacher were trained in data collection and collected inter-observer agreement and procedural reliability data.

Setting

All sessions took place in a self-contained special education classroom in an urban high school. The classroom had a kitchen area, a computer area with two computers, and three large tables for group instruction. All sessions took place in the classroom.

Materials and Equipment

In order to facilitate generalization, multiple exemplars were implemented for this study. Three Lego Creator sets, each containing pieces and instructions to build three different models of varying difficulty were used (see Table 2). Participants built one model per session. Participants built six of the nine possible models during intervention: the boxcar, engine, speedboat, helicopter, dump truck, and backhoe. The remaining three sets (i.e., locomotive, airplane, and front loader) were used in generalization probes following intervention. Sets were counterbalanced by randomizing the models used.

Table 2.2

Descriptions of Lego Sets

Set	Number of pieces	Model	Number of pages in the task analysis
Emerald Express	56	Boxcar	6
		Locomotive	10
		Engine	13
Red Thunder	66	Speedboat	6
		Airplane	11
		Helicopter	13
Power Digger	64	Dump truck	9
		Front loader	10
		Backhoe	14

Lego building instructions are created for non-readers and included with each set. They show a series of word-free picture directions, making them a PAS commonly used by individuals who purchase these sets. Teacher created data sheets were used to record the completion of steps on each page. Lego were presented on a tray to keep materials together and prevent the loss of pieces.

Response Definition and Data Collection

The dependent variable was percent independently completed steps for locating and building a model. A correct response was recorded on the data sheet if the participant initiated the step within 5s, located the pieces within 15s, or completed that step of the build within 15s. Correct independent responses were marked on the data sheet with a (+). Failure to initiate the step within 5s, locate pieces within 15s, build within 15s, was considered an incorrect response and received a combination verbal/gestural prompt. For this prompt, while locating pieces, the teacher selected the correct piece, pushed it towards the student, and said, “Here’s the piece.” While building, if the participant was unable to build the step within 15s, the teacher provided a verbal/gestural prompt by pointing to the correct piece then pointed to the location for placement on the build, and said “The piece goes here.” Verbal/gestural prompts were marked as (V) on the data sheet. While locating pieces, if the participant did not initiate the selection of the piece after the verbal/gestural prompt, the teacher said, “Here’s the piece,” and handed it to the participant. If the participant did not correctly build that step within 15s of receiving the verbal/gestural prompt, as a verbal/model prompt, the teacher picked up the piece, it in the correct location, said, “this piece goes here,” then laid it back on the tray. On the data sheet, verbal/model prompts were marked with a (M). If the participant was still unable to complete the build within 15s, the teacher completed that step and the participant moved on to the next step. Teacher completed steps were marked with a (T). Data collection was recorded in a trial-by-trial format for all pages of the PAS for each model. There were a varying number of pages in the PAS to complete each model, ranging from 6 to 14 pages. Each page in the PAS contained a varying number of steps, with 1-4 steps on each page.

The percentage of steps completed correctly were determined by dividing the number of accurately completed trials of locating and building by the total number of trials, multiplied by 100.

Experimental Design

A single subject, multiple probe design across participants was used to evaluate effects of SLP and PAS on the percent of locating pieces and building steps completed correctly. A multiple probe design was selected to show experimental control through the intermittent data collection prior to intervention and “where intervention is applied, change occurs; where it is not, change does not occur” (Horner & Baer, 1978, p. 189). A multiple probe design addresses threats to internal validity by evaluating history, maturation, and testing by staggering the intervention across participants to show that participants did not possess or learn the targeted skill prior to treatment (Gast, 2010). At the start of the study, all participants were probed for a minimum of three sessions or until data stabilized. Following baseline data collection, the first participant received the intervention. No other participants received intervention during this time. Once Participant 1 reached 80% independent completion in a session, the teacher probed the remaining participants for three sessions or until data stabilized. Participant 1 continued to receive intervention and Participant 2 began intervention. This continued until all students received intervention. During intervention, once a participant reached 100% independent completion in three consecutive sessions, they were probed for three additional sessions. Following the post-intervention probes, the participant was presented with three novel sets to measure for generalization of skills.

Procedures

General procedures. Sessions were conducted one-on-one in the classroom daily for approximately 10-15 minutes. The Lego pieces were prearranged on a tray prior to the sessions. The participant was presented with a boxed Lego set and given the verbal task direction to “build the set.” Participants had 5s to initiate the first step of the task analysis and 15s for both locating and building each step. During the build, if a participant incorrectly assembled a piece and requested help to remove the incorrectly placed piece through a verbal or gestural request, the teacher would remove that piece for the participant. If the set fell apart during the session, the participant had the opportunity to reassemble the set. If the participant was unable to rebuild the set, the teacher rebuilt it for them and data collection resumed at the previously initiated step. To act as a natural reinforcer, once the model was built, the participant was able to play with the completed model. No other tangible reinforcers were provided.

Baseline. Pre-intervention probes took place prior to the introduction of the combination of PAS and SLP. Post-intervention probes occurred after each participant reached mastery criteria of 3 consecutive days at 100% independence. Baseline data were recorded using a single opportunity probe, meaning the session ended after the first error or if the participant did not respond to the task direction within 5s. A single opportunity probe was used to prevent participants from inadvertently learning steps of the task analysis prior to intervention. Upon the first incorrect response, the teacher terminated the sessions and provided praise for participation. During baseline probes, a correct response was marked with a (+) and the first incorrect response was marked with a (-). All remaining steps of the task analysis were marked as incorrect responses. No task specific

verbal praise was provided during baseline sessions. Baseline sessions took place for a minimum of three sessions or until data stabilized for all participants. Participants were probed with one opportunity to build a model from each of the three Lego sets. The same procedures were used for pre- and post-intervention probes.

Picture Activity Schedules and System of Least Prompts. Intervention began after baseline data stabilized for all participants and followed the general procedures. During intervention, the target participant was presented with a tray containing one Lego set with the PAS direction booklet and given the verbal direction to “build the Lego.” If they initiated the building within 5s of the selection and correctly completed the step within 15s, a (+) was marked on the data sheet. Upon the first error, the system of least prompts was used, beginning with the verbal/gestural prompt, then a verbal/model prompt, and finally teacher completion. Since the number of individual steps on each page of the PAS varied in the chained task, a multiple opportunity format was used for each page. For instance, there might be three steps on a page of the PAS; if the participant accurately located and built the first and second steps but required a verbal prompt to locate pieces on the third step, but was able to build the third step, for that page’s data, a (V) would be marked for locating pieces and a (+) would be marked for building. The participant had the opportunity to complete the remaining steps on that page, but no more data were collected for responses on that page unless the participant required a more intrusive prompt than required on a previous step of that same page (i.e., the most intrusive prompt provided to get a page completed was recorded on the datasheet). The same steps were repeated for the remainder of the pages in the PAS for that set. Mastery criteria was three consecutive sessions with 100% independence in

locating and building the models. The same steps for intervention were followed in generalization sessions with three novel sets.

Generalization post-test condition. Multiple exemplars were used to program for generalization of participants' ability to read the PAS to build novel models following intervention. Generalization post-tests took place after completion of post-intervention probes using models that were previously unavailable to the participants. Generalization probes followed the same procedures as the intervention probes.

Reliability

Inter-observer Agreement and Procedural Reliability. The classroom teacher and paraeducators collected data on student performance (completion of task analysis steps) using identical data sheets. Inter-observer agreement (IOA) was calculated using the point-by-point method: the number of agreements divided by number of agreements plus disagreements multiplied by 100. Procedural reliability (PR) was evaluated simultaneously with IOA. Paraeducators were trained in data collection procedures and used a checklist to evaluate seven expected teacher behaviors (See Figure 2.4): teacher had materials prearranged, teacher provided specific task direction, intervention was administered to only one participant at a time, participants were given the opportunity to complete all steps of the task analysis, and that the teacher completed steps not completed correctly or within the time allowance using SLP, praise was provided only for participation, and participants were able to access the completed build as a natural reinforcer. PR was calculated by dividing the number of observed teacher behaviors by the number of expected teacher behaviors multiplied by 100.

Social Validity. Multiple formats were used to collect social validity measures. Prior to the start of the study, parents completed a questionnaire (Figure 2.5) and granted consent for their child to participate. Parental consent demonstrated parental agreement that learning new recreation skills were valuable and beneficial. The questionnaire asked seven questions. The first two multiple choice format questions asked if there were Lego in their home and the length of time since their child used Lego. The remaining questions asked if Lego building was an age appropriate activity for teenagers, if Lego building was an age appropriate activity for adults, and if PAS were an effective method to teach students with ASD or ID using a five point Likert scale. Students signed a simplified ascent form prior to participating (Figure 2.6). The form states, “My teacher wants to teach me how to make fun toys. I will get to play with Lego toys. Do I want to do this work?” The form had two boxes, one with “yes” and thumbs up and the other with “no” and thumbs down.

After completion of intervention, the teacher collected questionnaire responses from staff members and participants (Figure 2.7). The questionnaire asked seven questions: is it important to teach recreation and leisure skills to students with disabilities; is it important to teach students with disabilities to read commercially available PAS; if the intervention was effective; if the intervention was time consuming; whether they thought the study was worth replicating for other skills or participants; if the intervention was meaningful to the students; and if the intervention should be used again in the future. The questionnaire also provided space to leave additional feedback about the study. The post-intervention questionnaire for participants (Figure 2.8) asked four questions: if they liked playing with Lego; if they liked learning how to build Lego; if they liked looking at

pictures that show them what to do; and if they had Lego at home, with responses in a “yes,” “I’m not sure,” and “no” format with corresponding check marks for “yes,” questions marks for “I’m not sure,” and an X for “no.”

Section 3: Results

Reliability

Inter-observer Agreement (IOA) and Procedural Reliability (PR) data were gathered for all participants in all conditions. IOA collection took place in 51% of sessions with 95.7% agreement. PR agreement was calculated at 99.4% agreement for 43% of sessions.

Effectiveness

Upon introduction of the intervention, Patrick, Wayne, and Keith all showed immediate changes in level and trend. Ray showed changes in level and trend after three sessions. Patrick and Wayne were able to reach mastery criteria, maintain high levels of completion in post-intervention and generalization probes. Due to the end of the school year, despite accelerating trends, Ray and Keith did not reach mastery criteria. All participants had at least one session with a 96% or higher level of independent completion, demonstrating that they were able to learn to build Lego sets using PAS and SLP. See Figure 3.1 for the percentage of steps completed independently for all participants. In order to delineate the difficulty of the sets used, easier sets are indicated by an open symbol on the graph; closed symbols indicate more difficult sets. The medium level sets used for the generalization probes are marked with asterisks.

Patrick. In initial baseline sessions, Patrick was unable to complete any steps in the task analysis. Upon introduction of the PAS and SLP, he showed an immediate change in level with an accelerating trend. He reached mastery in 22 sessions. During post intervention probes, he remained at 100% completion. In generalization sessions,

when presented with three novel sets, Patrick continued to show high levels of completion (range 90%-95%).

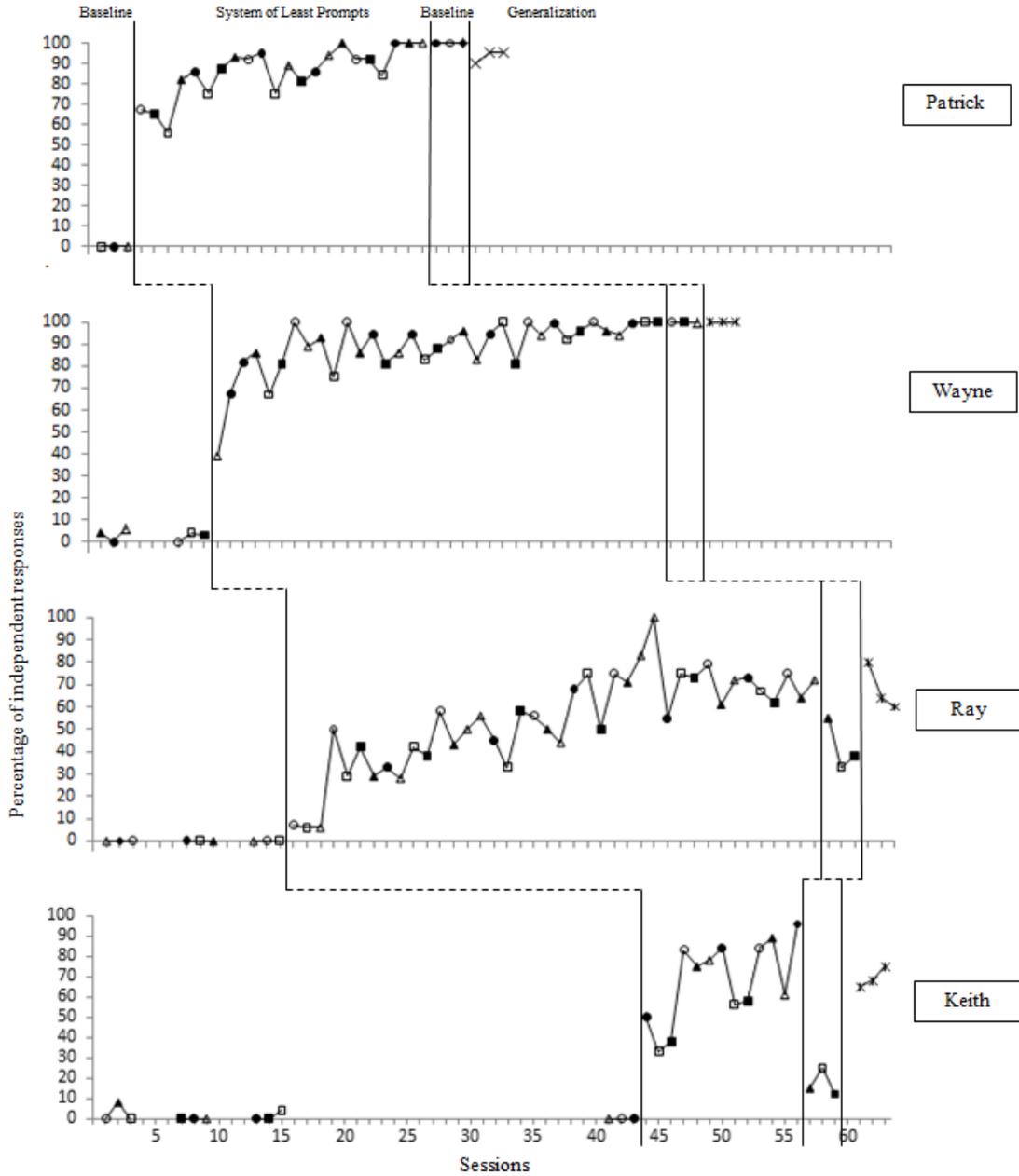


Figure 3.1: Graph of Results. Percentage of Steps Completed Independently for Participants

Key: □= Speed boat ■= Helicopter Δ= Dump truck ▲= Backhoe
 ○= Boxcar ●= Engine *= Generalization sessions

Wayne. During pre-intervention baseline sessions, Wayne showed low levels of completion (range 0%-6%). Once intervention began, he demonstrated an immediate change in level with an accelerating trend. He reached 100% accuracy after seven sessions and achieved mastery criteria in 35 sessions. During post-intervention probes, he maintained the skill with 100% completion across all three sessions. When presented with three novel sets, he generalized the skills with 100% accuracy across all three sessions.

Ray. In baseline sessions prior to intervention, Ray remained at 0% completion across all nine sessions. After minimal improvements in the initial three intervention sessions, Ray showed changes in level with an accelerating trend beginning in the fourth session. Due to the end of the school year, Ray was only able to complete 40 intervention sessions (range 6%-100%). In post-intervention probes, he increased his levels from previous baseline sessions (range 33%-55%). During the three generalization sessions, Ray showed scores similar or higher to his scores during intervention (range 60%-80%).

Keith. During two of his 13 initial baseline probes, Keith was able to complete one page of the build, but remained at 0% completion for the majority of sessions. Upon the introduction of intervention, Keith showed an increased level and an accelerating trend. He completed 13 intervention sessions, reaching 96% completion on his last probe. In post-intervention probes, Keith returned to lower levels (range 12%-25%). His scores during the generalization probes remained consistent with his scores during the last sessions of intervention.

Social Validity

All participants reported enjoying building with Lego and liked learning how to build sets. Patrick and Wayne indicated that they enjoyed looking at pictures to learn skills; Ray did not and Keith circled "I'm not sure." Patrick and Aaron said they did have Lego at home while Wayne and Ray did not. Wayne added that he would like to have Lego to build with at home. Two of four parents returned the questionnaire. Both parents agreed with their students that they did have Lego in their homes. Patrick's mother reported that he had used Lego within the past 30 days prior to the intervention. Keith's mom indicated that it had been over 5 years since he had played with Lego and that he had mostly disassembled them. Both parents agreed or strongly agreed on the remaining four questions regarding the importance of teaching recreation skills, that Lego were age appropriate for teens or adults, and if they thought that PAS were an effective way to teach new skills. All five instructors involved in data collection responded to the professional questionnaire. All five agreed or strongly agreed that it is important to teach recreation skills to students with disabilities, that PAS were effective in teaching new skills, that the intervention was effective, and that the intervention should be used again in the future. Four of five instructors agreed or strongly agreed that the intervention was meaningful to the participants. All instructors indicated that they disagreed or felt neutral about the intervention being time consuming.

Section 4: Discussion

According to the independently completed steps, the results of this study show a functional relation between using a combination of commercially available PAS and SLP to teach students with ASD and ID to build Lego sets. All participants had very low levels of independent completion during baseline sessions, but were able to significantly increase the number of steps completed after intervention began. The two participants that were able to reach mastery before the conclusion of the study were both able to remain at 100% independent completion during post-intervention probes. All participants showed significant improvement during intervention while using multiple exemplars for general case programming. This study supports the Koyama and Wang (2011) and Knight et al. (2015) findings by demonstrating increases in independence when using PAS for students with ASD and ID. The participants' unanimous responses on the social validity questionnaire that they enjoyed building with Lego is in agreement with Legoff's (2004) theory that Lego are an ideal recreational activity for people with ASD and ID due to their systematic and structured nature. The high levels of independent completion (range 60%-100%) with novel sets in the current study supports the findings of MacDuff, et al., (1993), showing that participants were able to build and perform new sequences and skills after instruction and relied on picture prompts rather than rote memory.

In the social validity questionnaires, parents agreed that Lego building was an age appropriate activity for both teenagers and adults. Through the variety of products offered by Lego, these assembly skills can be incorporated into the recreational repertoire for users with varying skill levels. Due to their larger size, Duplo blocks are marketed for preschool-aged children, but could be used for people with decreased fine motor skills.

Traditional Lego sets range in size from 13-5922 pieces, allowing builders to select the difficulty level. There are sets based upon popular movies, television shows, fairy tales, super heroes, video games, historically significant architecture, machinery, as well as sets that focus on free building and imaginative play. Lego MindStorm sets contain software to create programmable robots that use modular sensors and motors. Some schools have Lego Robotics clubs, providing an additional opportunity for people with disabilities to interact with their peers. There are Lego products to fit a variety of abilities and interests.

System of Least Prompts and PAS are both evidence-based practices for teaching students with ASD and ID to learn new skills (Bryan & Gast, 2000; Collins, 2012; Knight, et al., 2015; MacDuff et al., 1993). This study contributes to the existing research by demonstrating the effectiveness of combining the practices to teach a recreation skill to participants with ASD and ID.

Implications for Practitioners

With the knowledge of the importance of teaching recreation skills to people with ASD and ID in order to increase their QOL, teachers and practitioners must find evidence-based methods to teach highly motivating recreation skills. McConnell (2002) and Wolery and Garfinkle (2002) stressed the importance for teachers to combine evidence-based practices to teach new skills. The combination of PAS and SLP provides an easy and time efficient way to teach recreation skills that are motivating and play to the strengths of students with ASD and ID. This method can be generalized to other recreation activities, such as Lincoln Logs, Tinker Toys, Erector Sets, and other commercially available toys that provide PAS. Schleinen, Krotee, Mustonen, Kelterborn, and Schermer (1987) evaluated the effects of integrated recreational interactions of

students with ASD and their neuro-typical peers. Students with ASD showed significant increases in appropriate social interactions and a marked decrease in negative social interactions after inclusion in integrated recreation activities. Peer-mediated approaches have also been successful for teaching social skills to students with ASD (Bass & Mulick, 2007). Hudson, Browder, and Jimenez (2014) used peer-delivery of SLP to teach reading comprehension skills to participants with ID. After receiving training in the use of SLP and a script to follow, peer tutors were able to use SLP with fidelity. Practitioners can train peer tutors to implement SLP and PAS to teach a variety of recreational and educational skills.

Limitations and Implications for Future Research

There were several limitations to the study. The greatest barrier was the availability of data collection sessions due to the end of the school year. Due to time constraints, maintenance of the skill could not be measured. During baseline, single-opportunity probes were used to avoid participants inadvertently learning the skill during the probes. While this addressed the threat of testing to the internal validity of the study, it did not give an accurate evaluation of how many steps they could complete independently before or after intervention. There were certain steps in the builds that were more difficult than others. Some steps showed the pieces required in a box beside the build, while others showed the pieces already in place on the build. There was a piece on the Helicopter set that rotated within another piece. Due to the movement, participants had a difficult time attaching the rotating piece to another piece. Other steps required more pressure to build than others. For example, pushing the wheel into the rubber tire could be difficult and snapping some hinge pieces could be difficult to line up correctly.

To increase levels of success and encourage self-monitoring, future research could measure the completion of a single page rather than of the single steps within a page. Students frequently moved onto a next step without building a piece. Within the next step of the same page, the student would be unable to complete the second step without completing the first missed step. Participants should have the opportunity to correct their mistakes and problem solve, skills that are necessary in daily life. QOL is influenced by levels of independence, decision making, and participation in leisure activities based upon the participants' interest. In order to foster independence, in future research the participants could have the choice of the set they want to build for that session. To avoid fixation on a single set and to vary the sets, the teacher could rotate the choices to eliminate the previously built sets.

Replication of the current study could use peer-delivered interventions using SLP and PAS. Additional studies could examine the effectiveness of PAS and SLP on vocational skills, such as assembling furniture and packaging items by following a PAS. Assembly of furniture and packaging items are skills that participants can generalize to jobs, allowing them to financially support themselves and improve their QOL through meaningful work and social interactions.

Appendix A: Lego Sets Used



Red Thunder



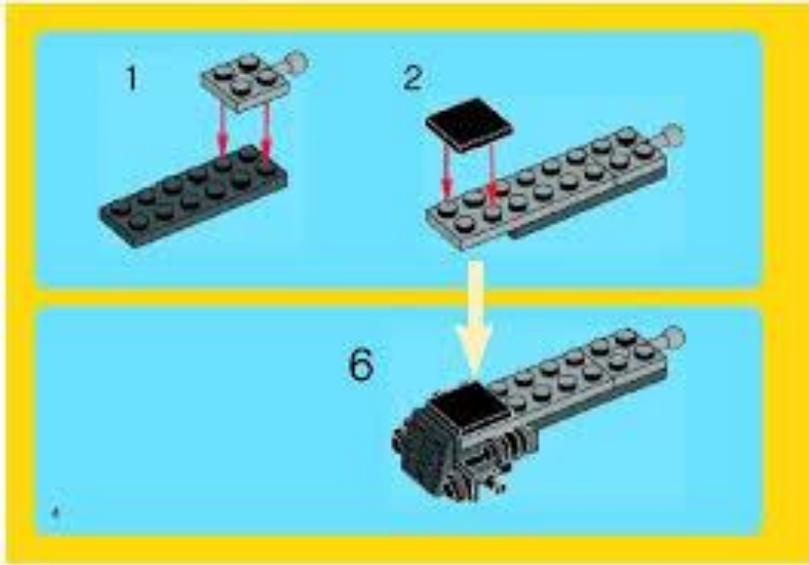
Power Digger



Emerald Express

Retrieved from <http://www.Lego.com>

Appendix B: Example of Lego PAS Instructions



Retrieved from <http://www.Lego.com>

Appendix C: Task Analysis and Data Sheet

Date:		/	/	/	/	/	/	/	/	/	/	/	/	/	/
Model		D T	E N	S B	H E	B X	B H	D T	E N	S B	H E	B X	B H	D T	E N
Page 1	Locate														
	Build														
Page 2	Locate														
	Build														
Page 3	Locate														
	Build														
Page 4	Locate														
	Build														
Page 5	Locate														
	Build														
Page 6	Locate														
	Build														
Page 7	Locate														
	Build														
Page 8	Locate														
	Build														
Page 9	Locate														
	Build														
Page 10	Locate														
	Build														
Page 11	Locate														
	Build														
Page 12	Locate														
	Build														
Page 13	Locate														
	Build														
Page 14	Locate														
	Build														
Number of steps															
% Steps completed															
PR %															
IOA %															

+=independent V=verbal with gestural M=model with verbal T=teacher completed

Boxcar=BX Engine=EN Speedboat=SB Helicopter=HE Dump truck=DT Backhoe=BH

Appendix D: Procedural Reliability Data Sheet

Date																	
Observer Initials																	
The teacher had materials pre-arranged.																	
The teacher provided a specific task direction.																	
The teacher used the intervention with only one participant at a time; other participants were not able to observe.																	
The teacher allowed the participant an opportunity to complete each step.																	
The teacher completed any steps not completed correctly, sequentially, according to the system of least prompts.																	
The teacher provided praise for participation only; no specific verbal praise was given.																	
Teach allowed participant to access the completed build as a reinforcer.																	
Percent Steps Completed Correctly																	

Appendix E: Social Validity Questionnaire for Parents

1. Do you have Lego in your home?
 Yes
 No
 I'm not sure

2. How long has it been since your child used Lego?
 In the past 30 days
 In the past year
 In the past 5 years
 Over 5 years
 They've never used Lego
 I'm not sure.

3. It is important to teach recreation skills to students with disabilities.
 Strongly agree
 Agree
 No opinion
 Disagree
 Strongly disagree

4. Do you consider building with Lego blocks to be an age-appropriate activity for teenagers?
 Strongly agree
 Agree
 No opinion
 Disagree
 Strongly disagree

5. Do you consider building with Lego blocks to be an age-appropriate activity for adults?
 Strongly agree
 Agree
 No opinion
 Disagree
 Strongly disagree

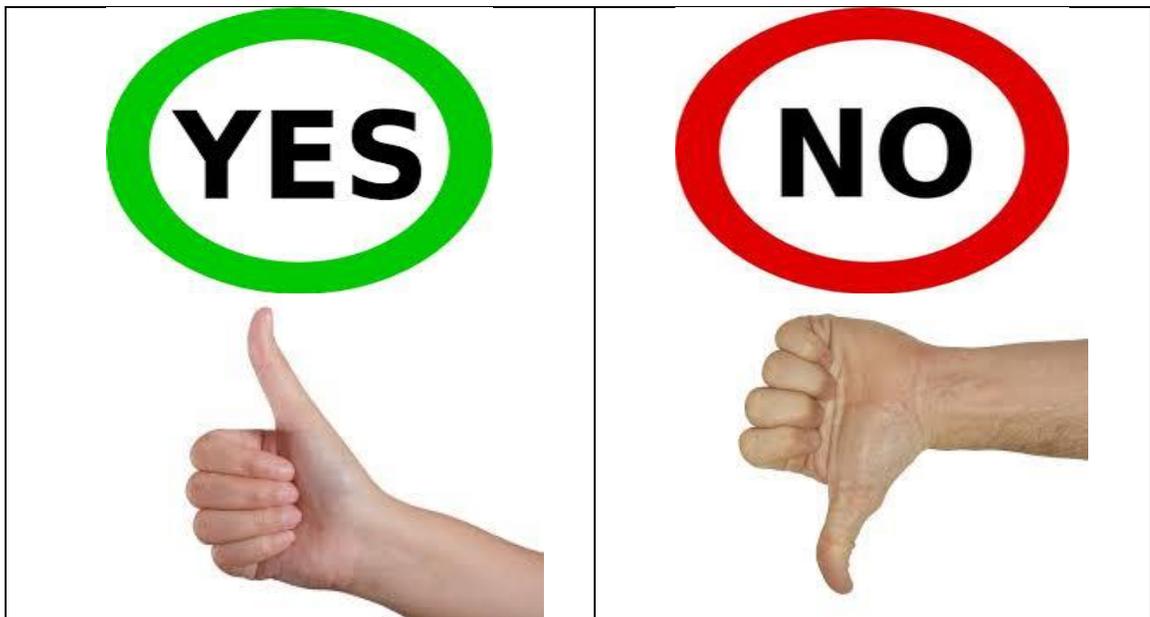
6. Do you consider picture activity schedules to be an effective way to teach students with autism or cognitive disabilities?

Picture activity schedules use pictures to communicate a sequence of activities or to show the steps of a task.

- Strongly agree
- Agree
- No opinion
- Disagree
- Strongly disagree

Appendix F: Simplified Participant Ascent Form

Ms. Sherrow wants to teach me how to make fun toys. I will get to play with Lego. Do I want to do this work with Ms. Sherrow?



My Name is: _____

Date: _____

Appendix G: Social Validity Questionnaire for Professionals

Please rate the following statements using the scale.

I think it is important to teach recreation/leisure skills to students with disabilities.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
-------------------	----------	---------	-------	----------------

I think picture activity schedules are an effective instructional strategy.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
-------------------	----------	---------	-------	----------------

The intervention used in this study was effective.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
-------------------	----------	---------	-------	----------------

The intervention used in this study was time consuming.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
-------------------	----------	---------	-------	----------------

The intervention used in this study is worth replicating with other activities and/or other students.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
-------------------	----------	---------	-------	----------------

The intervention used in this study was meaningful to the students.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
-------------------	----------	---------	-------	----------------

The intervention used in this study should be used in the future.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
-------------------	----------	---------	-------	----------------

Please list any other comments/feedback you would like to share this study.

Appendix H: Social Validity Questionnaire for Participants

I like building with Lego	Yes 	I'm not sure 	No 
I liked learning how to build Lego	Yes 	I'm not sure 	No 
I like looking at pictures that tell me what to do.	Yes 	I'm not sure 	No 
Do you have Lego at your house?	Yes 	I'm not sure 	No 

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