PROCEDURES UTILIZED IN SELF-HELP INTERVENTIONS FOR ELEMENTARY AGED CHILDREN WITH AUTISM: A REVIEW

by

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(Under the Direction of Kevin Ayres)

ABSTRACT

Deficits in self-help skills present a significant challenge to children diagnosed with Autism Spectrum Disorder (ASD). These deficits may result in more intrusiveness from caregivers in the daily lives of individuals with ASD. Interventions to improve self-help skills promote independence and autonomy of individuals with ASD. Previous literature reviews on self-help skills for individuals with ASD included majority adolescent and adult based research focusing only on the specific interventions utilized. This study presents a literature review of components of interventions utilized to improve self-help skills of elementary aged children with ASD. Fourteen studies that met the inclusion criteria were chosen. The interventions utilized within the research are a) in-vivo modeling, b) video modeling, c) video prompting, d) gaming, e) social story, f) pictorial self-management, and g) auditory intervention. This review further evaluates these interventions by focusing on procedures used such as: probe, chaining, generalization, and maintenance procedures.

INDEX WORDS: Autism or ASD, Self-help skills, Elementary, daily-living skills

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Bachelor of Science, University of Georgia, 2018

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2020

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December 2020

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CHAPTER 1

INTRODUCTION

Promoting the acquisition of various functional skills can provide more opportunities for the student to engage in other prerequisite skills that lead independence (Ayres et al., 2009). Self-help skills are considered functional skills that influence the daily routine for children. Interventions targeting these skills are of primary importance to individuals with autism spectrum disorder (ASD). Interventions targeting self-help skills are of importance primarily due to deficits in adaptive behavior (Shrestha et al., 2012). Compared to IQ-matched peers, individuals with ASD daily living skills performance remains very low (Liss et al., 2001). For typically developing peer's self-help skills do not require systematic instruction. These skills are typically expected to naturally develop with age over time. This development is not the same for individuals with ASD. Thus, individualized intensive instruction is needed in order to promote acquisition of these skills.

In everyday life typically developing independently complete tasks such as getting dressed and personal hygiene. Independence is upheld and valued in western culture; the ability to perform self-help skills independently represents a sense of "Self" (Kern et al., 2007). Independently performing a self-help task allows for individuals to make various decisions and/or display preferences that reflect characteristics of their autonomy (Kern et al., 2007). Preferences and unique decision making may be evident in the order of steps to put on a shirt, the color of the shirt, the amount of mayo on a sandwich, or flavor of toothpaste to use. Due to many children with ASD being dependent on their parents or caregivers to perform these self-help task

(Mays & Heflin 2011); children with ASD are often not provided the opportunity to express those unique characteristics of their identity (Kern et al., 2007). Having an excessive amount of dependence on others also can contribute to lower confidence or a diminished view of self-worth for the individual (Wertalik & Kubina, 2017). In the field of applied behavior analysis (ABA), it is of importance to develop interventions defined by the Applied dimension of ABA. The applied dimension refers to the importance of conducting research that enhances or improves the everyday life of a learner, and those closest to the learner (Baer et al., 1968).

Pierce and Schreibman (1994) found that the autonomy of a child is normally a primary concern for caregivers. Pierce and Schreibman (1994), stated that children acquiring self-help skills early in life acclimate and grow in other aspects of their life. Without these self-help skills, children's abilities to grow domestically, educationally, and vocationally are limited (Pierce & Schreibman, 1994). Due to deficits in self-help skills and other functional task; individuals with ASD have poor adult outcomes (Carter et al.,2011). Students who display more independence in self-help tasks are more likely to be employed (Carter et al., 2011). This may seem minor at a young age to most, considering that typically developing children are expected to gain this independence by the time employment is needed. However, this is not the same for individuals with ASD (Liss et al., 2001). Research shows that as individuals with ASD get older, the gap between self-help skills of those with ASD and their peers increases (Bal et al., 2015).There is also evidence of poor post school outcomes for individual's with continued dependence on caregivers for self-care task (Carter et al.,2011). Early intervention is necessary for children to begin acquiring self-help skills and sense of autonomy early in life that will benefit them in adulthood (Hong et al., 2015). This is a

primary reason why the present review will provide a collection of articles focusing on early intervention for elementary aged children 4-10 years of age.

Interventions promoting the acquisition of self-help skills not only help the individual with ASD, and their caregiver. Teaching children self-help task can be difficult for parents of both typically developing children as well as those with developmental disabilities. However, children with ASD require more of the care takers time and energy. Continued reliance on a caregiver to perform all self-help task can cause extreme stress on caregivers as well as the child concerned (Estes et al. 2009). Interventions promoting mastery of self-help task change the role of the adult in the child's daily routine. It affects their use of time, allowing them to engage in other activities or parts of the daily routine (Kern et al., 2007). Interventions promoting independence also effects the type and amount of assistance offered; a caregiver can transition from fully completing all steps to now only needing to point for steps to be completed. (Kern et al., 2007). Additionally, interventions promoting mastery of self-help skills allows caregivers to find value in those daily tasks by decreasing the amount off stress experienced due to the amount of energy, and intrusiveness required (Kern et al., 2007)). Thus, self-help skill acquisition improves the quality of life for both child and the caregiver (Sherstha et al.,2012). There are several articles later mentioned that evaluate the social validity of the interventions utilized for self-help skills. Several of these report that parents reported a noticeable change, and effect in the lives of the children. Parents have reported a decrease in the need of intrusive assistance and its benefits post intervention (Ayres et al., 2009).

COVID-19 has presented challenges in the daily lives of everyone. There are precautions and measures that the CDC has advised everyone to abide by. These include social distancing of 6 feet or more, increased hand sanitation, and overall decreased touching and interaction with

others (CDC, 2020). Individuals with ASD depend on caregivers to perform most daily task; they have more opportunities of close contact and intrusiveness than their typically developing peers. This presents another reason for the need of interventions designed to promote the acquisition of self-help skills, in turn reducing the level of intrusiveness needed to perform the task. By decreasing prompt dependency, individuals with ASD may pose less risk for contracting viruses which are transferred by touching the bacteria of one's hand. This is especially true during activities such as brushing other's teeth, making sandwich, getting dressed, and other self-care task.

The goal for all children should be to have the best possible life they can and experience independence and autonomy as much as possible. Previous literature reviews such as those conducted by: Ninci et al. (2015), Hong et al. (2015), and Hong et al. (2017) collectively synthesized interventions focusing on teaching functional skills from several functional skill categories: domestic skills, community skills, and self-help skills. The articles they included primarily consisted of adolescents and adult participants. The present review resembles that of a more recent review by Wertalik et al. (2016). This past review examined and summarized interventions to teach personal care skills to individuals with ASD. Over half of the articles within this review include participants of various ages. Only six of the articles included in this past review overlap with those included within the present review. The present review examines components of how the interventions were implemented: probing, chaining, generalization, and maintenance procedures. The review is an extension of existent research; it contributes to research by providing interventionist, caregivers, and others a collection of the procedures utilized within various interventions to teach elementary school aged children self-help skills. The purpose of this review was to answer the following questions: What interventions have

researchers used to teach self-help skills to elementary aged children with ASD? How were these interventions taught? What procedures were utilized?

CHAPTER TWO

METHOD

Literature search

The search process consisted of an electronic search of the following databases: PsycINFO, ERIC, Science Direct, Education complete, and academic complete. A combination of the following key words were utilized: self-help skills, daily living skills, chaining, ASD, children, and hygiene. The abstracts of the studies were reviewed and those that met the inclusion criteria were retained. Excluded articles were kept and the reasons for exclusion were documented. This search process can be seen in the PRISMA diagram (Kendall et al., 2014). (Figure 1) c. A search was also conducted for specific literature reviews done on the topic in the past. These past reviews were screened to identify any studies included that the search may have missed and met the inclusion criteria. Next, the references list of the articles that were included were evaluated to identify any studies the initial search may have missed. As a result of these search procedures 64 articles were identified for possible inclusion in this review. These articles were then further evaluated to determine whether it met the inclusion criteria. Google forms were utilized to organize the information for the articles that would be included and categorize those that did not meet the criteria. In total there were 14 articles included.

Inclusion/Exclusion Criteria

Only articles that met the following inclusion criteria qualified for this review. The study needed to (a) have at least one participant meeting criteria for diagnosis of ASD; (b) target acquisition of at least one personal self-help skill; (c) use single-case research design; (d) include

at least one participant under the age of 10; (e) include an explicit task analysis, and (f) be peer reviewed. Self-help skills were defined as skills that directly benefit oneself upon completion and are necessary to live successfully independently. Both toileting and feeding research articles were excluded due to them requiring more specialized intervention components. Such as most toileting interventions resembling a Rapid Toilet Training procedure. Also, specifically toileting interventions, had heavy outcomes in the literature search suggesting a review focusing on toileting independently would be appropriate (Levato et al. (2016), Francis et al. (2017), Kroeger and Sorensen-Burnworth (2009).

Data extraction

The included studies were each summarized by the following characteristics: (a) participants age, gender, and diagnoses; (b) setting; (c) design type; (d) dependent variable; (e) type of self-help skill; (f) specific intervention utilized; (g) chaining procedure; (h) probe procedure; (i) reinforcement, (j) generalization procedures, (k) outcomes, (l) maintenance.

Participants demographics were coded to identify any patterns within the participants included in the research studies. This coding provides other researchers and readers an idea of the demographics the intervention is effective for and the demographics that research should expand upon or replicate. For example, if diagnosis is not discussed one may assume an intervention for a typically developing child will work the same for a child with developmental disabilities. Age is of importance for the same reason stated above. Hong et al. (2015), suggests that responding in interventions may be different according to ages. Self-help intervention teaching a 24-year-old to wash his hands may look different and have different outcomes with a seven-year-old child. The coding of gender is of importance because it can influence participant

selection in research of others. If there is consistently a certain intervention only used with males' researches could replicate in order to extend the research generalizability.

Setting is coded for and is of importance because different settings may lead to different outcomes. Setting is of prime important for generalization purposes. If a researcher is teaching a student to take a shower in the school locker shower, there must then be some programmed generalization training or assessment so that this skill can transfer to the home shower. Also, different environments may require different considerations and challenges when implementing certain interventions. Explicit description of the setting, the setup of the environment and materials utilized within that environment is beneficial for replications and extending purposes.

Chaining procedures are grouped into three possibilities. Each article was coded for one of the following procedures; (a) forward chaining, (b) backward chaining, (c) total task, (d) not applicable (i.e. procedures not adequately described). Those articles that do not explicitly state the type of procedure utilized, will be evaluated and categorized into one of the described chaining categories based on description of procedures. Chaining was coded to further parse out how interventions were conducted and observe commonalities. Also, chaining is a valuable concern with self-help skills due to its uniqueness. Many self—help task are reinforcing within themselves at completion of the task (i.e making a sandwich and eating it). However, backward chaining, forward chaining, and whole task chaining each provide a different criterion to access the ultimate reinforcement. (i.e backward chaining results in ultimate reinforcement sooner due to starting with last task). Thus, evaluating how chaining is incorporated with the unique reinforcement involved in self-help skills is of importance.

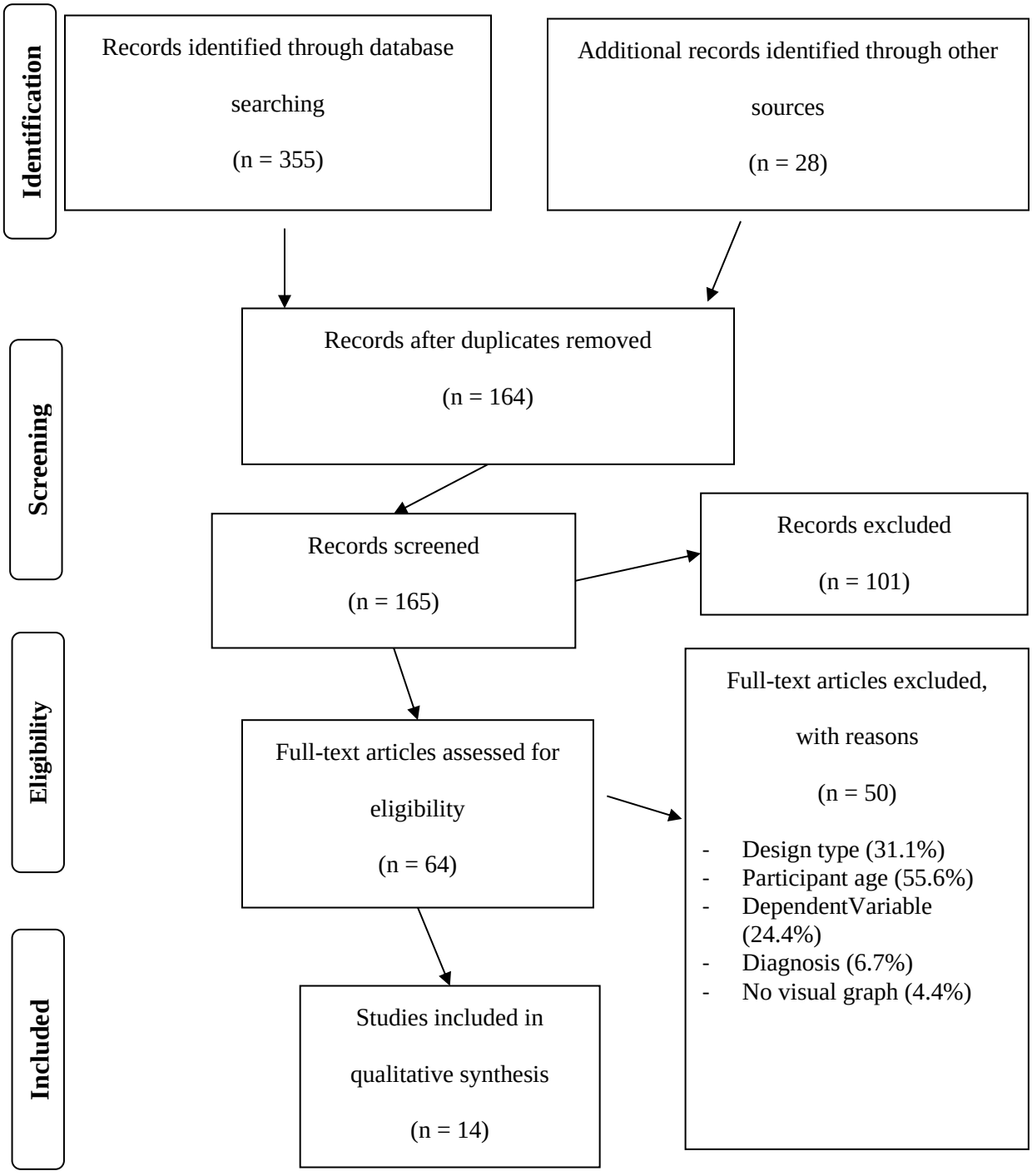
Probe procedures were grouped into four categories: (a) single opportunity probe, (b) multiple opportunity probe, (c) Natural (Fixed) opportunity probe, or (d) not applicable (i.e

articles did not describe probe procedures). Those articles that do not explicitly state the type of procedure used, will still be evaluated and categorized into one of the described probe categories based on description of procedures. Probing procedures were coded for the same reason as chaining: to parse out the procedures used with interventions. Probing is important because researches may face challenges in measuring an individual's baseline behavior or probing the behavior for more complex task such as self-help skills (Alexander et al., 2017). Researchers must use caution and careful consideration when choosing which probe procedure to utilize during baseline. These probe procedures have different threats to internal validity of the research. Defining and evaluating which probe procedures are used with self-help interventions provides a reference and suggestion on which were utilized and how to control for the threats to internal validity.

SCARF

Single case analysis and review framework (SCARF) (Ledford et al., 2020) is a tool designed to asses articles quality and rigor. It requires answers to multiple yes/no questions and ratings between zero and four. SCARF assists researchers with evaluating rigor by asking questions concerning things such as: reliability measurement, sufficiency of procedures, fidelity, and sufficiency of data. SCARF also scores quality by evaluating things such as: participants demographics, dependent variable, social validity measured, and ecological validity indicators (Ledford et al., 2020). Primary outcomes are coded based on consistency of outcomes. A score between one and four can be given. Scores of one and two indicated weak or moderate effects, while score three and four mean a functional relation can be identified (Ledford et al., 2020). The results are then displayed in a scatter plot containing quadrants with the coded score

FIGURE 1. PRISMA Flow Diagram



CHAPTER THREE

RESULTS

Participants

All participants included in the review were between the ages 3 and 10 years of age. Due to the inclusion criteria only requiring studies to include at least one participant under the age of ten; some of the studies with multiple participants include a participant older than 10. 11 years of age was the oldest age of any individual that was an additional participant within the study. Of the articles in this review 29% (4/14) include at least one additional participant 11 years of age. These older participants were not evaluated in this review. Only 36% of (5/14) studies included exclusively participants under the age of 5. Matson et al. (1990), included only one out of three participants under the age of 5. Of all participants 26 were males and six were females. Rayner (2011) did not explicitly state the gender of participants. However, the gender was assumed based on the pronouns utilized with name (i.e, he, she, him, her). Certrez-Isac et al. (2016) did not describe their participants gender and utilized "the student" instead of pronouns when describing procedures with them. All participants met the criteria for diagnosis of ASD.

Setting

Of the included articles 57% were primarily conducted in the classroom setting, classroom bathroom, or other room in the participants school; 21% of the studies were solely conducted within the home setting. Ayres et al. (2009) conducted their study both in the home and classroom. 28% of the studies were conducted in a clinic or outpatient facility. The settings for all studies not done in the natural environment were altered to contain some type of materials

to resemble the natural environment: a small table, small sized chairs etc. were placed in the room. Majority of the studies conducted within therapist clinic rooms consisted of a two-way mirror for observation, this is with an exception to the studies that were conducted in the bathroom setting.

Targeted skills

The inclusion criteria required the articles to target self-help skills. The research targeted self-help skills that were either grooming, food preparation, or dressing. Dressing skills (pants, tying shoe, jacket) were targeted within 29% (4/14) of the included interventions. Grooming was targeted (i.e. handwashing, washing face, brushing teeth, showering) within 50% of the studies included, while 36% (5/14) of studies included a targeted skill of preparing and consuming food or drink. 43% (6/14) focused on a combination of self-help task or other skills not considered personal self-help skills for the purposes of this review. There were only four articles that included other skills other than self-help. Ayres et al., (2009) included table setting as one of the skills targeted. Shipley-Benamou et al. (2002) includes domestic task such as setting the table, mailing a letter, and pet care. Charlop-Christy et al. (2000) evaluated social skills, play, and communication in addition to self-help skills. Pierce and Schreibman (1994) taught participants to fold clothes.

Interventions utilized and Outcomes

Video Modeling (VM). There were various interventions focused on children acquiring self-help skills. Within this review the 50% (7/14) of the interventions involved a form of video instruction (i.e video modeling, video prompting, computer-based video instruction). Video modeling involves the participant observing a videotape of a model engaging in a target behavior and in turn imitating the actions. Charlop-Christy et al. (2000) utilized video modeling but also

compared its effectiveness with in-vivo modeling to teach self-help skills to one child with ASD. The video was from a third person perspective with a familiar person serving as the trainer. The video was slowed down to make the steps more apparent (Charlop-Christy et al., 2000). The participant either watched the trainer perform brushing teeth or washing face twice or watched the video model twice before engaging in the task. The procedures and steps for both video and in-vivo modeling were identical with the only difference being the way the models were presented. Results showed that VM is more effective than in-vivo modeling. Additionally, Rosenberg et al. (2010), Shipley-Benamou et al. (2002) and Sherestha et al. (2012) each investigated video modeling as its sole intervention.

Rosenberg et al. (2010) investigated the effectives of commercially available video model and customized video modeling for teaching children with ASD handwashing. The commercial videos were chosen from a series of premade videos utilizing an unknown adult, different materials and without any verbalization of the steps. The customized videos include familiar individuals to the participant with enthusiastic verbalization of the steps. Both videos were in third person perspective and were watched twice before engaging in the behavior. In this study, two of the three children did not learn from the commercially made video. With a custom-made video, these two children subsequently demonstrated acquisition of the skill. In contrast Shipely-Benamou et al. (2002) only presented their video model once to teach orange juice making, and they utilized the researcher as the model in the instructional video. A primary difference in Shipely-Benamou et al. (2002) VM intervention is the use of a 5-s animated video segment of the child's favorite cartoon with the same instruction at the start of the instructional video. Outcomes demonstrated the intervention as successful. Shrestha et al. (2013) was the only VM study included to have separate videos for different steps of the task analysis. There was a video

for steps 1-4, 1-13, and 1-13. This article also utilized a point of view model instead of a third person perspective. The camera was held over the shoulder of the child's parent showing two hands completing the task and verbalization of the steps. The outcomes demonstrate a clear and criterion-related increase in the number of steps completed in the target skill of making a snack.

Ayres et al., (2009) not only uses the traditional video modeling instruction but also included a computer-based simulation. During computer-based intervention (CBVI), the children were trained to log in and utilize the program prior to intervention. First, they viewed two narrated video models of targeted task. Then, the program asked them to complete the skill in a computer simulation by utilizing the mouse to click and move items to correct locations. The video consisted of images that were filmed from a first-person perspective and each step was verbalized. The study utilized in-vivo sessions to evaluate the participants acquisition of the skills before and after CBVI. The participants each mastered the skills they were taught via CBVI and generalized this to the natural environment.

Video Prompting. In contrast, video prompting is a form of modeling in which a video shows each step of a task analysis followed by the chance to engage in each step separately (Rayner, 2011). Rayner (2011) and Richard and Noell (2019) were the only two studies that utilized this method of video instruction. Both studies investigated a video prompting procedure to teach three children with ASD to tie a shoelace knot. Both studies' video instructions were shown in first person point of view showing the hands of the modeling tying the shoes. However, Rayner (2011) started instructional videos with a title slide and showed the model person in third person perspective here only, whereas Richard and Noell (2019) began the video with a cartoon for 5s to increase the likelihood the child was engaged with the video. Rayner (2011) made four different videos of the task utilizing a peer model, adult model, adult model using colored laces,

adult model with different mock shoe and a video with no opening and closing showing third person model. Richard and Noell (2019) only utilized one video to investigate the use of the video modeling procedure utilizing backward chaining. Rayner et al. (2011) demonstrated only two participants benefited from the video prompting procedures and no participants reached mastery of the target behavior as a result of the video prompting procedures alone. With the addition of backward chaining the participants demonstrated acquisition of shoe tying. The backward chaining procedure was more effective, enabling one participant to reach mastery and a second participant to approach mastery. Richard and Noell's (2019) video prompting combined with backward chaining intervention demonstrated positive effects in promoting skill acquisition.

Lastly, Hagiwara and Myles (1999) investigated a multi-media social story intervention. This video based instructional program resembled that of a book. It contained video movies of the steps to handwashing, with the text of the social story, and audio vocalizing the sentences. Identical to traditional VM the participants engaged with the program and then performed the behavior in the designated environment. The story was told and written in first person. The video images consisted of some first-person point of view steps and some third person point of view steps. They did not conclude that multi-media social story intervention was effective.

Behavioral in-vivo models. In-vivo modeling was used within 14% (2/14) of the articles included. Matson et al. (1990) utilized an intervention package consisting of: modeling, verbal instruction, prompting, and edible and social reinforcement use. The dependent variables included tying shoes, combing hair, and drinking are the self-care skills. The target behavior was first modeled and verbally described by the therapist, next participants were physically guided and verbally prompted. The last phase consisted of the child performing the behavior unassisted. The child received edible or social reinforcers at the end of the chained task. This intervention

was proven to be effective and resulted in acquisition of skills. Çetrez-Iscan et al. (2016) also used in-vivo intervention. Çetrez-Iscan and colleagues investigated the effect of most-to-least prompting on dressing skill of students with ASD. The level of intrusiveness decreased during the session. Intervention first began with full physical prompting, then partial physical touching of the elbow, next verbal prompting, and finally independent performance. The trainer moved back to the previously used prompt level if the participant made a mistake during a higher level. This study revealed the effectiveness of most to least prompting in teaching dressing skills.

Audio intervention. Audio based intervention were not common in the literature, only 14% of the article included utilized solely audio interventions (i.e. self-operated auditory prompts, embedded music). Kern et al. (2007) investigated the effectiveness of adding songs embedded in hand washing and cleaning up for a participant with ASD. Pre-existing routines and songs utilized in the participants environment were incorporated in the intervention. "Row Row Row your boat" was utilized for handwashing, precomposed "clean up" song by Barney and Friends was utilized for cleaning task analysis. The song intervention was alternated with a lyric intervention which only used words. Both conditions consisted of the same words and steps. In the lyric intervention the classroom teacher repeated the verbal lyrical prompts two times for each step in the task, whereas the teacher only sang the song once in the song intervention. Kern et al. (2007) found that both interventions were beneficial for all task, but the song intervention resulted in higher independent responding.

Mays and Heflin (2011) investigated the effect of self-operated auditory prompts (SOAP) on the acquisition of handwashing and tooth brushing chained task. Prior to the session the teacher provided the discriminative stimulus (SD) "wash hands" or "brush your teeth" while also pointing to the cassette tape needed for the intervention. The teacher recorded verbal prompts for

each step on a cassette tape. Each step on the tape had a pause between them to allow time for the student to perform the steps. If the student made a mistake and skipped a vital step the teacher provided a prompt. The results showed that participants performance improved immediately after introduction of SOAP.

Gaming technology. Kang and Chang (2019) utilized a Kinect senor to gamify taking a shower. Kinect sensor being a device that monitors or detects the users body movements as they play the game. The game was called *Take a Shower* and comprised a 25-step task analysis. Students had to stand 3 ft in front of the kinetic sensor for optimal performance. The game started with the children choosing their favorite cartoon model by holding their hand over the selected model on the screen for 3s. The movements of the model were controlled by the child using natural body movement. A water fairy was used as a visual cue and moved around parts of the body to guide the children where to wet the body. Points were scored when the children aimed the water at the locations of the water fairy. Reinforcement was delivered in the form of a dog appearing on the screen and providing enthusiastic praise. The student then took a shower and data was collected on the steps completed independently. Researchers counted steps as independent if the first step was initiated within 5s and subsequent steps were completed within 20s with no assistance. The participant's independent performance increased immediately when the game intervention was introduced.

Pictorial self-management. The last intervention included in the present review is a study conducted by Pierce and Schreibman (1994). They investigated the effects of a pictorial-self management intervention to teach self-help task. For the purpose of this review, we consider the task such as making lunch, making a drink, and getting dressed. In phase one of the intervention the participants were taught to discriminate pictures depicting steps for the target

behavior. These were the same pictures that they used to depict the task analysis in the picture book. They received verbal praise and a snack on a variable ratio of three for independent correct responses. In phase two the children were taught to choose their own reinforcer, independently turn the pages in the picture book, perform motor actions (e.g. making a drink, lunch), and self-reinforce. In phase three the therapist presence was faded by having them leave for approximately 20s. This time increased gradually over time until successful fading of the therapist's presence with the child performing 100% of the steps independently. Pierce and Schreibman (1994) measured on task behavior and inappropriate behaviors. For on task to be scored the following had to have occurred: self-selection of reinforcer, self-reinforce, correct self-monitoring. This treatment package resulted in an increase in engagement in the self-help task and decrease in inappropriate behavior. Figure 2 summarizes the above demographics and interventions within the review.

FIGURE 2. Summary of Intervention Demographics

CITATION	PARTICIPANTS	SETTING	DESIGN	DEPENDENT VARIABLE	SELF-HELP TASK	INTERVENTION USED
Ayres et al., (2009)	M-9, M-7, F-9	multiple locations: in home and classroom	multiple probe design across behaviors replicated across students	steps completed independently	making soup, making a sandwich	Computer Based Intervention (CBVI)
Cetrez-iscan, et al,. (2016)	8,10 - gender unknown	empty classroom	Multi-Probe design	students zippered coat wearing	dressing	Most to least prompting
Charlop-Christy et al,. (200)	7-year-old male	clinic's kitchen	multiple baseline across children	number of correct responses	Brushing teeth, washing face	video modeling
Hagiwara & Myles (1999)	7,7,9 All male	school	multiple baseline	completion of hand washing steps	handwashing	social story
Kang, & Chang (2019)	M-9, M-9, F-9,F-9,	home bathroom	non-concurrent multiple baseline	the number of task steps for taking a shower completed	showering	game-based

Kern et al,. (2007).	3-year-old male	Classroom	alternating treatment	number of independent steps	handwashing	embedded music compared just lyrical interventions with song
Matson et al,. (1990)	M-9, F-6, M-4	classrooms or bathroom across	multiple baseline	number of steps completed independently	shoe tying, toothbrushing, hair combing, putting on pants, shirt. and socks and eating and drinking.	total task chaining procedure, modeling, verbal prompting, social reinforcement
Mays & Heflin (2011).	M- 6, F- 7	restroom in classroom	multiple baseline design across students	percentage of steps completed	handwashing and toothbrushing	self-operated auditory prompts
Pierce & Schreibman (1994)	9,8,6 all male	room with one-way mirror	multiple baseline probe	percentage engagement.	getting dressed, making lunch	pictorial self-management

Rayner, C. (2011).	9,10,10	Classroom	Multiple baseline across subjects and an alternating treatment design	number of independent steps	Shoe Tying	Video prompting
Richard & Noell (2018)	M-5, F-5, M-5	Clinic	multiple baseline	number of steps completed independently	shoe tying	Video Prompting and backward chaining
Rosenberg et al,. (2010)	M-3,M-4,M-5	restroom in school	multiple baseline design across students	the number of correctly completed hand washing steps	handwashing	Video Modeling
Shipley-Benamou et al,. (2002)	M-5,M-5,F-5	room with one-way mirror	multiple baseline probe	percentage engagement.	Making juice	Video Modeling
Shrestha et al,. (2013)	4-year-old male	in the home	changing criterion design	number of steps without prompts	independently preparing and eating an afternoon snack and tidying up afterwards	Point of view video modeling plus forward chaining

Chaining and Reinforcement

Forward chaining. Forward chaining is a method for teaching complex task analysis. The first step of a task analysis (TA) is taught first followed by each subsequent step being taught. This procedure requires the cumulative performance of all previous steps in the correct order until the child can do all steps of the chain independently (Shrestha et al., 2012). Forward chaining was used in 21% (3/14) of all the studies included in this review. Çetrez-Iscan et al. (2016) began teaching sessions by drawing target student's attention. When the target student focused his attention, praise was provided, and skill instruction was given. Researchers waited 4 s for the target student to realize the skill. When he did not initiate the step, prompts were given. This continued for each subsequent step. Reinforcement was given in the form of praise after steps completed correctly. This is similar to the methods employed by Shrestha et al. (2012) to teach a young individual to make himself a snack. However, Shrestha et al. (2012) grouped their steps into three phases. The forward chaining started with Phase 1 which was step 1-4. Phase 2 consisted of steps 1-10 and Phase 3 consisted of steps 1-13. There were three videos made for each set of steps. Reinforcement was given in the form of social praise, high fives and cuddles from the participants parent at the end of the TA.

Peirce and Schreibman (1994) did not explicitly state the name of the chaining procedure utilized. However, their procedures resemble a forward chaining method. First the children were taught to choose their reinforcer. Once reinforcer selection was acquired the children were taught to open the book, praise was given for all attempts. Once the behavior of book opening was acquired the therapist taught the children to retrieve the item or perform the action depicted in the first picture in the book, followed by praise for correct identification and a verbal prompt to retrieve the object or to perform the action depicted in the picture. If there was no response after 15s the

therapist modeled the behavior. After the skills were acquired with prompting, therapist transferred stimulus control by reinforcing successive approximations and delayed prompting. Social praise was given by the therapist after the step was completed to signal the child to self-reinforce. This entire procedure was repeated until the child independently engaged in the first step of the pictured task for three consecutive session. At this point the second step was trained. All steps were chained in the same format

Backward Chaining. Backward chaining is a procedure in which the therapist completes all of the steps except for the last and provides prompting for the last step. After the last step is mastered the therapist moves to providing prompting to the second to last step and so on (Rayner, 2011). This allows the participant to receive reinforcement associated with the end product quickly which is considered more naturalistic. They receive reinforcement associated with completing the entire task first. Only two articles used backward chaining: Rayner (2011) and Richard and Noell (2019). Rayner (2011) evaluated the effects of video prompting and backward chaining for teaching students to tie their shoe. They utilized a total task format during the video prompting intervention sessions. They included a backward chaining intervention as a pragmatic measure when the child did not progress in their performance of the target behavior during the video prompting phases (Rayner 2011). Participants were provided in-vivo modeling with verbal cues throughout. The steps were group together and followed this sequence: steps 9-11, steps 4-8, and lastly steps 1-4. The researchers did not describe reinforcement procedures.

Richard and Noell (2019) conducted a similar study to Rayner, except they combined video prompting with backward chaining to observe the effect of them as an intervention package. Also, Richard and Noell (2019) did not break their task analysis into groups. They had six total steps in the TA. After the student watched the video, a shoe tied up to the current step being taught was

placed in front of them. After the step was completed or attempted the shoe was returned to the current training step. Any failed attempts at the step resulted in the video being watched again. After each trial the child was given praise and access to the preferred toy for 30s.

Whole Task Chaining. Whole task format is another common chaining method. Whole task chaining involves teaching each step of the task analysis for every instructional trial. It was the most utilized method within this present review. However, 8/14 of the articles do not explicitly mention the name of the chaining procedure. 7/8 of the articles that do not explicitly mention the name of the chaining procedure do describe chaining procedures in a whole task format. Ayres et al. (2009) is the only article to explicitly report that they used a whole task chaining procedure. The participants could go through the entire sequence of the chained task regardless if they were correct or incorrect. A correct response was when a student began the response within 5s of the SD to perform task or within 5s of previous step. The students could consume the item they had made at the end of the intervention.

Unspecified Chaining procedures. Mays and Heflin (2011) describe the use of a total task chaining procedure. The participants were given the SD to "wash your hands or Brush your teeth" while having access to auditory prompts on tape. The students then proceeded to complete consecutive steps in the task. Steps that were critical for the completion of the next steps were the only ones that were prompted by the teacher. Noncritical steps were ignored and marked as absent. If the step was out of sequence or performed before the auditory prompt it was still considered as correct. Mays and Heflin (2011) did not describe their reinforcement procedures. This is similar for Rosenberg et al. (2010) and Hagiwara et al. (1999), who described a chaining procedure that seem to be whole task format. Within their procedures they include that a participant was not required to complete all previous steps correctly to gain credit for a later step. Rosenberg et al.

(2010) praised attending intermittently, and sitting was praised at competition. However, Hagiwara et al. (1999) participants received reinforcement in the form of candy and praise at the end of the task.

Kang and Chang (2019) procedures are also consistent with a total task chaining procedure due to the students having the opportunity to complete all the steps of showering during intervention regardless if some steps were correct or incorrect. The teacher did not interfere with or try to prevent any inaccuracies from occurring in the participants' performance. The students received praise contingent on how many correct steps were completed during the intervention. Additionally, Shipley-Benamou (2002), first showed the video of the task then gave the child an opportunity to engage in all steps of the task. No prompts were made in between steps. The criterion for reinforcement was 100% independent acquisition of all steps of the task. Reinforcement was provided in the form of praise and candy or access to preferred toy.

Charlop-Christy et al. (2000) provided the SD "let's do the same like on TV" or "let's do the same like they did" for in-vivo sessions. The participant then was provided the opportunity to proceeded through the total task analysis. Therapist did not provide prompts for the steps only prompts to pay attention. Lastly, Matson et al. (1990) taught target skills in a total task format but within three different phases. The first phase included the trainer modeling and verbally describing the entire target sequence. Next, the child actively took part in the entire sequence with physical and verbal prompting. The child then completed the steps in total task format unassisted.

Probe Procedure

Single Opportunity Probe (SOP). When SOP procedures are used, the assessor presents an opportunity to perform the first step of the task. The session continues until the participant engages in an error or completes all steps correctly. If the participant makes an error, the assessor

scores the error and all other steps as incorrect (Alexander et al., 2017). Three articles explicitly named the probing procedure utilized or explicitly described procedures matching the definition of a probing procedure. Certrez-Iscan et al. (2016) explicitly named that the study used a single chance method during probe sessions. They gave the students 4s to initiate the action or to perform the next step. If they did not initiate the steps this was considered incorrect and the session was ended. Rosenberg et al. (2010) and Richard and Noell (2019) describe using a similar procedure however, these studies did not explicitly name the procedures as SOP. Richard and Noell (2019) allowed 5s for the child to initiate the task and subsequent step. Failure to initiate the first step resulted in the end of the session. The only difference in Rosenberg et al. (2010) is that the participant was allowed 30s to complete a step and move to the next step of the hand washing sequence. If the child did not proceed to another step of the chain within 30s, the session was terminated.

Fixed Opportunity Probe (FOP). FOP provides the participant a certain amount of time to complete all steps in the TA. The total time is determined by multiplying the number of steps by the number of seconds given for each step (Alexander et al., 2017). The probe ends when one of the following occurs: (a) the participant notifies the assessor that he or she is finished, (b) a predetermined interval of time elapses without the completion of a correct step (i.e. 5 s, 30 s), (c) the session timer end (e.g., 50 s), or (d) the participant completes all steps correctly (Alexander et al., 2017). Only one study included describes probing procedures that match the definition of FOP. Shipely-Benamou et al. (2002) did not explicitly state the method of probing they utilized. However, sessions were terminated when the subject didn't engage in the appropriate behaviors needed to complete the task after a full 60s. The student also had to responded affirmatively (nodding head) to the researcher asking if they were all done.

Multiple Opportunity Probe (MOP). MOP provides individuals with opportunities to complete each step in the task. When an error occurs, the researcher arranges the environment out of view of the participants and then provides the opportunity to complete the next step. MOP provides the opportunity for the student to perform all steps correctly regardless if previous steps were incorrect (Alexander et al., 2017). Two of the include articles described procedures matching the explicit definition of MOP. Ayres et al. (2009) did not explicitly state the use of MOP but described procedures identical to the definition of MOP. If an error was made within the task the researcher stopped the student, blocked the students view of materials, and corrected or completed the next step. This procedure was the same for Rayner (2011) during shoe tying. However, the TA in this study was grouped into phases. For example, if the participant did not complete steps 1–3, the author would take the mock shoe or shoe, turn his back to the participant (so that incidental modeling would not occur) and complete these steps. Similarly, if the participant did not complete steps 4–8 successfully, the author would complete these steps before presenting the student with an opportunity to perform the next phase.

Over half, (8/14), studies reviewed did not thoroughly describe their probing procedures (Hagiwara et al. (1999), Shrestha et al. (2012), Matson et al. (1990), Kang and Chang (2019), Charlop-Christy (2000), Mays and Heflin (2011), Kern et al. (2007), Pierce et al (1994)) Unlike others that did not provide a name of the procedures these eight articles did not provide enough description to conclude which probe type the procedures most resembles. Pierce et al. (1994) only described their baseline probes as being terminated after 5 min if no interaction with task materials occurred. This would seem to be a Fixed Opportunity probe, but it is not described in enough detail to match to the definition.

Generalization Procedures.

Generalization can be evaluated various ways. Generalization was assessed in a context different than training for 79% (11/14) of the articles, 57% (8/14) assed the target behavior with different material, and 29% (4/14) assed the target behavior with different social partner. Several studies evaluated multiple form of generalization. Of the articles that assed the target behavior in different context only three articles used the home environment or the environment where the task was to take place within generalization. Peirce and Schreibman (1994) utilized both a clinic setting and home setting to test generalization. This study also trained for generalization within intervention by using different stimuli each session (e.g., different plates). Shrestha et al. (2012) evaluated generalization by using a different type of snack for the participants to make at three different points in the day at locations differing from intervention. Rayner (2011) assessed generalization to a different context by assessing shoe tying with a real shoe on the participants actual foot. The study also assessed generalization of materials by utilizing different color shoelaces.

Richard and Noell (2019) and Hagiwara and Myles (1999) both only evaluated generalization of the target behavior to different settings or context. Richard and Noell (2019) evaluated the acquisition of tying shoes actual on their feet vs on the table in training. Hagiwara et al. (1990) evaluated the generalization to a different context in the school day (i.e after recess, before lunch, before resource room). Rosenberg et al (2010) performed probes for generalization to persons and setting either in a different classroom or in an alternate bathroom, with a different teacher present. Ayres et al (2009) conducted in-vivo sessions as generalization assessment. This was done for one participant in his home kitchen and dining room, whereas the other two participants in-vivo generalization assessment was done in different areas of the school (picnic

table outside, cafeteria). Ayres et al. (2009) also utilized different types of materials during the intervention (i.e. different types of meat, cheese, condiments.) In contrary, Kang and Chang (2019) assessed generalization to a different setting. The shower gaming intervention took place in the classroom. The actual showering took place in the home of the participant. Shipley-Benamou (2002) also only evaluated generalization to the natural environment as well. The student's juice making was evaluated in replication probes in the home.

Only two articles evaluated each type of generalization across people, settings, and materials. Certrez-Iscan et al (2016) assessed generalization of the task at a different time in the school day, in a different classroom with another teacher present. Charlop-Chirsty et al. (2000) generalization probes were conducted using a new toothbrush, toothpaste, face cloth, and soap. This was assessed in a different bathroom and with a different trainer. Matson et al. (1990), Mays and Heflin (2011), and Kern et al. (2007) did not asses generalization.

Maintenance Procedures

Maintenance is ensuring that the target behavior maintained over time. Maintenance procedures can vary in its implementation. Of the articles included 71% reported evidence of continued mastery post intervention, four articles did not report maintenance procedures or results. Of the articles that measured maintenance over time only 60% (6/10) reported measuring maintenance more than once. A commonality amongst the research that measure maintenance is the implementation. Maintenance procedures are described as being the same as baseline but with no prompting. No intervention components were provided during maintenance sessions. These intervention procedures are summarized in Figure 3.

FIGURE 3. Summary of Intervention Procedures and Outcomes

CITATION	CHAINING	PROBE PROCEDURE	SR	GENERALIZATION	MAINTENANCE	OUTCOMES
Ayres et al., (2009)	total task	Didn't state - described Multiple opportunity probe	allowed to consume the food made (no programmed reinforcement) at the end of task	utilized different types of materials during the intervention and different setting	2-week probes	The participants each mastered the skills and generalized to the natural environment. Skills were maintained after a two-week follow up.
CETREZ-ISCAN, et al,. (2016)	Forward chaining	Single opportunity probe	Food reinforces and praise given for correct reactions.	Done 3 consecutive weeks at a time of school ending in different classroom. An alternate trainer was present	first third and fourth weeks after teaching sessions	Demonstrated effectiveness of most to least prompting
Charlop-Christy et al,. (2000)	Did not specify-seems like total task	N/A	N/A	utilized a new toothbrush and new toothpaste in different bathrooms. For washing face a new washcloth, bathroom, and soap	N/A	video modeling is an effective and efficient technique for teaching children with ASD several different behaviors
Hagiwara & Myles (1999)	did not specify-seems like total task	N/A	N/A	3 different environments	N/A	no consistent effect of social story

Kang, & Chang (2019)	didn't specify - seems like total task	N/A	praise contingent on certain number of steps, cut off for praise rose as things were mastered	Intervention was assessed in natural environment	4 weeks after the intervention phase	The intervention, in conjunction with operant conditioning strategies, can increase independent showering accuracy. The skill maintained well.
Kern, et al,. (2007).	didn't specify - seems like total task	N/A	NA	NA	NA	both interventions were beneficial, but the song intervention resulted in higher responding.
Matson et al,. (1990)	total task prompting throughout	N/A	Social praise and candy at completion of the task	N/A	7 Month follow-up	This intervention was proven to be effective and resulted in acquisition and maintenance of skills
Mays & Heflin (2011).	did not specify seems like total task	N/A	N/A	N/A	NA	Participants improved in their performance of hand washing and tooth brushing immediately following implementation of the SOAP system.

Pierce & Schreibman (1994)	didn't specify-seems like Forward chaining	N/A	social praise given at each step to prompt self-reinforcement	different training stimuli were used for each day of training. Probes were done in the home, clinic, or both settings during baseline and posttreatment.	Three posttreatment probes in the training setting across 1 or 2 days were done. Follow-up measures 2 months after posttreatment probes in training setting	On-task behavior was stable at 0%, and inappropriate behavior was high during baseline. During posttreatment, inappropriate behavior decreased and on-task behavior increased to high levels
Rayner, C. (2011).	Backward chaining (total task during VP phase)	did not state-described multiple opportunity probe	N/A	real shoes used, with different color shoelaces	Assessed 30 days after intervention	two participants benefited from the video prompting procedures and no participants reached mastery of the target behavior as a result of the video prompting procedures alone but did with the addition of backwar d chaining.
Richard & Noell (2018)	Backward chaining	didn't state - seems like Single opportunity probe	Praise and access to a toy after completion of task	Each participant was prompted to tie a shoe on their own foot instead of on the table	One week after the video prompting phase was completed, the retention phase session was conducted.	Effective in promoting skill acquisition for all participants. Although the current procedure was effective, the number of teaching trials needed was excessive.

Rosenberg et al,. (2010)	didn't specify- seems like total task	Didn't specify seems like Single opportunity probe	PRAISE only for attending no programmed reinforcement for task	probes (across per sons) occurred in the same bathrooms while probes for generalization across settings and persons occurred at the various locations.	One-month maintenance probes occurred at school-based summer camp bathroom	Two of the three children did not learn from the commercial video. With a custom made tape, these two children demonstrated some acquisition and one of them immediately mastered the skill
Shipley-Benamou, et al,.(2002)	Did not specify-- seems like total task	Did not specify seems like fixed opportunity	Candy or access to a toy after certain criterion	Generalization session done with in the home	no video phase and 1 month follow up phase	Instructional video modeling was effective in promoting skill acquisition
Shrestha et al,. (2013)	Forward chaining	N/A	praise for efforts, high fives and cuddles from mom at the end of the task	Once during intervention phases, the participant was asked to get a different snack and was asked to get Weetbix during breakfast in a different location instead of in the afternoon	Follow-up data were collected 2 weeks after the intervention.	skill was acquired and maintained at follow-up. Generalization was limited.

Rigor and Quality

Generalization. Utilizing SCARF generalization outcomes were evaluated for each article. SCARF is a tool used to assess the quality and outcomes of single case design studies. The intermittently (43%) category means that generalization probes were taken during the study in both baseline and intervention conditions but with fewer than three data points in each condition. Experimentally (21%) means that generalization probes were taken during the study in both baseline and intervention conditions with at least three data points per condition. Only two of the studies were categorized under post only, which means that generalization was evaluated only after the intervention was completed and not during the intervention. Three studies are not included on this graph at all because they did not evaluate or describe generalization procedures.

Maintenance. Figure 3 displays the results of SCARF quality and rigor evaluation of Maintenance. The results show that 21% of the articles evaluated maintenance at least one week after intervention but not more than a month after. It also displays that 50% of the articles evaluated maintenance one or more-month post intervention. Of the articles included 29% (4/14) did not report maintenance outcomes.

Overall Study Rigor. SCARF was utilized to evaluate the quality and the rigor of each study included. The results are displayed in Figure 4. Each point represents one of the articles include in the category. Most of the studies fall into quadrant two. This quadrant represents those that have high quality evidence of positive effects. Quadrant 1 has 2 data points which means those are articles that have low quality evidence of positive effects. Lastly, Quadrant 3 has only 1 article, this mean there is low quality evidence of negative or minimal effects. This one article is Hagiwara et al (1999), due to the very minimal effects found in the study.

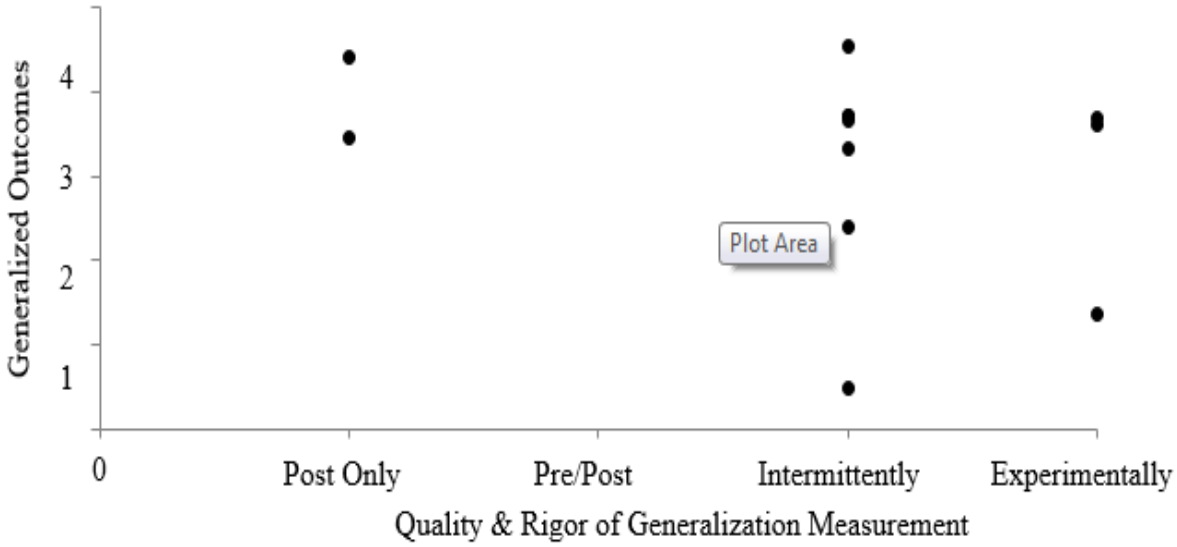


FIGURE 4. Quality & Rigor of Generalization

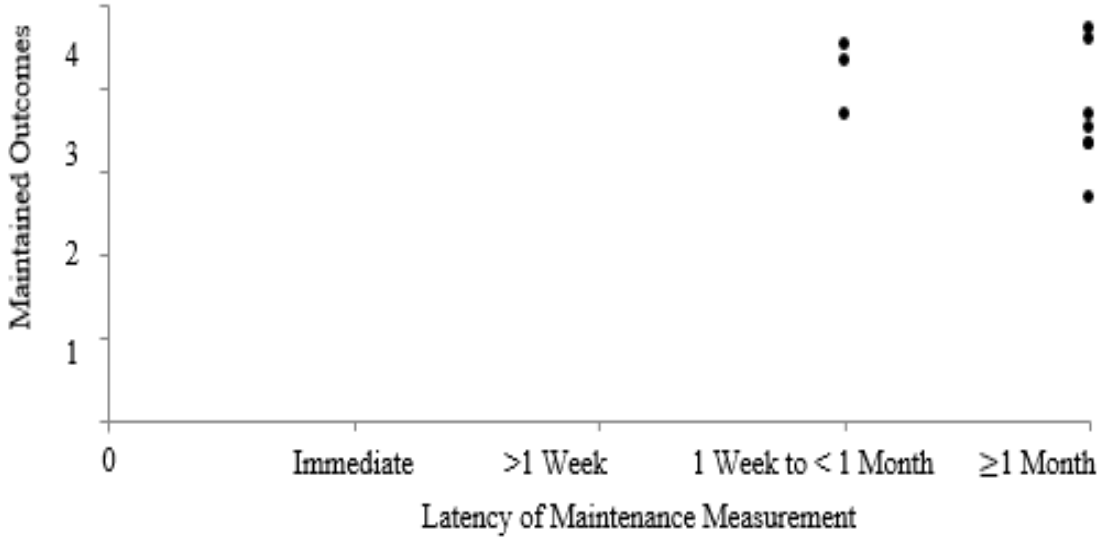


FIGURE 5. Quality & Rigor of Maintenance

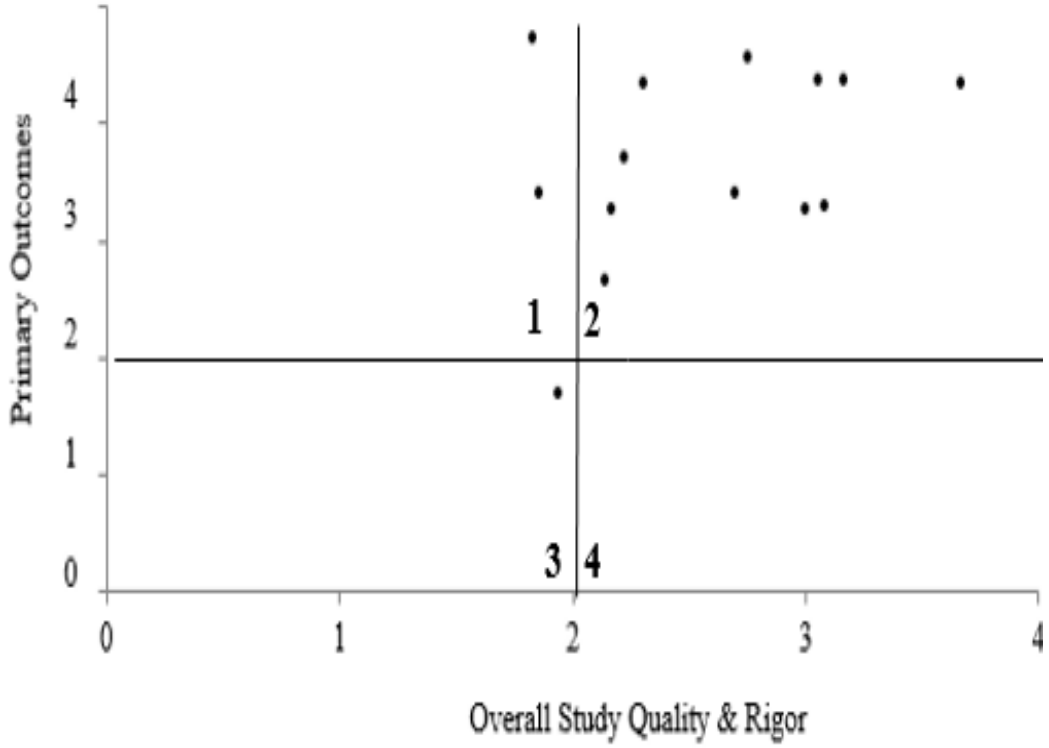


FIGURE 6. Overall Quality & Rigor

CHAPTER FOUR

DISCUSSION

Implications for Practice

This review examined research on interventions focused on teaching elementary aged children self-help skills. Based on the results, majority of the participants are on the later end of the age requirement 6-10 years of age. There is a lack of research on early interventions teaching self-help skills to children five and under (i.e preschool). During the initial literature search we found several articles evaluating social skills and play skills for preschool aged children. Future research should extend the literature on self-help skills for preschool children with ASD. Early intervention on daily living skills may play an important part in improving the current level of skills as well the development of those skills and new skills in the future (Bal et al., 2015).

The ratio for males to females with ASD is 3:1 (Loomes et al., 2017). The gender of the participants included in this review was evaluated and over 80% of participants included were male. This ratio is similar to that provided by Loomes et al. (2017). Gender of participants is important because it is possible for predetermined assumptions to affect the interventions and for researchers to form biases about males or females with ASD. Loomes et al. (2017) describe different male and female phenotype examples based on the DSM diagnostic criteria. This shows that males and females can display symptoms of ASD differently. Thus, a generic intervention should not be utilized across all participants, gender should be considered, and interventions should be aware and based on the child's unique behavioral symptoms (Loomes et al., 2017)

Results demonstrate the most common setting for the primary intervention was the classroom. Overall, over half of the studies were conducted in a setting other than the child's home. Future research should evaluate some intervention in the home or even a community setting (i.e., church, movies, etc.). Setting consideration is of importance due to its influence on both generalization and maintenance outcomes. Furthermore, setting is also of importance because majority self-help skills in a child's daily routine occurs in the home thus should be trained or at least evaluated in this setting if possible. (i.e., getting dressed, brushing teeth, washing face etc.)

Each article targeted self-help skills, however some studies evaluated additional skills as well (e.g., setting the table, mailing a letter, pet care). These articles considered these skills self-help task. However, for the purposes of this study these were not considered personal self-help skills. These skills seem to be more domestic skills than self-help skills. Charlop-Christy et al. (2000) evaluated in-vivo modeling and VM for social skills, play, and communication in addition to self-help task. The intervention was only evaluated with one participant for self-help skills the other participants had other target skills. This leads to a limitation of generalization and would be considered a weak functional relation due to the one participant and only two tasks evaluated independently. Future research should extend Charlop-Christy et al. (2000) research by evaluating the two interventions exclusively with self-help skills and more participants. This is the same for the other targeted skills evaluated. These skills should also be evaluated independently of each other.

Typical measurement procedures for chained tasks involve one of two procedures: SOP or MOP (Alexander et al., 2017). Results showed over half of the articles did not explicitly state the name or effectively describe probing procedures. This is a limitation of each of those articles.

All procedures should be described in enough detail that they can be replicated and evaluated thoroughly by other researchers. Of the six articles that the results described as utilizing a type of probe procedure, only one of them actually used the name of the exact method (Certrez-Iscan et al. 2016). The lack of explicit use of the probe type name prevents people that would like to search for studies on probe procedures from finding these studies. Probe procedures mattes within interventions because it can have a very heavy effect on baseline data as well as probe data collected throughout. SOP procedures can lead to inhibitive testing effects, and MOP can cause facilitative testing threats (Alexander et al., 2017). Explicit description of the probe procedure and recommendations and suggestions on how to control for those threats should be provided so that skill level of the child is accurately measured.

Most self-help chained task seem to be reinforcing within themselves which makes them a unique set of skills. One would think that if the skill is reinforcing within itself there is no need for programmed reinforcement. For example, Ayres et al. (2009) allowed consumption of the material made as a natural form of reinforcement. Several articles (4/14) utilized only praise as reinforcement throughout the intervention. Only two of those four specified praise used only for attending and not contingent upon independent steps. Of the four articles that did provide a physical reinforcer, it was delivered at the completion of the task not for each step. Five studies did not include a description of their reinforcement procedures. This would lead some to assume that reinforcement was not used in the intervention or the procedures were not thoroughly described. For those studies with no programmed reinforcers, praise for attending, and the five studies that don’t describe reinforcement; it seems as though researchers may view these task as being reinforcing within themselves and needing nothing more than praise for attending and sitting. For example, Rosenberg et al. (2010) did not have any programmed reinforcement for

skills such as making lunch and getting dressed. Making lunch results in the reinforcement of food consumption. Getting dressed could provide reinforcement of being dressed to go somewhere or do something preferred. This conclusion should be taken with caution seeing that five of studies did not include description of reinforced procedures thus left for assumptions to be made. This is a limitation of the of the review. Future research should ensure explicit description of reinforcement procedures for the purposes of evaluation and replication. A review evaluating reinforcement procedures for a larger range of self-help skills with other individuals (i.e age, diagnosis, etc.) would provide insight into what makes self-help chained tasks unique.

The present review focused on specific components of the interventions such as: chaining and reinforcement, generalization and maintenance, and probing procedures. Results indicate half of the interventions involved a form of video instruction (i.e video modeling, video prompting, computer-based video instruction). The most common video-based instruction utilized was video modeling of the task. Specifically, 4/7 articles utilizing video instruction specifically utilized VM. First person recording was the most described point of view used within video instruction interventions and Third person was the second most commonly used. Future research could extend by investigating the point of view used within the intervention and if there is data that may indicate one is more effective than the other.

Both acquisition and generalization of target skills are important especially for self- help skills. However, maintenance of those skills over time should be evaluated. Four articles in this study did not report any maintenance outcomes. If the skills are not maintained over time the target behavior may return to baseline levels and require caregiver's assistance again. Of those that reported maintenance procedures, half of them evaluated maintenance of the skill in the same setting or similar setting, however, half of them evaluated maintenance in the natural

environment or an alternative environment separate from previous setting. At the onset of intervention there should be a focus on incorporating strategies to promote maintenance. Those articles that programmed for maintenance in a different setting simultaneously have provided some generalization measures even if unintended. Future research should extend those studies that did not evaluate maintenance to ensure the intervention successfully resulted in maintained acquisition of the behavior.

Acquisition of self-help skills are important but ensuring that these skills can generalize to different settings, people, or materials is also important (Stokes and Osnes 1989). For these skills to be beneficial students should be able to perform the skills outside of the intervention. For example, it is possible for the child's hand washing behavior to gain faulty stimulus control, where the SD to wash hands is the presence of a certain teacher, white foam soap, or a certain type of sink. Only three articles included did not asses or train for generalization. Generalization to a different setting was the most assessed generalization type. There was a large lack in assessment of generalization to people. This deficit is important due to majority of these articles utilizing the teacher or researcher as the interventionist, thus posing the potential for faulty stimulus control with a person. Teachers and researchers are not normally in the participants daily routine in the natural environment thus this poses a problem if the child is unable to generalize the skill to the primary caregiver. While, generalization to materials was moderately assessed. Future research should train for generalization within the intervention or extend the current research by assessing generalization types not evaluated in the study. This can be done in a variety of ways: utilizing multiple exemplars, training loosely, program common stimuli, introduce natural maintain contingencies, and more (Stokes and Osnes 1989). Also, future research should ensure objective procedures are written, for possibility of replication.

Future literature review

Rosenberg et al. (2010) demonstrated that students correct responding improved when a personalized video was used rather than a generic premade video. Three studies utilized people familiar to the participant, Shrestha et al (2012) even used the participants parent. Some of the video instruction studies used the researcher as the model in the video instruction, and even a peer. An interesting extension to the present review would be to evaluate the specific components of the video instruction that make it effective. This study could evaluate things such as: the point of view recorded, person modeling the task, length of the video, video presentation, technology utilized to present the video instruction.

The use of gaming technology was very scarce in the research with only 1 intervention included. This interventions outcome demonstrated that gaming is an effective way to improve showering skills. Being that technology is consistently improving and becoming more interactive; interventions should utilize this to their advantage. Advanced technology has the advantage of acting as fun motivation during the interventions (Kang & Chang, 2019). Gaming utilizing a kinetic sensor is a fairly new intervention (Kang & Chang, 2019), thus a review on the use of this intervention across skills would be a valuable expansion to the literature.

Social validity was not something that the present review coded for, but it would be a valuable expansion to the present review and past reviews. If the intervention is not accepted or liked by the caregivers there is a high possibility that the caregiver will not continue to utilize or recommend its use in the future. This feedback provides a guide to interventions likely and unlikely to be accepted. Those researchers that report parental surveys or interviews can then make accommodations or changes to the intervention. The reported effects can also be beneficial for future research to replicate and consider recommendations and thoughts of those interviewed

for social validity measures. For example, Ayres et al. (2009) report parents and professionals felt elementary school rather than pre-school, middle school, or high school was the time to learn self-help skills. This social validity example demonstrates that reports can provide valuable insight and suggestion for future research. This statement suggests that the research on self-help skills for younger children should be expanded and intervention should be conducted earlier in life rather than later.

Limitations

There are a number of limitations within this review that should be noted. One, the number of articles that explicitly named and described their probe and changing procedures were limited. Thus, many of the analyses must be viewed with caution. Some of these researchers could possibly be contacted by email and asked to provide an explicit name or description of the probe procedure utilized. However, I would encourage researchers to use objective terms and description when describing procedures. Two, many of the interventions here evaluate multiple skills in addition to self-help skills. Thus, limiting the generalizability of the results to other self-help skills. These skills should be evaluated in isolation of each other. This is the same for the interventions that evaluate multiple different functional skills with different participants. Three, many of the studies included had a small number of participants under 10 ranging from one participant to four participants included in a study total. Even if including the participants older than 10 the number of participants included in the studies still were no more than five total participants include. This poses a limitation to the generalization of these studies. Four, maintenance outcomes were not reported for some of the articles included. Thus, the effectiveness of those articles should be taken with caution as they do not report sustained outcomes.

This review extended previous literature by evaluating the specific components of interventions focused on teach self-help skills to children under the age of 10. These results should be viewed with care, given that there were only 14 articles included and scarcity in those focusing solely on teaching students under the age 10 self-help skills. This review demonstrates that there is a need for further research evaluating self-help skills with younger children.

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