

**THE USE OF ACTIVITY SCHEDULES AMONG THOSE WITH AUTISM
WITHIN THE SCHOOL SETTING: A LITERATURE REVIEW**

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ABSTRACT

Parents of children diagnosed with autism often report that their children lack the independent skills that typically developing children have that can help them succeed on their own throughout life, especially into adulthood. To increase task and daily independence and to decrease dependence on adults, and other people, there are a wide variety of interventions that can be implemented. This systematic literature review evaluated studies that had incorporated activity schedules; these activity schedules were implemented among those diagnosed with autism within the school setting and between the ages of three and twenty-one. Twenty-nine studies were included and analyzed to determine the most frequently used type of activity schedule format and why it is implemented, reasons an activity schedule may be chosen for implementation, and evaluated whether social validity is a frequently used tool of measurement for studies implementing an activity schedule. Percent rigor for more than half of the studies included concluded that those studies had the components to identify a quality study, and those that fell below the necessary criteria lacked measurements of social validity or procedural fidelity. The results showed that a photographic activity schedule is the most commonly used type of schedule and it is used to teach a child to independently complete an activity or a sequence of activities; these skills have been shown to generalize and be maintained over periods of time, across settings, and researchers.

Keywords: autism, activity schedule, visual schedule

TABLE OF CONTENTS

	Page
ABSTRACT	ii
LIST OF TABLES	v
LIST OF FIGURES	vi
CHAPTER	
1. INTRODUCTION	1
Visual Supports	4
Activity Schedules.....	5
2. METHOD.....	10
Inclusion Criteria	10
Search Procedure	10
Selection Of Studies.....	14
Analysis Of Included Studies	15
Interobserver Agreement (IOA)	16
3. RESULTS	19
Study Selection.....	19
Participants	19
Research Designs.....	20
Dependent Variables	21
Independent Variable.....	23

Procedural Fidelity	25
Social Validity.....	26
Generalization And Maintenance.....	28
Percent Rigor	30
Percentage Of Non-Overlapping Data.....	32
4. DISCUSSION.....	35
Conclusion.....	35
Limitations.....	40
Future Research.....	40
REFERENCES	43
APPENDICES	
A. DATA EXTRACTION CHART	53
B. DATA EXTRACTION WITH DETAIL.....	54
C. IOA DATA COLLECTION FOR ARTICLE SELECTION	58
D. IOA DATA COLLECTION SHEET FOR PERCENT RIGOR	59
E. IOA DATA COLLECTION SHEET FOR PND.....	61
F. OPERATIONAL DEFINITION FROM HORNER ET. AL (2005).....	62
G. HORNER ET AL. RATINGS FOR INCLUDED STUDIES	65

LIST OF TABLES

Table	Page
1. Task Analysis For Article Search.....	13
2. Process Of Article Selection.....	14

LIST OF FIGURES

Figure	Page
1. Percentage Of Designs Used.....	21
2. Types Of Activity Schedule Used.....	24
3. Activity Schedule Format.....	25
4. Study Inclusions.....	26
5. Percent Rigor.....	32
6. Percent Of Non-Overlapping Data.....	34

The Use of Activity Schedules Among those with Autism within the School Setting:

A Literature Review

CHAPTER 1:

INTRODUCTION

According to the American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders V (2013), autism spectrum disorder is described as deficits in social communication and social interaction with a lack in upholding and understanding relationships. A diagnosis of autism may also include deficits in verbal communication skills pertaining to social interactions, and repetitive patterns of behavior, interests, or activities (DSM-V, 2013). For parents of children with an autism diagnosis, the child's possible life outcome has become an important part of how they cope with the initial diagnosis (Howlin, et al., 2004). One goal for those diagnosed with autism is to make them as independent as possible (Volkmar, & Weisner, 2017). Parents and teachers often report that a lack of independence, including independence during transitioning between tasks or activities, amongst those with autism has an effect on their future employment, living on their own, and relationships with others (Brown et al., 2011; Hume et al., 2009).

Children with autism who lack independent skills frequently rely on adults and teachers to remind them to start or complete the steps of an activity, rather than engaging in the activity on their own. This dependence on others may have a negative effect on their future independent task completion (Copeland & Hughes, 2000). The more frequently adults assist children in the completion of tasks, the more reliant they may

become on these adults. Relying on adults could also have other negative effects as well, including negative social and academic implications. These negative effects may include depending on adults to initiate or engage in a task or not engaging with age appropriate peers in social situations (Milley & Machalicek, 2012). A lack of independent task completion in those with autism, including not calmly and efficiently transitioning from one activity to another, might also have a negative effect on leisure skills for those with autism. This inability to remain continuously engaged in a sequence of tasks for leisure or work can decrease their quality of life and acceptance within the community (Caldwell et al., 2001; Schleien et al., 1981).

The mastery of independent transitions, that is the changing from one activity, task, or setting to the next, may be inadvertently delayed due to the prompts that are often provided by teachers and caregivers to a child or young adult with autism (Hume et al., 2009; Merriam-Webster, 2020). Prompting is the act of reminding or encouraging someone to do something or providing them with guidance to begin or complete a task or activity (Merriam-Webster, 2019). Within the school environment, adult supervision is often increased for those with intellectual and developmental disabilities, such as autism, and this increase of supervision can lead to prompt dependency and have a negative effect on self-initiation of tasks (Milley & Machalicek, 2012; Giangreco et al., 1997). In these situations, children begin to rely on adults as the discriminative stimulus (i.e., a cue that signals the behavior that follows will be reinforced) to completing a task (Hume et al., 2009). As children get older, and leave the school system, the sources of support that they have in the school setting may no longer be available to them in vocational and

community settings, such as one-on-one support. Therefore, as children are younger, it is important for teachers and staff to learn to effectively fade their supports and prompts to these students as it will allow them to function more independently as they get older (Milley & Machalicek, 2012; Giangreco et al., 1997).

Challenges for those with autism are not just faced within the school setting, but within the home environment and job placements as well. Parents of children and adults with special needs, like autism, face challenges in the home setting that other parents do not experience (Haveman et al., 1997). For example, the older a typically developing child gets, the less time and effort that is demanded of the parents. As they get older their ability to complete a sequence of tasks independently increases, whereas that demand may never decrease for a parent of a child diagnosed with special needs (Haveman et al. 1997). Teaching children at a young age to be less dependent on others assists the child throughout their childhood and into adulthood, where it may be harder to change a learned behavior (see, e.g., Milley & Machalicek, 2012; Sowers et al., 1985; Wehmeyer et al., 1998; Koyama & Wang, 2011).

Those diagnosed with autism sometimes have difficulty when it comes to transitioning in many types of settings and contexts in school, home, and community settings (Giangreco et al., 1997). Some individuals may experience difficulty transitioning between activities during daily routines throughout the school day (e.g., from gym class back to the classroom) or during transitions during one specific activity (e.g., moving from one math problem to the next; Giangreco et al., 1997). Those students who show difficulty with transitions often rely on prompts from adults, or they may

engage in challenging behavior, which may only get worse over time (Giangreco et al., 1997). Becoming reliant on others for prompts will make a child less independent (Milley & Machalicek, 2012; Sowers et al., 1985). Different approaches, such as visual supports, may be implemented to provide those with autism the appropriate level of prompting to complete tasks more independently, including their transitioning throughout the day. Some visual supports that aid with transitions include, but are not limited to, self-monitoring, video modeling, individual work systems, and activity schedules (e.g., Hume et al., 2009; Buggey, 2005; Jaime & Knowlton, 2007).

Visual Supports

Visual supports are a type of intervention that have been implemented among those diagnosed with autism to provide a supplemental visual stimulus to aid someone in successfully completing a task or demand (Hume et al., 2009; Jaime & Knowlton, 2007). Visual supports have become a part of everyday life for many individuals with and without autism (Jaime & Knowlton, 2007). Within the category of visual supports, there are many different types, which include, but are not limited to: token economy boards, social stories, choice boards, visual schedules, video modeling, and activity schedules (Jaime & Knowlton, 2007). Within a classroom there are often many contrived visual supports (e.g., daily schedules, seating charts, and directions for a fire drill); these types of supports can be used for understanding directions, schedules, and rules (Jaime & Knowlton, 2007). Visual supports can be presented with letters/words, pictures, or a combination of both; sometimes these types of supports may be present in everyday life and never faded (Tissot & Evans, 2003).

A variety of visual supports have been implemented for various educational goals, such as independent task completion or independent transitioning. For example, video modeling has been effective in increasing independent task completion and in increasing behaviors that are needed, but lacking (Buggey, 2005). Choice boards have been implemented to allow students to display preferences and control their environment. The use of this intervention has shown a decrease in resistance to teacher related demands that include less tantrums, ignoring the teacher, or eloping from the work area (Newman et al., 2002). Past research has shown that activity schedules have been implemented successfully for teaching proper transitions (Banda et al., 2009).

Activity Schedules.

An activity schedule is a type of visual support that can be used as an intervention for those diagnosed with autism and intellectual disabilities for various educational and clinical objectives (Pierce et al., 2013). It is a visual schedule that uses pictures, words, or a combination of pictures and words to display a sequence of activities that a person must complete (Sevin et al., 2015). The schedule is intended to show the expectations of the student from the teacher's perspective (Watson & DiCarlo, 2015). There are two different types of activity schedules: within-activity schedule and an across-activities schedule (McCollow et al., 2015). An across-activity schedule is one that includes all of the activities that one must complete as part of their routine, and a within-activity schedule is a schedule that aids the learner in completing all of the steps of one specific task (McCollow et al., 2015). Typically, across-activity schedules are not used to teach a new task, but rather to promote students' independence in completing mastered activities;

whereas within activity schedules are used for learning the steps of new tasks (McCollow et al., 2015). To promote independence in transitions, across-activity schedules are often used to help the child initiate a sequence of tasks on their own, without the assistance of an adult (McCollow et al., 2015).

In a study involving across-activity schedules conducted by MacDuff, Krantz, & McClannahan (1993), they found that activity schedules were effective in shaping engagement behavior amongst those that completed them. In the study four boys diagnosed with autism how to follow a photographic activity schedule in their group home. Prior to the experiment, the participants were dependent on verbal prompts and required constant supervision. With the implementation of the activity schedule, the participants were able to stay on task and complete their schedules without adult guidance. The results indicate that stimulus control was transferred from the adult to the photographic activity schedule and the schedule promoted engagement, even after training. A limitation to this study, that could have affected the intervention data in a negative manner, was not knowing if any of the participants had prior knowledge and skills required to complete an activity schedule.

Activity schedules have been used in all types of settings, from group homes (MacDuff et al., 1993) to classrooms (Banda et al., 2009) to vocational placements (Carson et al., 2008). In a research study using a withdrawal design to implement an activity schedule by Carson, Gast, and Ayres (2008), independent changes between tasks increased with the implementation of an activity schedule and decreased when the activity schedule was not present within a school, vocational setting, and at a job

placement (Carson et al., 2008). Both independent transitions and task completion increased after the introduction of the picture activity schedule. The study showed that the portability of the activity schedule was beneficial because the schedule can be taken into any environment that may be necessary (Carson et al., 2008).

Not only have studies shown that activity schedules have been effective in independent transitions within multiple settings and increased task completion, but they have also been shown to decrease prompting from adults. In a study conducted by Massey and Wheeler (2000), the researchers found that implementing an activity schedule resulted in a decrease in prompting from adults and an increase in task engagement from the child. The participant in this study was a four-year-old diagnosed with autism. A photographic activity schedule was implemented within the classroom setting using graduated physical guidance and prompt fading in a multiple baseline design across activities. Task engagement across the two phases, work and leisure, increased with the use of a picture activity schedule, and the participant was able to generalize with minimum training to other settings. A limitation to this study was that the effects of prompting during the implementation of the picture activity schedule on challenging behavior was inconclusive. There was no distinct trend to show a change in challenging behavior during the implementation of the picture activity schedule. In a future study, baseline data can be utilized to observe how frequently a person is engaging in challenging behavior to compare the data before and after an activity schedule has been implemented.

Research on activity schedules has shown that they are an effective intervention for those with autism in the classroom during academic sessions and leisure time (Banda et al., 2009). These schedules have shown to be effective at increasing on-task behaviors, without the assistance of a teacher, thus promoting independence (Banda et al., 2009). Through the use of an activity schedule, independent task completion has also been shown to increase amongst those with severe disabilities (Duttlinger et al., 2012). Through the use of activity schedules, children have also demonstrated the ability to generalize their independence to other settings, places, and people (e.g., Cohen & Demchak, 2018; Duttlinger et al., 2012; Pierce et al., 2013; MacDuff et al., 1993). An advantage to using activity schedules is that they have shown to be effective when implemented with people of all ages and diagnoses (Koyama & Wang, 2011). Learning how to engage in schedule following helps participants independently change activities and display long response chains in the absence of adult supervision (MacDuff et al., 1993).

In previous research, literature reviews have been conducted regarding the implementation of activity schedules for a variety of topics. Lequia, Machalicek, & Rispoli (2012) concluded that activity schedules have been an effective tool for children with autism in a variety of situations to improve target behaviors and decrease challenging behavior. Lequia, Wilkerson, Kim, and Lyons (2014) determined that activity schedules are the most frequently used intervention to promote easier transitions for those that use them. Knight, Sartini, and Spriggs (2015), and Spriggs, Mims, and van Dijk (2017), through their literature reviews, concluded that visual activity schedules are

effective for people of all ages, within multiple settings to increase, maintain, and generalize a variety of skills. The majority of the studies that were previously analyzed by Knight, Sartini, and Spriggs (2014) included visual activity schedules that involved only pictures. The purpose of the current literature review will be to examine whether or not one type of activity schedule (e.g., picture, text, or a combination of both) is more effective than another when implemented among those diagnosed with autism spectrum disorders.

The current literature review will address the following research questions in regard to studies that have been done in the last decade (2010-2020): 1) Does current published research show that one specific type of activity schedule (e.g., picture, text, or a combination of both) is more common than another when implemented among school aged children diagnosed with autism within the classroom setting? 2) When an activity schedule is utilized, what is the purpose of the implementation of such an intervention (e.g., task completion, new skill being taught, or to teach independence)? 3) How often is social validity assessed when implementing activity schedules?

CHAPTER 2:

METHOD

Inclusion Criteria

Five criteria were established to determine if an article was to be included in this study. The inclusion criteria are as follows: (a) the study must include only participants that are diagnosed with autism, (b) the participant must be at least 3 and no older than 21 (school age), (c) one of the interventions implemented must be an activity or visual schedule, (d) the study needs to explain the procedures that were used to implement the activity schedule, and (e) the article must be published in a peer-reviewed journal between 2010 and 2020. Studies were automatically excluded if they were a duplicate article or if they did not meet all five inclusion criteria based on their abstract.

For the purpose of this study those between the ages of 3 and 21 were included as they are the ages of school age children in special education. If a study included one or more participants without an autism diagnosis, the study was excluded from this current literature review. The years 2010-2020 were chosen to determine if there is more use of electronic versions of activity schedules in current literature with the rise in use of technology.

Search Procedure. Searches were completed electronically through the following databases: Education Source, ERIC, and APA PsycInfo, all via EBSCOHost. Only studies that were peer-reviewed, empirical, and those that were published in English language journals and met the above-mentioned criteria, were included in the study. The

following keywords were used in the search to find applicable research articles: *activity schedule OR visual schedule*.

For all of the database searches the same exact search terms were used, *activity schedule OR visual schedule*. *Peer-Reviewed* was selected first, followed by *Academic Journal* as the source type. The last search items that were used to narrow the results were the language, *English*, and the publication dates, *2010-2020*. The first search completed was of the database Education Source. The next database accessed was ERIC, and the last one accessed was APA PsycInfo. Following the search of the three databases, all duplicates were immediately removed.

After compiling a list of articles from the databases, the abstracts were read, then the article was considered appropriate for the study, by meeting all of the inclusion criteria, or they were excluded because it did not meet at least one of the criteria. Next a review was completed of reference lists from previous literature reviews. There were four previous literature reviews that were found in the initial database search that were relevant to this study. The reference lists of these previous literature reviews were reviewed, as well as the reference lists of all included articles, and articles which cited the studies that were included within this study. The first criteria examined was whether or not they were published between 2010 and 2020. If they were published within these years, each of their reference lists were examined. Next, the articles were reviewed to remove any duplicates. If they were published between the years 2010-2020 their abstracts were then read. These articles then needed to meet the other four criteria in

order to be included for the review. If they were determined to meet the inclusion criteria they were further examined by the researcher.

Those articles that met inclusion criteria, were included for this literature review by being thoroughly analyzed to determine what the effects of the activity schedule were on the target behavior(s). A chart, like that in APPENDIX A, was used to organize the data and results from each of the studies and can be viewed in APPENDIX B.

Table 1: Task analysis of steps used to determine appropriate studies to be included for this literature review.

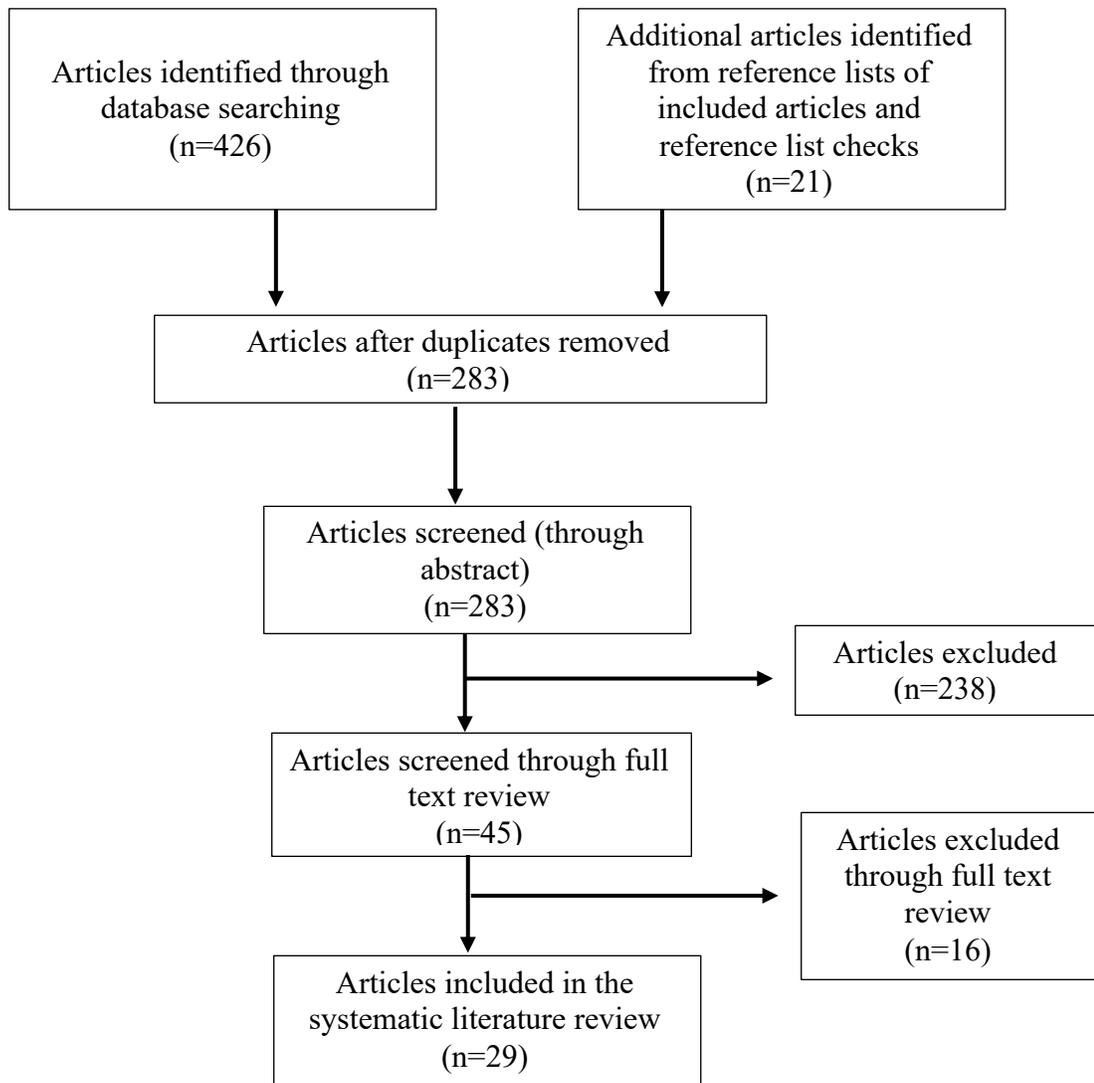
Search Forum	Search Terms (“_”) and Filters (())	Studies Yielded	Studies Chosen After Screening
Education Source	“Activity schedule OR visual schedule”	619	
	(Peer Reviewed Only)	341	
	Source type: (Academic Journals)	332	
	Language: (English)	308	
	Date: (2010-2020)	104	9
ERIC	“Activity schedule OR visual schedule”	818	
	(Peer Reviewed Only)	154	
	Source types: (Academic Journals)	149	
	Language: (English)	149	
	Date: (2010-2020)	76	21
APA PsycInfo	“activity schedule OR visual schedule”	878	
	(Peer Reviewed Only)	679	
	Source Types: (Academic Journals)	679	
	Language: (English)	651	
	Date: (2010-2020)	223	15

	Total Articles Selected from Database Searches (Journal Articles)	Articles from Previous Literature Reviews	Articles from Reference List Reviews
Articles Selected for Full Review	45	13	18
Articles Selected for Final Inclusion	29	0	0
Final Article Count: 29			

Selection of Studies

The PRISMA diagram (Liberati et al., 2009) that was used to extract articles for this study is depicted in table 1. This task analysis details the search process; identifying the specific key words and settings that were used within the databases to narrow down the results. Table 2 further depicts the process in which articles were discarded from the extraction process.

Table 2. The PRISMA chart that was used to select included articles.



Analysis of Included Studies

To assess the quality of articles that were chosen for this study, Horner et al. (2005) was referenced. This article discusses the 21 quality indicators for single-subject research. The data were analyzed by reporting descriptive summary information for each of the studies that were included, identifying the overall percentage of how many participants benefited from the use of an activity schedule, and the teaching procedure that was used to teach the participants how to use an activity schedule.

A percentage of nonoverlapping data (PND) was also calculated to describe intervention effectiveness. The overlapping data were calculated by taking the number of data points during intervention phase that surpassed the highest datapoint during baseline divided by the total number of data points and multiplying it by 100 to get a percentage for behaviors that were increased. For those behaviors that were decreased, it was the opposite. For decreasing behaviors, the overlapping data were calculated by taking the number of data points during intervention phase that were below the lowest datapoint during baseline and dividing by the total number of data points and multiplied by 100 to get a percentage. For studies that had multiple phases PND was calculated separately for each phase of the study. This percentage determines how effective the intervention is. Data points are considered more reliable when the intervention phase data points do not overlap with those during baseline; these show an effect of the intervention (Scruggs et al., 1987). The higher the percentage, the more effective the activity schedule is on the targeted behavior.

Interobserver Agreement (IOA)

For study selection, a second researcher was recruited to code a group of studies to determine whether they met inclusion criteria or not. IOA was calculated for study selection and the percent rigor. Study selection was defined as the process of selecting studies that met all five inclusion criteria as defined above. The first step for study selection, after the initial search, was to determine if the study should be included based on the abstract.

The second data collector also examined 21% of the same articles that the primary researcher examined for 6 randomly selected articles that showed up in the initial search of articles among all three databases. From here they decided, based on the abstract, whether or not the article should be included in the current study. A chart, like that in APPENDIX A, was filled out by each of the researchers. An agreement meant that both researchers agreed that the study should or should not be included based on the abstract, and a disagreement meant that the researchers had different opinions about whether it should be included (i.e., one said yes, and the other said no). Different opinions meant that there was at least one criterion that the data collectors did not agree on; specifically focusing on whether a participant was diagnosed with autism and if an activity schedule was implemented. IOA was calculated by dividing the number of agreements by the total number of agreements and disagreements added together, then multiplying that number by 100 to get a percentage.

IOA was 100% for the article selection process for the six articles (21%) that were randomly selected. Both the primary researcher and the secondary completely agreed on

which articles should be included (two of the articles met inclusion criteria, four did not meet all of the inclusion criteria), as well as which ones should not be included, in the search according to the inclusion criteria. Each researcher filled out a chart like that in APPENDIX A.

IOA data were also calculated for percent rigor. The second researcher and primary data collector analyzed the articles and put the results in a chart like that in APPENDIX D. Both of the researchers read the articles and calculated the percent rigor; the second data collector did this for 4 of the articles that were included in this study, 13% of the total articles. The percent rigor percentages were then compared and IOA data were calculated. An agreement meant that both researchers agreed on the percentage for percent rigor, or it did not, and a disagreement meant that they did not agree (i.e., one said yes, while the other said no). IOA were calculated by dividing the number of agreements by the total number of agreements and disagreements added together, then multiplying that number by 100 to get a percentage. The results indicated that IOA were 75%. The researchers completely agreed for 3 out of 4 of the included studies and had a disagreement for the fourth study. For the one study that was not agreed upon, the primary researcher reported 16 'yes' out of 21 (76%), while the secondary researcher reported 18 out of 21 'yes' (86%). The two differences were under the category for social validity. The primary researcher reported that the variable was not socially important and practical, whereas the secondary researcher said that the variable was socially important and practical according to their review of the article.

Lastly, IOA data were collected by the secondary data collector to compare the PND that was calculated by the primary researcher. These data were collected for 17% of the studies (5 studies) that were included in this literature review. Like the primary researcher, the second researcher calculated PND by taking the number of data points during intervention phase that surpassed the highest datapoint during baseline divided by the total number of data points and multiplying it by 100 to get a percentage for behaviors that were increased. IOA was calculated by dividing the number of agreements by the total number of agreements and disagreements added together, then multiplying that number by 100 to get a percentage. An agreement meant that both the primary researcher and the secondary researcher calculated the same percentage of PND for the study. A sample of the data collection sheet that were given to the secondary researcher is displayed in APPENDIX E. IOA for PND were calculated to be 60%. The primary and secondary researchers agreed on the calculations of PND for three of the included studies; there were two disagreements. The two disagreements were off by less than 8% for the one and 4% for the other.

CHAPTER 3:

RESULTS

Study Selection

A total of 426 articles were identified during the initial search of the databases. Of those articles, 143 were excluded because they were duplicates. Of the remaining articles, 238 were discarded after reading the abstract and keywords because they did not meet all of the inclusion criteria. This then left 45 articles for a full article review; these articles were a collection of studies from the initial database search, literature review reference checks, and searches of current article citations. From this the 45 articles were read in full detail and 16 articles were excluded because one or more inclusion criteria were missing. The final 29 articles met all of the inclusion criteria and were further examined for this study.

Participants

There was a total of 120 participants across the 29 studies included within this review. There was an average of four participants per study (range, 1-25). The youngest participant included was three years old (Akers et al., 2018; Giles & Markham, 2017; Sprinkle & Miguel, 2013; Gadaire et al., 2020; Liu & Breslin, 2013; Budzinska et al., 2014), while the oldest participant was 19 years old (White et al., 2011). An average age could not be determined due to the fact that some of the studies did not include the exact age of all participants; they only provided a range of ages for the participants included.

Research Designs

The research design of a study should be chosen carefully depending on the type of research that is being conducted. Among the studies that were used for this study, there were five different experimental designs that were used to evaluate the effectiveness of activity schedules. Figure 1 displays the different types of research designs that were used to evaluate the effectiveness of activity schedules. The most commonly used design was the multiple baseline design (Lora et al, 2020; MacDonald et al., 2018; Akers et al., 2018; Torres et al., 2018; Giles & Markham, 2017; Akers et al., 2016; Cheung et al., 2016; White et al., 2011; Schneider & Goldstein, 2010; & Brodhead et al., 2018); this design was used by 35% of the studies included. A multiple baseline design is one in which baseline conditions remain in effect for either multiple behaviors, settings, or participants (Cooper, Heron, & Heward, 2007). It could be one of the better best designs chosen for evaluating an activity schedule because without a withdraw it still allows for the researcher to conclude if the change in behavior is a direct result of the treatment and not another factor (Cooper, Heron, & Heward, 2007).

The next most used design was the multiple probe design (24%), which is a variation of a multiple baseline design. A multiple probe design is one that analyzes the relation between the independent variable across days or conditions (Cooper, Heron, & Heward, 2007; Ledford & Gast, 2018). The reason that the studies included a multiple probe design was to look at the effects of teaching a task sequence through the use of an activity schedule to the participants and to determine whether behavior change happened before the intervention (Cooper, Heron, & Heward, 2007). This type of design allows the

intervention to be implemented at different periods of time for each of the participants; each participant is introduced to the intervention once the previous participant has met criteria (Cooper, Heron, & Heward, 2007). This design type was used by 24% of the included studies (Ledbetter-Cho et al., 2020; Torres et al., 2018; Kurkcuoglu et al., 2015; Carlile et al., 2013; Cuhadar & Diken, 2011; Blum-Dimaya et al., 2010; Elicin & Volkan, 2010).

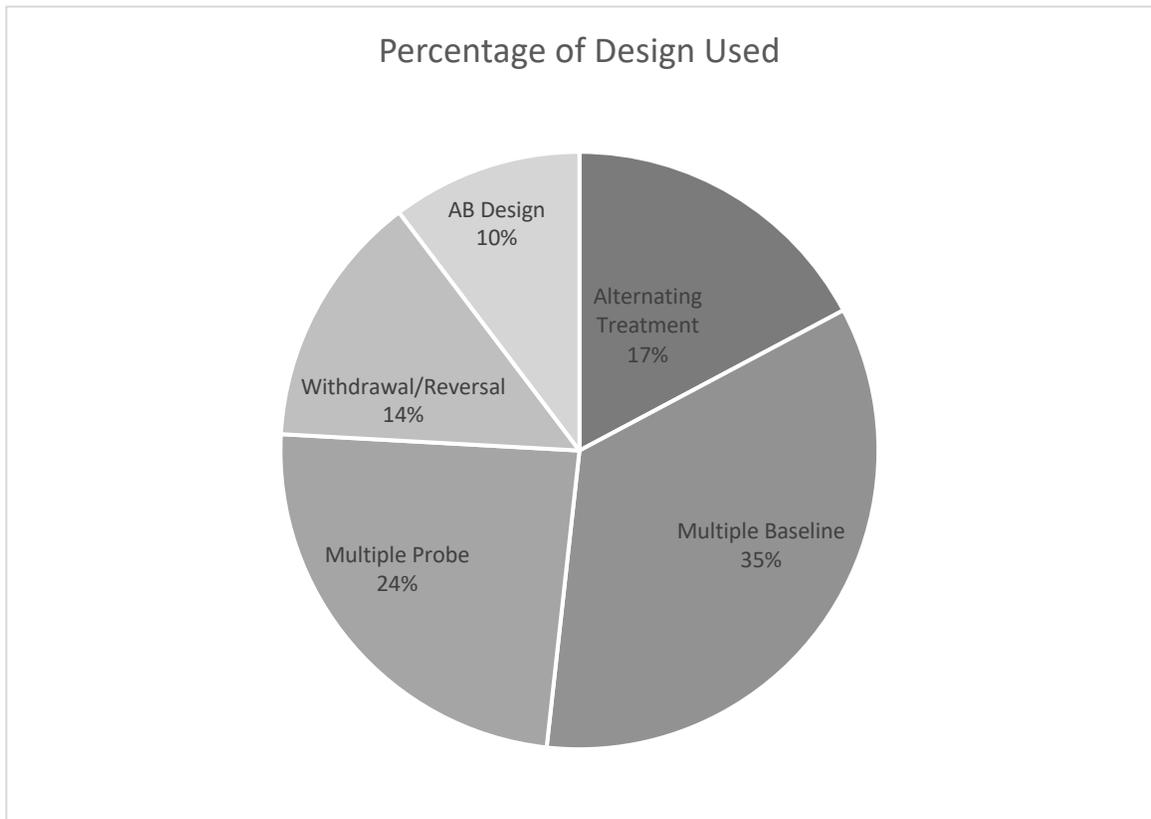


Figure 1. The percentage of designs used in the included studies.

Dependent Variables

The studies that were included in this systematic literature review covered a multitude of dependent variables. The reason for implementing an activity schedule varied by the study. For some the goal was to increase independence of tasks and

transitions (Akers et al., 2016; Pierce et al., 2013; & Lora et al., 2020), while others focused on increasing social skills (Daneshvar et al., 2018; Gadaire et al., 2018; Akers et al., 2018; Gadaire, et al., 2020; Brodhead et al., 2014; & Budzinska et al.; 2014).

For the purpose of this review the dependent variables were broken down into three categories: task completion, on-task behavior/engagement (including transitions and schedule following), and other. Twelve of the included dependent variables were related to some type of task completion, depending on the purpose of the study and the type of activity schedule that was used. Those that were under this category included dependent variables as such: trials completed (Lora et al., 2020), steps of a task analysis completed (Ledbetter-Cho et al., 2020; Giles & Markham, 2017), playing hide and seek (Akers et al., 2018), activities or tasks completed (Akers et al., 2016; Sprinkle & Miguel, 2013; White et al., 2011; Mills & Chapparo, 2017), and schedule completion (Carlile et al., 2013; Blum-Dimaya et al., 2010; Beaver et al., 2017).

The next category was on-task behavior and/or engagement of an activity schedule. For this category there were five subcategories: engagement (Akers et al., 2016; Brodhead et al., 2018; Brodhead et al., 2014), social engagement (Gadaire et al., 2018), on-task/schedule behavior (Macdonald et al., 2018; Torres et al., 2018; Carlile et al., 2013; Blum-Dimaya et al., 2010; Schneider & Goldstein, 2010; Gadaire et al., 2020; Beaver et al., 2017; Gadaire et al., 2020; Kurkcuoglu et al., 2016), schedule following (Torres et al., 2018; White et al., 2011; Elicin & Volkan, 2016), and transitions (Pierce et al., 2013; Cihak 2011). The purpose of focusing on transitions was to see if the use of an activity schedule would increase independence within the classroom moving between

activities. The authors of these studies were looking to determine if an activity schedule could increase on-task behaviors, such as transitioning, staying on schedule, and engaging in the activity schedule following behavior; they found that all of these target behaviors were positively affected by the implementation of an activity schedule.

The last category was ‘other;’ this covered the topics that were less used, such as increasing social skills (Daneshvar et al., 2018), task mastery (Mills et al., 2016), and challenging behavior (Lory et al., 2020; Ledbetter-Cho et al., 2020). All of these topics were less frequently used, but still just as significant as all of the other targeted behaviors with the implementation of an activity schedule.

Independent Variable

The 29 studies included within this systematic literature review implemented an activity schedule of some type as the independent variable. Figure 2 shows the types of activity schedules that were used among the included studies. The four different types of activity schedules that were implemented among the studies were: textual, photographic, a combination of photographic and textual, and video schedules.

The most commonly implemented visual schedule among these studies was a photographic activity schedule; 16 of the 29 articles included this schedule type (Daneshvar et al., 2018; Akers et al., 2016; Giles & Markham, 2017; Cuhadar & Diken, 2011; Kurkcuoglu et al., 2015; Pierce et al., 2013; Gadaire et al., 2018; Lory et al., 2020; Blum-Dimaya et al., 2010; Liu & Breslin, 2013; Mills et al., 2016; Mills & Chapparo, 2017; Budzinska et al., 2014; Carlile et al., 2013; Brodhead et al., 2018). A textual schedule was the second most used type of activity schedule. This type of schedule was

implemented in 6 of the activity schedules that were studied here (Lora et al., 2020; Gadiare et al., 2020; Sprinkle & Miguel, 2013; Cheung et al., 2016; Macdonald et al., 2018).

The format of the activity schedules also varied among the included studies. The different types of format that were used were broken down into three subcategories: electronic, book/binder, and picture strips. All of the activity schedules were presented in one of these three formats. An electronic format was used for nine different studies while the book/binder format was the most used (16 different activity schedules were presented in this format). A picture strip presentation was only used for four of the studies. The results for the formats used for the activity schedules are depicted in Figure 3 below.

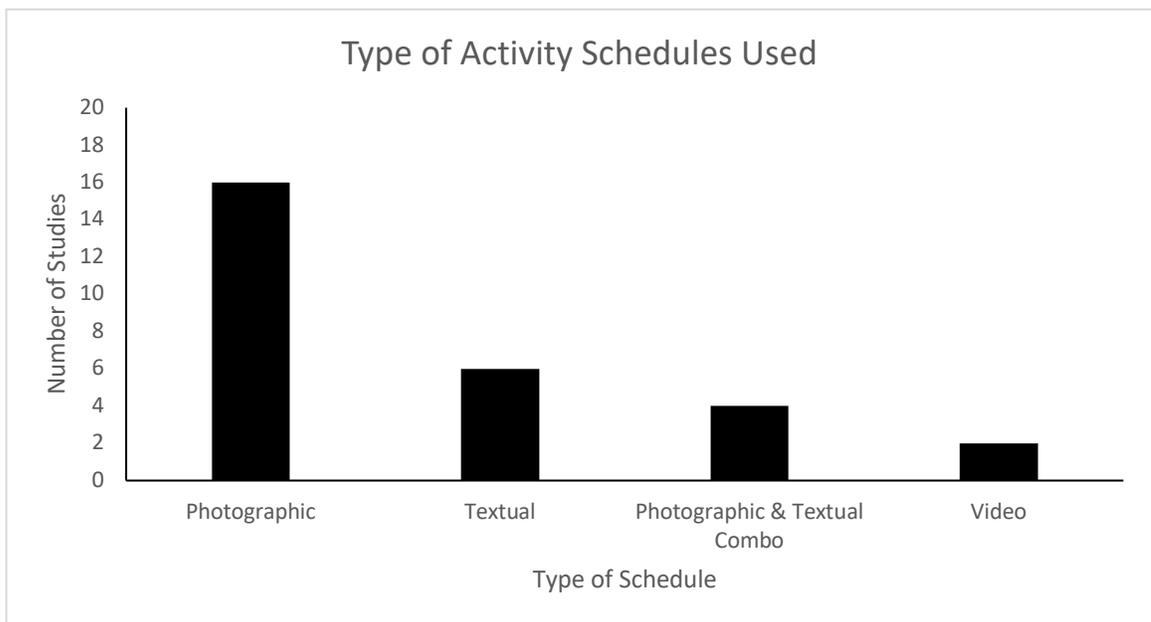


Figure 2. Types of activity schedule used for all of the studies included.

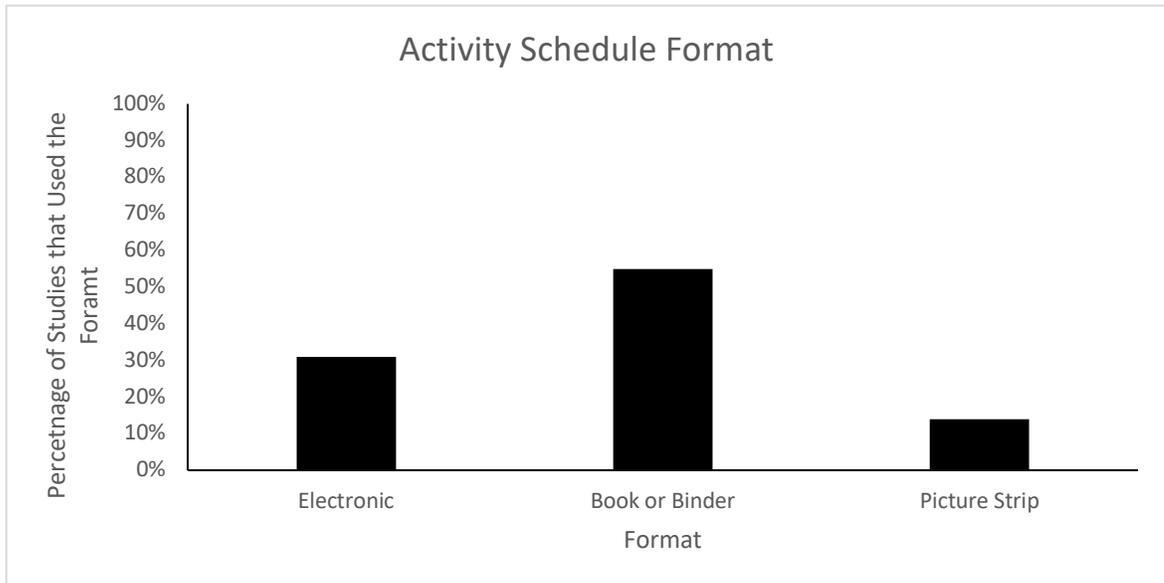


Figure 3. Activity Schedule Format

Procedural Fidelity

Procedural fidelity is an aspect of a study that examines whether research procedures were implemented as written among all of the participants. Procedural fidelity determines if the intervention was implemented the same for all participants, because if it was not this can be a confounding variable. For this study an analysis was completed to see if the studies included procedural fidelity within their study. The results, as displayed in Figure 4, determined that only 55% of the included studies conducted some type of procedural fidelity; that is 16 of the 29 studies included procedural fidelity.

The average inclusion of sessions for the calculation of procedural fidelity was 62% (30%-100%). Some of the articles (Carlile et al. 2013; Schneider & Goldstein, 2010; Macdonald et al., 2018) included 100% of the sessions that were conducted during the study for the calculation of procedural fidelity. The use of this many sessions for procedural fidelity has an advantage over those that used less sessions. There were some

studies (Broadhead et al., 2018; Blum-Dimaya et al., 2010; Akers et al., 2018; Giles & Markham, 2017) that included less than 50% of the conducted sessions for procedural fidelity.

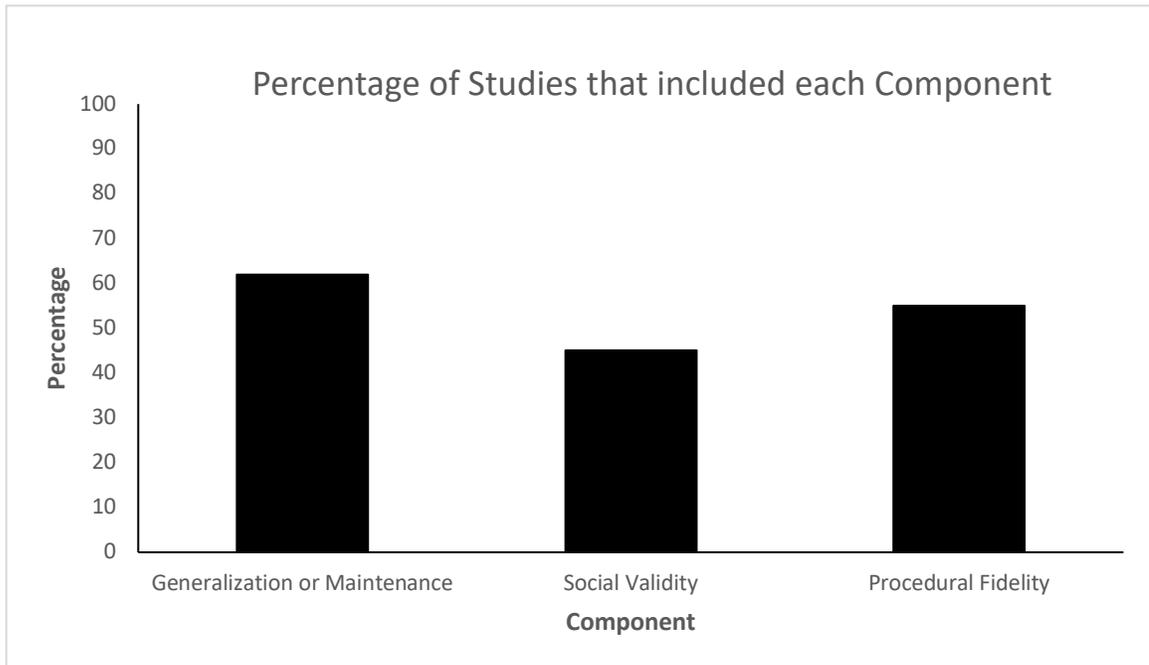


Figure 4. The following chart shows the percentages of studies that included generalization or maintenance, social validity, and procedural fidelity.

Social Validity

Of the studies that were included in this systematic literature review, only 45% (13 out of 29 studies) incorporated a measurement of social validity (Lora et al., 2020; Ledbetter-Cho et al., 2020; MacDonald et al., 2018; Torres et al., 2018; Cheung et al., 2016; Kurkcuoglo et al., 2015; Pierce et al., 2013; Carlile et al., 2013; Cuhadar & Diken, 2011; Blum-Dimaya et al., 2010; Elicin & Volkan, 2016; Lory et al., 2020; Beaver et al., 2017). The inclusion of a social validity measurement results are depicted in Figure 4 above.

For the studies that included social validity, three of those studies included a direct measurement by an external observer (Cheung et al., 2011; Carlile et al., 2013; Blum-Dimaya et al., 2010). A more reliable type of social validity measurement is one that is measured directly, specifically by someone that is not a part of a study as this leaves no room for bias. The remaining articles (55% of the 29 articles) all used an indirect measurement of social validity (MacDonald et al., 2018; Torres et al., 2018; Lora et al., 2020; Ledbetter-Cho et al., 2020; Kurkcuoglo et al., 2015; Pierce et al., 2013; Cuhadar & Diken, 2011; Elicin & Volkan, 2016; Lory et al., 2020; Beaver et al., 2017).

The different types of social validity measures that were implemented among the involved studies include: surveys for teachers, parents, or other observers (Lora et al., 2020; Ledbetter-Cho et al., 2020; Macdonald et al., 2018; Kurkcuoglo et al., 2015; Beaver et al., 2017), rating scales (Torres et al., 2018; Cheung et al., 2016; Pierce et al., 2013; Carlile et al., 2013; Blum-Dimaya et al., 2010), and interviews (Cuhadar & Diken, 2011; Elicin & Volkan, 2016). The studies included a variety of people for social validity measurements. These people ranged from teachers to parents, as well as people not included in the research procedure (just observers for the purpose of social validity), such as psychology students.

Of the 13 studies that included a social validity measure, 85% (11 of the 13) specifically concluded that their implementation of an activity schedule was socially acceptable, and the results of the intervention were socially valid. All of the studies (100%) concluded that the intervention of an activity schedule was effective and is something that will be used again in the future, as reported by parents and teachers, due

to the fact that it was so effective. These conclusions all came from indirect measurements compiled by teachers, caregivers, and other observers through the use of interviews, rating scales, and surveys.

There were two studies that specifically stated that the teachers, Board Certified Behavior Analysts, and paraprofessionals who participated in the social validity measure would recommend this type of intervention for others to use (MacDonald et al., 2018; Torres et al., 2018). A total of six studies (46%) also concluded that they would implement an activity schedule in the future according to the intervention that was used in their respective study (Ledbetter-Cho et al., 2020; Lora et al., 2020; Kurkcuoglu et al., 2015; Carlile et al., 2013; Lory et al., 2020; Beaver et al., 2017). Lastly, the results of all of the social validity measures concluded that the interventions that were in place for these particular studies were socially acceptable.

Generalization and Maintenance

For this review the results for those studies that included generalization and maintenance are depicted in Figure 4. Of the studies included in this study, 62% conducted some form of generalization or maintenance (Lora et al., 2020; Ledbetter-Cho et al., 2020; MacDonald et al., 2018; Daneshvar et al., 2018; Akers et al., 2018; Torres et al., 2018; Giles & Markham, 2017; Akers et al., 2016; Cheung et al., 2016; Kurkcuoglu et al., 2015; Pierce et al., 2013; Sprinkle & Miguel, 2013; Carlile et al., 2013; Cuhadar & Diken, 2011; Blum-Dimaya et al., 2010; Elicin & Volkan, 2016; Beaver et al., 2017; Budzinska et al., 2014).

Some of the studies included just generalization or just maintenance, and others included both generalization and maintenance. Those that included just generalization (5 of the 29 studies; Akers et al., 2016; Pierce et al., 2013; Cuhadar & Diken, 2011; Elicin & Volkan, 2016; Buszinska et al., 2014) assessed generalization to different settings, teachers, and materials. For the measurement of maintenance, some studies (MacDonald et al., 2018; Giles & Markham, 2016; Sprinkle & Miguel, 2013) waited a period of time after removing the intervention and then providing the participants with the same probe as they had during the intervention phase before. One of the studies conducted the maintenance probe immediately upon the conclusion of the original study (MacDonald et al., 2018), while others waited for school breaks (e.g., summer vacation between school years) to be over (Giles & Markham, 2016).

The remaining articles (34%; 10 of 29 included studies; Lora et al., 2020; Ledbetter-Cho et al., 2020; Daneshvar et al., 2018; Akers et al., 2018; Torres et al., 2018; Cheung et al., 2016; Kurkcuoglu et al., 2015; Carlile et al., 2013; Blum-Dimaya et al., 2010; Beaver et al., 2017), included both maintenance and generalization probes.

Of the 18 studies that included maintenance, generalization, or both, 16 of them (89%) had positive results during the maintenance or generalization. The two studies that did not, Blum-Dimaya et al., (2010) and Ledbetter-Cho et al., (2020), had some generalization or maintenance, but not all participants were able to generalize or maintain the skills that they demonstrated during implementation of an activity schedule. In the study conducted by Ledbetter-Cho et al. (2020), only three of the five participants were able to demonstrate maintenance without an intervention in place. In the study conducted

by Blum-Dimaya et al. (2010), there were low rates of generalization across some of the participants, causing them to have levels of generalization below 80%. For the remaining studies (Lora et al., 2020; MacDonald et al., 2018; Daneshvar et al., 2018; Akers et al., 2018; Torres et al., 2018; Giles & Markham, 2017; Akers et al., 2016; Cheung et al., 2016; Kurkcuoglu et al., 2015; Pierce et al., 2013; Sprinkle & Miguel, 2013; Carlile et al., 2013; Cuhadar & Diken, 2011; Elicin & Volkan, 2016; Beaver et al., 2017; Budzinska et al., 2014), there were high rates of generalization across the participants that were able to be demonstrated across settings, researchers, and after periods of time had passed since the initial introduction to the intervention. Overall, the common theme among the studies that did include some type of generalization or maintenance demonstrated that the skills taught during the implementation of an activity schedule were able to be maintained and generalized.

Percent Rigor

Horner, Carr, Halle, McGee, Odom, and Wolery (2005) identified the core elements of single subject research. The authors created a list of 21 key items that should exist within single-subject research, see APPENDIX F for full details. The key items were broken down into the following categories: description of participants and settings, dependent variable, independent variable, baseline, experimental control/internal validity, external validity, and social validity. For this particular study, each study was analyzed to determine the percent of rigor using the 21 key items outline by Horner et al. (2005) and defined by the current author of this study. The results for each of the included articles is

depicted in APPENDIX G. Figure 5 below shows the percent rigor for all of the studies included. The average percent rigor was 78% for the 29 included studies.

Within the field of applied behavior analysis, 80% is typically considered mastery criteria level. The highest percent rigor was 100% for the study conducted by Lora et al. (2020) and the study conducted by Beaver et al. (2017). For this particular study, 17 of the studies had a percent rigor of 80% or higher (Lora et al., 2020; Ledbetter-Cho et al., 2020; MacDonald et al., 2018; Akers et al., 2018; Torres et al., 2018; Akers et al., 2016; Cheung et al., 2016; Kurkcuoglu et al., 2015; Carlile et al., 2013; Cuhadar & Diken, 2013; Blum-Dimaya et al., 2010; Schneider & Goldstein, 2010; Elicin & Volkan, 2016; Gadaire et al., 2020; Lory et al., 2020; Beaver et al., 2017; Brodhead et al., 2014), while the remaining studies fell below the mastery criteria number. The results of percent rigor are depicted in Figure 4 below.

The studies with the lowest percent rigor (Liu & Breslin, 2013; Mills & Chapparo, 2017) are to be considered the least reliable; future research that is similar in nature to those that fell below 80% should be conducted with a different approach. A pattern among the studies that had a lower percent rigor was that they were lacking social validity or procedural fidelity which gave them a lower percent rigor. The most commonly left out aspect of the elements of single subject research was a social validity measure. More than half of the studies, 16 out of the 29, were lacking this type of measurement (55%).

The one aspect that was included in the majority of the studies (97%) was external validity. There were no other patterns among the data that were calculated for percent

rigor. Overall, the majority of the studies implementing an activity schedule met mastery criteria and may be replicated in the future; although, there are changes that may need to be made moving forward, for instance including social validity or procedural fidelity, which would bring up their percent rigor.

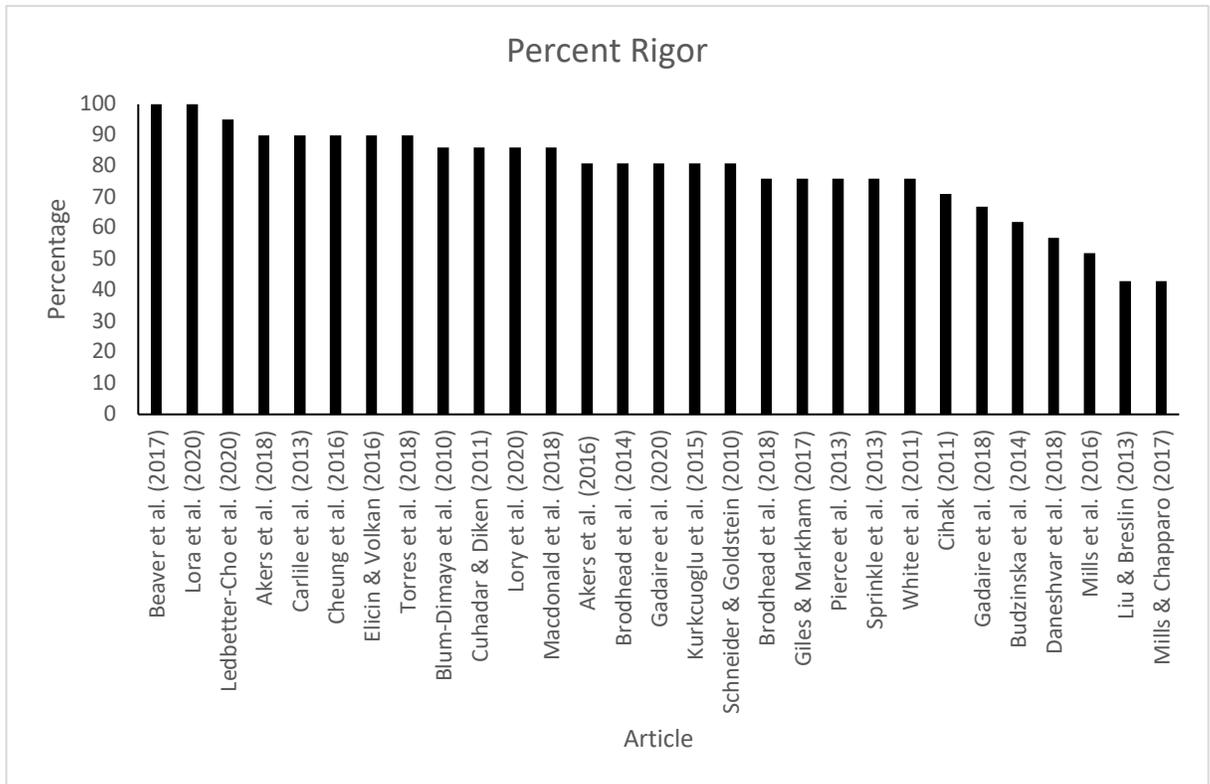


Figure 5. Percent rigor for each of the included studies.

Percentage of Nonoverlapping Data Points (PND)

A percentage of nonoverlapping data points were calculated for all of the included studies. The results are depicted in Figure 6. The average PND (35%-100%) was 88.55%. Of the studies included, there were a few that are questionable according to their PND (Mills & Chapparo, 2017; Macdonald et al., 2018; Torres et al., 2018; Mills et al., 2016;

Kurkcuoglu et al., 2015; Schneider & Goldstein, 2010) because their scores fell below 80%. With a low percentage of non-overlapping data, this may indicate that the intervention was not effective and that there were outside, uncontrolled variables that were effecting the dependent variables instead. A percentage of nonoverlapping data points decides subjectively whether an intervention is effective or not by comparing the data points during intervention to those during the baseline. For those that had low percentages, this indicates that the baseline level was higher and too many data points fell below this number, determining that the intervention may not be effective.

The remaining articles (Lora et al., 2020; Ledbetter-Cho et al., 2020; Daneshvar et al., 2018; Gadaire et al., 2018; Akers et al., 2018; Giles & Markham, 2017; Akers et al., 2016; Cheung et al., 2016; Pierce et al., 2013; Sprinkle & Miguel, 2013; Carlile et al., 2013; Cuhadar & Diken, 2011; Cihak, 2011; White et al., 2011; Blum-Dimaya et al., 2010; Elicin & Volkan, 2016; Gadaire et al., 2020; Lory et al., 2020; Beaver et al., 2017; Liu & Breslin, 2013; Brodhead et al., 2014; Budzinska et al., 2014; Brodhead et al., 2018) all had numbers that characterize their intervention as effective. This means that the PND was high enough that the results average was higher than the highest point during baseline; showing there was an increase in the targeted behavior from baseline to intervention phases.

Of the included articles, 6 studies fell below the 80% PND mark, while the other 23 were above that number. Those that were below the mark ranged from 77%-35%, with two of those being so close to 80% (77% and 78%) it may be argued that their interventions were effective as well (Torres et al., 2018; Schneider & Goldstein, 2010).

This concludes that more than half (79%) of the included studies showed that the intervention was effective and there were few, if any, outside variables that were likely to have caused the data to be this way. Overall, a majority of the studies involving activity schedules were effective according to the change in baseline level to the intervention phase of the experiment.

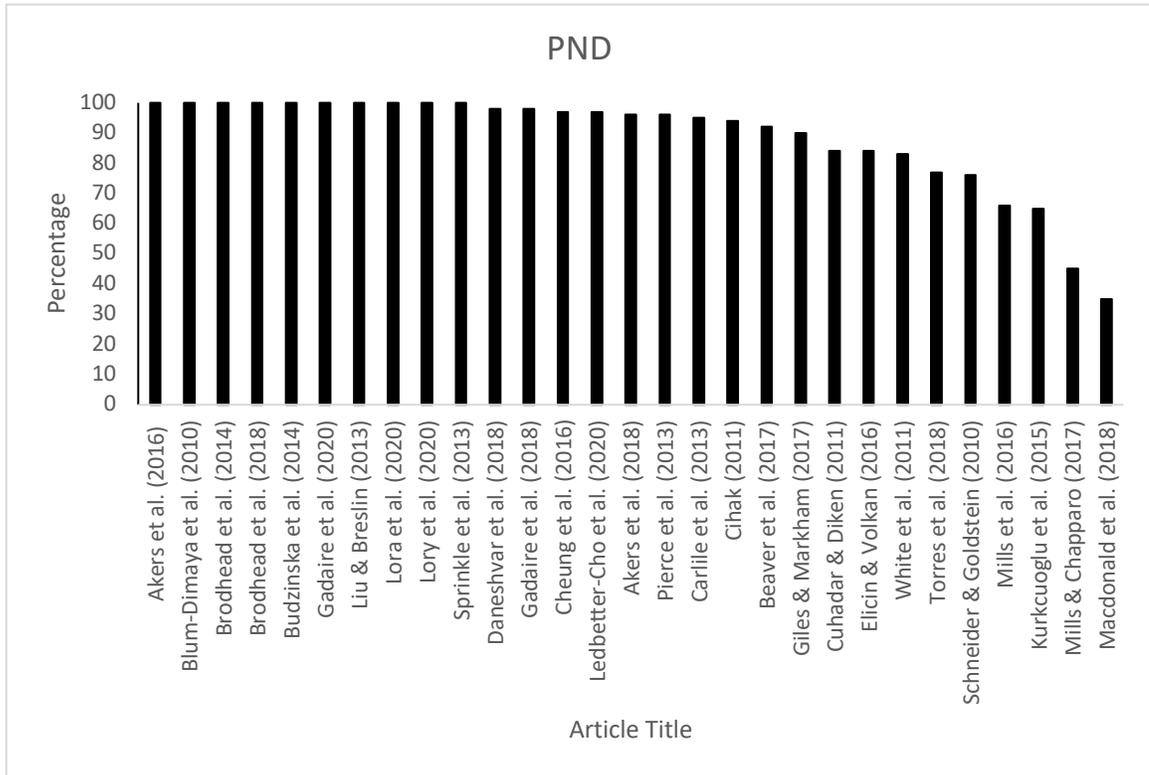


Figure 6. Percentage of non-overlapping data points.

CHAPTER 4:

DISCUSSION

Conclusion

The purpose of the current research study was to answer the following questions:

1) Does current published research show that one specific type of activity schedule (e.g., picture, text, or a combination of both) is more common than another when implemented among school aged children diagnosed with autism within the classroom setting? 2)

When an activity schedule is utilized, what is the purpose of the implementation of such an intervention (e.g., task completion, new skill being taught, or to teach independence)?

3) How often is social validity assessed in studies implementing activity schedules?

There were four different of types of activity schedules used among the studies that were included in this review; they were photographic, textual, a combination of text and pictures, or a video schedule. The most commonly used activity schedule reported from the included studies was a photographic activity schedule; this type of schedule was implemented in 16 of the 29 included studies (55%). This aligns with the findings from Knight, Sartini, and Spriggs literature review in 2014, which concluded that when an activity schedule is implemented, it is most often a photographic activity schedule.

Activity schedules are implemented for a wide variety of reasons. When activity schedules are implemented within the school setting the reason is typically to teach some type of completion skill. For some studies that included a task or activity completion (i.e., Akers et al., 2016), while others were focused on the number of trials completed (i.e., Lora et al., 2020) or transitions (Lequia et al., 2014). Activity schedules are a useful tool

in increasing desired behaviors, such as independent task completion, and decreasing unwanted behaviors, such as off-task behavior. In 2012, Lequia, Machalicek, & Rispoli, concluded that activity schedules were effective in a vast variety of situations. These schedules were commonly used to improve appropriate behaviors while decreasing challenging behaviors (Lequia, Machalicek, & Rispoli, 2012). Current research has continued to show how effective the implementation of activity schedules are among children diagnosed with autism, specifically when implemented within a school setting.

Multiple baseline designs and multiple probe designs were the two most used research designs among the studies that were included for the purpose of this literature review. A multiple baseline design was commonly used because it allowed the researchers to evaluate the effects of an intervention across behaviors, settings, or subjects without having to withdraw an intervention (Cooper, Heron, & Heward, 2007). A multiple probe design was helpful because it examines the effects of an intervention on skill sequence; skill sequence means that it is a skill in which one cannot improve until all steps have been taught. A multiple probe design can be beneficial in teaching children how to use an activity schedule because it teaches them the steps of completing an activity schedule.

This literature review has determined that research involving activity schedules is lacking procedural fidelity measurements, which can decrease a study's reliability. Procedural fidelity is an important characteristic of a study because it determines if the intervention was conducted appropriately, as identified in a method section. The use of procedural fidelity, specifically across all phases of the study, helps to draw more reliable

conclusions. These conclusions can determine whether or not the control condition and intervention were implemented correctly by all researchers, across all of the participants. For the purpose of this literature review, some of the studies had misleading procedural fidelity data as they did not test it across all phases of the study.

Social validity of a study determines whether the target behavior was appropriate to address, if the intervention is acceptable, and if an intervention produces significant changes in the target behavior (Cooper, Heron, & Heward, 2007). A graph may display what looks to be behavior change, but that does not mean that it is socially valid change for that participant. Researchers must look at the social acceptability, difficulty of implementation, practicality, and cost before deciding on an appropriate intervention for their particular client and this can be done by assessing social validity (Cooper, Heron, & Heward, 2007). Measuring social validity can help parents and teachers choose interventions that are appropriate and specific to their population. It also helps to determine whether the targeted behavior is meaningful. Measurement of social validity is currently lacking in studies that implement activity schedules.

To find and select socially acceptable interventions to aid those with autism, research should include a social validity measurement. Like previously discussed, parents and teachers often report that those diagnosed with autism typically lack independence during transitions, which can have an effect on their future employment, living on their own, or relationships with others and may need additional assistance or prompts to complete these things (Brown et al., 2011; Hume et al., 2009). Social validity can help parents and teachers make informed decisions before implementing an intervention. For

example, one may choose to implement an activity schedule that is on a smaller tablet/handheld device as to not stand out from everyone else compared to using a binder activity schedule out in the community.

Social validity can be measured in one of two ways, directly or indirectly. The majority of the studies included in this review that measured social validity concluded that the most commonly used type was an indirect measurement. In the case of the included studies, the measurements were indirect because those who were surveyed or completed the social validity measure, were typically teachers or parents that saw the effects of the intervention. The researchers used an indirect measurement because they would be able to see the effects of the intervention firsthand. Those included were also able to identify whether the intervention and process met the social acceptability factor, were cost effective, easy to implement, and had a positive effect on the behavior of the participant. The inclusion of social validity in the studies analyzed in this literature review concluded that the interventions were socially valid and socially acceptable. The interventions that were used were ones that teachers would continue to use in the future, as well as, they would recommend the intervention to other people with similar goals for their students.

One of the defining characteristics of applied behavior analysis is generality. Generalization is the indication that a behavior lasts over time, in different settings, or across different participants (Cooper, Heron, & Heward, 2007). Maintenance is the extent to which a participant performs the target behavior after the intervention is over (Cooper, Heron, & Heward, 2007). Generalization and maintenance are two important parts of a

study in the field of applied behavior analysis. The results of this study determined that generalization and maintenance should be included in more studies that involve activity schedules as it is lacking in previous literature.

Overall, the findings of this study can conclude that when generalization or maintenance were included, almost, if not all, participants were able to maintain or generalize the skills that they had learned through the implementation of an activity schedule. This means that they were able to take the skills that they learned and apply them across settings, people, or different situations, and sometimes even over periods of time. This aligns with the findings of Knight, Sartini, and Spriggs (2015), and Spriggs, Mims, and van Dijk (2017), that activity schedules are useful among those of all ages, settings, and that the skills that are learned through the implementation of an activity schedule can be generalized to settings, people, and for a variety of skills.

An activity schedule is a type of visual support that has been used and continues to be used as an intervention for those diagnosed with autism and intellectual disabilities for various educational and clinical objectives (Pierce et al., 2013). The activity schedules that have been implemented throughout this comprehensive literature review have shown to be effective in teaching new skills, helping participants stay on task, aiding in transitions, etc. In conclusion, these activity schedules, which are typically picture based, can be an effective intervention to implement among those with autism, specifically within the school setting. Activity schedules have been deemed socially acceptable and valid by teachers, parents, and researchers through previous research, and the use of social validity measures and will continue to be used in the future.

Limitations

One possible limitation to the current review is that only studies that were completed within schools were included. Future research might include other settings to see if an activity schedule is as effective in these settings as it was found to be in school settings. Another limitation might be the narrowness of the years that were included. One might say that this is too narrow of a time frame. The years may be broadened to include prior recent to see if the results were different. One other limitation could have been the broadness of the research questions. Future research questions may look to be more specific and include details, like analyzing the teaching procedure of the activity schedule.

Future Research

Future research implementing activity schedules should make sure to include social validity, a generalization or maintenance component, and procedural fidelity. Social validity is a component that is lacking in the studies in this review, as less than half of the included articles included a social validity measure, such as a survey or rating scale. In the future, researchers should make sure to also include social validity to determine if the goals, intervention procedures, and results include direct measures as to ensure that they are socially valid and acceptable. More studies in the future should also include procedural fidelity because it will ensure that the study and all of its components have been implemented in the same manner for all of the participants, with no variations.

Another suggestion for future research is to take the activity schedule that has been taught in the school setting and mastered and generalize it to the community. This

could allow for the participants to generalize their skills to utilize them in a job or post-secondary placement in the future. Future research may focus on utilizing the skills learned within a school setting and generalizing them to more functional situations for future use in everyday life. This generalization might also aid in decreasing dependence on adults to initiate or engage in a task like Milley & Machalicek (2012) discussed.

One other suggestion for future research is to look at the implementation and effectiveness of the different types of activity schedules. Researchers may examine whether one type (i.e., a picture activity schedule) is more effective than another (i.e., a textual schedule). In determining if one type of schedule is more effective than another this will help caregivers and teachers make more informed decisions when they are trying to decide what type of activity schedule is best to use for their child or student.

Another suggestion for future literature reviews would be to include studies from before 2010. A literature review that includes articles from less recent studies (i.e., before 2010) may look at the measurement of percent rigor and the interventions overall quality. The researchers may look to see if percent rigor is higher or lower for studies involving activity schedules that were conducted before Horner et al., (2005) wrote the 21 indicators for effective single subject research. The researchers may also look to compare the rates of percent rigor of current literature compared to prior literature. Lastly, future research may look to determine if one particular teaching procedure is more effective in teaching the use of an activity schedule over another.

In conclusion the current literature review has concluded that the use of activity schedules, picture, text, or a combination, have helped participants increase wanted

behaviors and decrease unwanted behaviors all while promoting independence. This will not only help them in their future, but also those that are a part of their lives, like teachers and family members.

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APPENDIX B
DATA EXTRACTION DETAILS OF EACH OF THE INCLUDED STUDIES

Author(s)	Participants (sex, age, diagnosis)	Research Design	Independent Variable(s)	Dependent Variable(s)	Generalization, Maintenance, or both	Social Validity Measure (direct or indirect)	Procedural Fidelity	PND	Percent Rigor
Lora et al. (2020) Effects of a problem-solving strategy on the independent completion of vocational tasks by adolescents with autism spectrum disorder	3 males, 1 female, all diagnosed with autism, between the ages of 12 and 16	Concurrent multiple baseline across participants design	Visual activity schedule for problem solving	percentage of trials completed	Both	indirect	Yes	100%	21/21=100%
Leobetter-Cho et al. (2020) The effects of a teacher-implemented video-enhanced activity schedule intervention on the mathematical skills and collateral behaviors of students with autism	1-male, 8 years old, autism 2-male, 9 years old, autism 3-male, 7 years old, autism 4-male, 7 years old, autism 5-male, 6 years old, autism	Multiple probe across participants design	Video activity schedule	percentage of task analysis steps that the participant completed independently; engagement in untargeted stereotype or other challenging behaviors	Both	Indirect	Yes	97%	20/21=95%
Daneshvar et al. (2018) A treatment comparison study of photo activity schedule and Social Stories for teaching social skills to children with Autism Spectrum Disorder: a brief report	1-female, 10 years old, autism 2-male, 6 years old, autism 3-male, 5 years old, autism 4-female, 8 years old, autism	Alternating treatment design with multiple baseline control	Photo activity schedule, social stories	Increase social skills (different for each participant)	Both	None	No	98%	12/21=57%
Gadaire et al. (2018) Evaluating group activity schedules to promote social play in children with autism	1-male, 6 years old, autism 2-male, 10 years old, autism 3-male, 7 years old, autism 4-male, 5 years old, autism 5-male, 5 years old, autism, ADHD	ABAB reversal design	Group activity schedules	Social engagement	Neither	None	No	98%	14/21=67%
Macdonald et al. (2018) The use of visual schedules and work systems to increase the on-task behaviour of students on the autism spectrum in mainstream classrooms	1-male, 10 years old, autism 2-male, 10 years old, autism 3-male, 11 years old, autism 4-male, 8 years old, autism	Multiple baseline single case design across participants	Work schedules, activity schedules	On-task behavior, off-task behavior, independent work, teacher prompting	Maintenance for one participant	Indirect	Yes	35%	18/21=86%
Akers et al. (2018) An evaluation of group activity schedules to promote social play in children with autism	1-female, 3 years old, autism 2-male, 4 years old, autism 3-female, 5 years old, autism	Nonconcurrent multiple baseline across playgroups	Activity schedule (pictures and words)	Hide and seek behavior	Both	None	Yes	96%	19/21=90%
Torres et al. (2018) The effects of a video-enhanced schedule on exercise behavior	1-male, 13 years old, autism 2-female, 13 years old, autism 3-male, 12 years old, autism	Multiple probe across participants design/nonconcurrent multiple baseline design for one participant	Video activity schedule	Exercise behavior; independent schedule following behavior; on-task behavior	Both	Indirect	No	77%	19/21=90%

Author(s) & Title	Participants (sex, age, diagnosis)	Research Design	Independent Variable(s)	Dependent Variable(s)	Generalization, Maintenance, or both	Social Validity Measure (direct or indirect)	Procedural Fidelity	PND	Percent Rigor
Giles & Markham (2017) Comparing Book- and Tablet-based picture activity schedules: acquisition and preference	1-male, 4 years old, autism 2-male, 4 years old, autism 3-male, 3 years old, autism	Multiple baseline across participants and adapted alternating treatments design	Book and tablet based activity schedule	Steps in the task analysis completed independently; mastery criteria	Maintenance	None	Yes		90% 16/21=76%
Akers et al. (2016) An evaluation of photographic activity schedules to increase independent playground skills in young children with autism	3 males diagnosed with autism between the ages of 4 and 5 years old	Nonconcurrent multiple baseline across participants	Photographic activity schedule	Play activities completed, engagement	Generalization	None	Yes		100% 17/21=81%
Cheung et al. (2016) Teaching community skills to two young children with autism using a digital self-managed activity schedule	1-female, 8 years old, autism 2-male, 10 years old, autism	Multiple baseline across participants	Activity schedule	Steps performed correctly; non-overlapping data	Both	direct	No		97% 19/21=90%
Mills et al. (2016) The impact of an in-class sensory activity schedule on task performance of children with autism and intellectual disability: a pilot study	1-male, 7 years old, autism 2-male, 5 years old, autism 3-male, 6 years old, autism 4-male, 6 years old, autism	Nonconcurrent AB single system design across multiple behaviors and participants	Sensory activity schedule	Classroom task mastery	Neither	None	No		66% 11/21=52%
Kurkuoglu et al. (2015) Effectiveness of instruction performed through computer-assisted activity schedules on on-schedule and role-play skills of children with autism spectrum disorder	1-male, 6 years old, autism 2-male, 4 years old, autism 3-male, 10 years old, autism 4-male, 4 years old, autism	Multiple probe across participants	Computer assisted activity schedules	On-schedule skills, role play skills	Both	Indirect	Yes		65% 17/21=81%
Pierce et al. (2013) Effects of visual activity schedules on independent classroom transitions for children with autism	1-male, 11 years old, autism 2-male, 9 years old, autism 3-male, 10 years old, autism 4-male, 10 years old, autism	ABAB withdrawal design	Visual activity schedule	Independent transitions	Generalization	Indirect	Yes		96% 16/21=76%
Sprinkle et al. (2013) Establishing derived textual activity schedules in children with autism	1-female, 8 years old, autism 2-female, 3 years old, autism	Alternating treatments design	Textual activity schedule	Independent completion of activity	Maintenance	None	Yes		100% 16/21=76%

Author(s)	Participants (sex, age, diagnosis)	Research Design	Independent Variable(s)	Dependent Variable(s)	Generalization, Maintenance, or both	Social Validity Measure (direct or indirect)	Procedural Fidelity: PND	Percent Rigor
Carlile et al. (2013)	1-male, 9 years old, autism 2-male, 12 years old, autism 3-male, 8 years old, autism 4-male, 9 years old, autism	Multiple probe across participants design	Activity schedule	Independent schedule completion; on-task behavior	Both	direct	Yes	95% 19/21=90%
Cuhadar & Diken (2011)	1-male, 5 years old, autism 2-male, 6 years old, autism 3-male, 4 years old, autism	Multiple probe design across subjects	Teaching process of activity schedule	Engaging in schedules; dealing with activities; behavioral patterns to complete activities	Generalization	Indirect	No	84% 18/21=86%
Chhak (2011)	1-male, 13 years old, autism 2-female, 11 years old, autism 3-male, 12 years old, autism 4-male, 13 years old, autism	Alternating treatments design	Static picture schedule; video modeling schedule	Independent transition	Neither	None	No	94% 15/21=71%
White et al. (2011)	1-male, 19 years old, autism 2-male, 19 years old, autism 3-male, 16 years old, autism 4-male, 16 years old, autism 5-male, 17 years old, autism 6-male, 17 years old, autism	Multiple baseline design	Activity schedule	Schedule following; tasks completed	Neither	None	No	100% 16/21=76%
Blum-Dimaya et al. (2010)	1-male, 11 years old, autism 2-female, 11 years old, autism 3-male, 12 years old, autism 4-male, 9 years old, autism	Multiple probe across participants design	Activity schedule	Schedule completion; on-task behavior	Both	direct	Yes	83% 18/21=86%
Schneider & Goldstein (2010)	1-male, 10 years old, autism	Multiple baseline design across participants	Social story; activity schedule	On-task behavior	Neither	None	Yes	76% 17/21=81%
Elicin & Volkan (2016)	1-male, 5 years old, autism 2-male, 6 years old, autism 3-male, 7 years old, autism	Multiple probe design across participants	Education provided via computers using graduated guidance	Acquisition level of schedule following	Generalization	Indirect	Yes	84% 19/21=90%

Author(s)	Participants (sex, age, diagnosis)	Research Design	Independent Variable(s)	Dependent Variable(s)	Generalization, Maintenance, or both	Social Validity Measure (direct or indirect)	Procedural Fidelity	PND	Percent Rigor
Gadire et al. (2020) Effects of group activity schedules on evidence-based practice for social play among children with autism	1-male, 5 years old, autism 2-male, 4 years old, autism 3-male, 4 years old, autism 4-male, 3 years old, autism	ABAB reversal design for three participants and an AB design for the last participant	group activity schedule	on-task and on-schedule behavior	none	none	No	100%	17/21=81%
Lory et al. (2020) Reducing escape-maintained challenging behavior in children with autism spectrum disorder through visual activity schedule and instructional choice	1-male, 4 years old, autism 2-male, 6 years old, autism	withdrawal design with embedded alternating treatment	visual activity schedule	challenging behavior	none	indirect	Yes	80%	18/21=86%
Beaver et al. (2017) Self-reinforcement compared to teacher-delivered reinforcement during activity schedules on the iPod touch	2 male, 1 female, between the ages of 15 and 17, autism diagnosis	alternating treatment design	Activity schedule	Independent schedule completion, on-task behavior, decreasing proximity and thinning reinforcement	both	Indirect	Yes	92%	21/21=100%
Liu & Breslin (2013) The effect of a picture activity schedule on performance of the MABC-2 for children with autism spectrum disorder.	25 participants, all diagnosed with autism and between the ages of 3 and 16	alternating treatment design	activity schedule	fine and gross motor skills	None	None	No	100%	9/21=43%
Brodhead et al. (2014) The use of linked activity schedules to teach children with autism to play hide-and-seek	1-male, 5 years old, autism 2-male, 5 years old, autism 3-male, 5 years old, autism 4-female, 5 years old, autism 5-male, 3 years old, autism 6-female, 4 years old, autism	nonconcurrent multiple baseline design	activity schedule	correct responding	none	None	No	100%	17/21=81%
Mills & Chapparo (2017) Use of perceive, recall, plan, perform, stage two cognitive task analysis for students with autism and intellectual disability: the impact of a sensory activity schedule	1-male, 7 years old, autism 2-male, 5 years old, autism 3-male, 6 years old, autism 4-male, 6 years old, autism 5-female, 9 years old, autism 6-male, 6 years old, autism 7-male, 7 years old, autism	AB single system design	sensory activity schedule	task completion	none	none	No	45%	9/21=43%
Budzinska et al. (2014) Use of scripts and script fading procedures and activity schedules to develop spontaneous social interaction in a three-year-old girl with autism	1-female, 3 years old, autism	A-B design	scripts and script fading, activity schedule	initiations, unscripted initiations	Generalization	none	No	100%	13/21=62%
Brodhead et al. (2018) Using activity schedules to promote varied application use in children with autism	1-male, 4 years old, autism 2-male, 9 years old, autism 3-male, 6 years old, autism	nonconcurrent multiple baseline across participants design	activity schedule on iPad	engagement/responding	none	none	Yes	100%	16/21=76%

APPENDIX C
IOA DATA COLLECTION SHEET FOR ARTICLE SELECTION

1- Were all participants diagnosed with autism?	YES	NO
2- Are the participants between the ages of 3 and 21?	YES	NO
3- Was an activity schedule implemented?	YES	NO
4- Was the process of implementing the activity schedule described?	YES	NO
5- Is the article peer reviewed?	YES	NO
6- Was the article published between 2010-2020?	YES	NO

Does the article fit all 6 criteria? YES or NO

APPENDIX D
IOA DATA COLLECTION FOR ARTICLE SELECTION

- Article Title** _____/21= ___%
- Description of Participants and Setting**
- Participants are described with sufficient detail to allow others to select individuals with similar characteristics—YES or NO
 - The process for selecting participants is described with replicable precision-- YES or NO
 - Critical features of the physical setting are described with sufficient precision to allow replication-- YES or NO
- _____/3
- Dependent Variable**
- Dependent variables are described with operational precision—YES or NO
 - Each dependent variable is measured with a procedure that generates a quantifiable index—YES or NO
 - Measurement of the dependent variable is valid and described with replicable precision—YES or NO
 - Dependent variables are measured repeatedly over time—YES or NO
 - Data are collected on the reliability or interobserver agreement associated with each dependent variable, and IOA levels meet minimal standards—YES or NO
- _____/5
- Independent Variable**
- Independent variable is described with replicable precision—YES or NO
 - Independent variable is systematically manipulated and under the control of the experimenter—YES or NO
 - Overt measurement of the fidelity of implementation for the independent variable is highly desirable—YES or NO
- _____/3
- Baseline**
- The majority of single-subject research studies will include a baseline phase that provides repeated measurement of a dependent variable and establishes a pattern of responding that can be used to predict the pattern of future performance, if introduction or manipulation of the independent variable did not occur—YES or NO
 - Baseline conditions are described with replicable precision—YES or NO
- _____/2
- Experimental Control/Internal Validity**
- The design provides at least three demonstrations of experimental effect at three different points in time—YES or NO
 - The design controls for common threats to internal validity (e.g., permits elimination of rival hypotheses)—YES or NO

- The results document a pattern that demonstrates experimental control—YES or NO
___/3

External Validity

- Experimental effects are replicated across participants, settings, or materials to establish external validity—YES or NO
___/1

Social Validity

- The dependent variable is socially important—YES or NO
- The magnitude of change in the dependent variable resulting from the intervention is socially important—YES or NO
- Implementation of the independent variable is practical and cost effective—YES or NO
- Social validity is enhanced by implementation of the independent variable over extended time periods, by typical intervention agents, or typical physical and social contexts—YES or NO
___/4

APPENDIX E
PND IOA DATA

Percentage of non-overlapping data (PND) points calculation-calculate PND by taking the number of data points during intervention phase that surpassed the highest datapoint during baseline divided by the total number of data points and multiplying it by 100 to get a percentage for behaviors that were increased

Please complete PND for the following data:

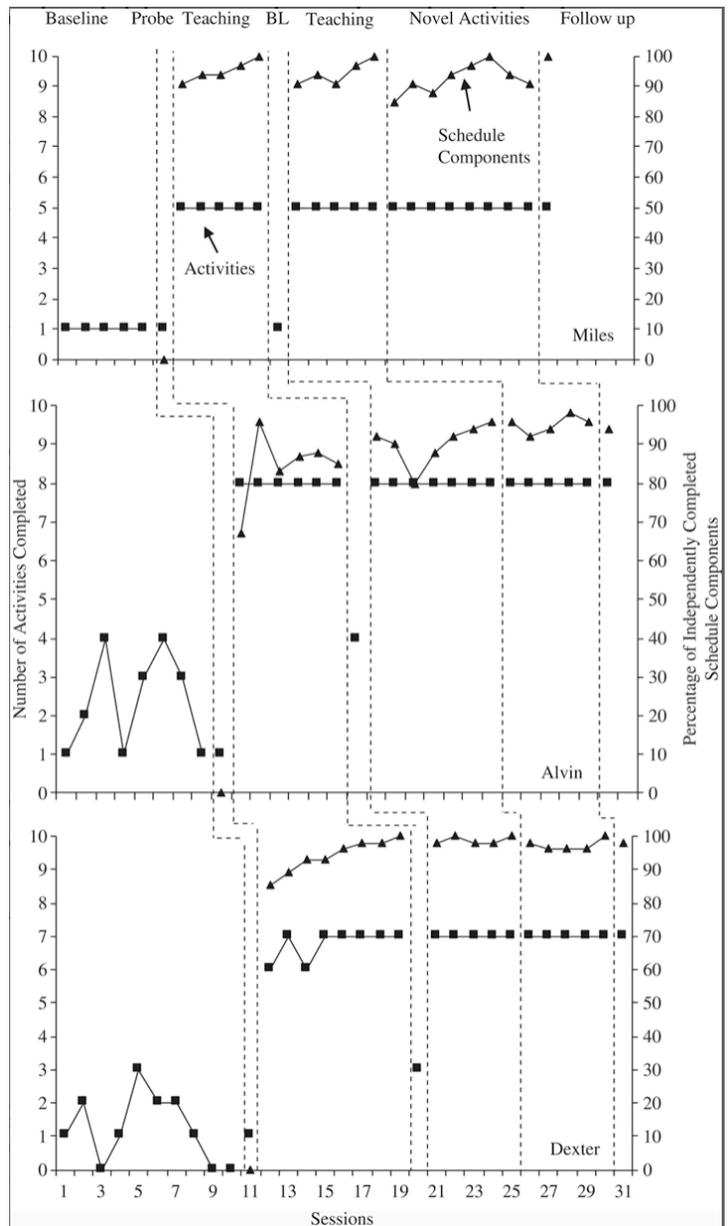
Sample Data

Article Title

Data points above the highest baseline point: _____

Total number of data points: _____

above/total= _____ x100= _____ %



APPENDIX F

Horner et al. (2005) Quality Indicators to Identify Evidence-Based Practice in Special Education	
Description of Participants and Setting	
1- Participants are described with sufficient detail to allow others to select individuals with similar characteristics	Sufficient detail was defined as including age, gender, diagnosis, and the functioning level of all participants.
2- The process for selecting participants is described with replicable precision.	The process by which, where, and how the participants was provided with enough detail and replicable.
3- Critical features of the physical setting are described with sufficient precision to allow replication	A description was considered sufficient if it included and described all of the following: the location of the intervention and any generalization/maintenance sessions, all of the materials used for the intervention, category of play materials used by the participant (if applicable), and the duration of each session.
Dependent Variable	
4- Dependent variables are described with operational precision.	Operational precision was defined as explicitly or clearly defining variable such that it is measurable, can be identified by two or more observers, and can be identified across time and in different settings or contexts.
5- Each dependent variable is measured with a procedure that generates a quantifiable index.	Quantifiable index was defined as a result that is capable of being measured or counted and can be displayed graphically.
6- Measurement of the dependent variable is valid and described with replicable precision.	Replicable precision was defined as a description of materials and processes used for data collection.
7- Dependent variables are measured repeatedly over time.	Repeatedly over time was defined as two or more data points for baseline sessions, three or more data points for intervention sessions, and one or more data points for maintenance and generalization measures.
8- Data are collected on the reliability or interobserver agreement associated with each dependent variable, and IOA levels meet minimal standards	Minimal standard was defined as describing the process of calculating interobserver agreement. The results of the IOA calculation had to yield results of IOA = 80%; Kappa = 60%. This item was only marked 'yes' if the process was described and it met adequate percentages (80% and 60%).
Independent Variable	
9- Independent variable is described with replicable precision.	Replicable precision was defined as including a description of materials and processes used to implement independent variables. For interventions that included training, this item was only marked 'yes' if it included the mastery criteria associated with the variable.
10- Independent variable is systematically manipulated and under the control of the experimenter.	Under the control of the experimenter was defined as the systematic manipulation of the independent variable across phases and participants. This item was marked 'yes' if criteria were described for moving between phases and participants if applicable.

11- Overt measurement of the fidelity of implementation for the independent variable is highly desirable.	If procedural fidelity data were taken in any capacity on the implementation of the independent variable, this item was marked 'yes.'
Baseline	
12- The majority of single-subject research studies will include a baseline phase that provides repeated measurement of a dependent variable and establishes a pattern of responding that can be used to predict the pattern of future performance, if introduction or manipulation of the independent variable did not occur.	When stability of baseline data was exhibited based on a visual analysis, this was marked 'yes.'
13- Baseline conditions are described with replicable precision.	Replicable precision was the description of setting, materials used by participants (if applicable), and instructions given to the participants (if applicable).
Experimental Control/Internal Validity	
14- The design provides at least three demonstrations of experimental effect at three different points in time.	A 'yes' was marked when three or more datapoints appeared for the intervention phase for each participant.
15- The design controls for common threats to internal validity (e.g., permits elimination of rival hypotheses).	This item was marked 'yes' if any mention of counterbalancing, random assignment of participants or conditions, preference assessments or any other control measures were discussed during the method section. This was marked 'no' if during the discussion section the authors discuss confounding variables or other hypotheses. If both were mentioned in the article, this item was marked 'yes' to credit their attempt to control and as to not punish the authors for discussing their own limitations openly.
16- The results document a pattern that demonstrates experimental control.	Experimental control was defined based on a visual analysis of the data. A common pattern among the data points meant that there was experimental control.
External Validity	
17- Experimental effects are replicated across participants, settings, or materials to establish external validity.	Experimental effects were marked 'yes' if the study replicated across participants, settings, or materials.
Social Validity	
18- The dependent variable is socially important.	This item was only marked 'yes' if social validity was measured (either directly or indirectly) and the outcomes of the measure were discussed and indicated that the dependent variable was social valid. This was not based on the current researcher's opinion.
19- The magnitude of change in the dependent variable resulting from the intervention is socially important.	Socially important was defined as a significant increase in at least one dependent variable for all participants. For direct measures, a significant increase was defined as an increase in positive ratings by all naïve observers for at least one variable across all participants from baseline to intervention. For indirect measures, an increase in

	the ratings of positive questions or decrease in rating for negative questions from baseline to intervention for all raters for all participants for at least one variable.
20- Implementation of the independent variable is practical and cost effective.	Independent variable implementation was only marked 'yes' if the cost and/or efficiency of the intervention was discussed and indicated that it was practical and/or cost effective.
21- Social validity is enhanced by implementation of the independent variable over extended time periods, by typical intervention agents, or typical physical and social contexts.	Social validity was only marked 'yes' if the study included maintenance or generalization probes.

APPENDIX G
HORNER ET AL. PERCENT RIGOR CALCULATIONS

Quality indicator	Author →	Lora et al. (2020)	Ledbetter-Cho et al. (2020)	Daneshvar et al. (2018)	Gadaire et al. (2018)	Macdonald et al. (2018)	Akers et al. (2018)
Description of Participant and Setting		3/3	2/3	2/3	1/3	2/3	3/3
Dependent Variable		5/5	5/5	1/5	5/5	4/5	5/5
Independent Variable		3/3	3/3	2/3	2/3	3/3	3/3
Baseline		2/2	2/2	2/2	2/2	2/2	3/3
Experimental Control/Internal Validity		3/3	3/3	2/3	2/3	3/3	2/3
External Validity		1/1	1/1	1/1	1/1	1/1	1/1
Social Validity		4/4	4/4	2/4	1/4	3/4	3/4
TOTAL PERCENTAGE OF INCLUSION:		100%	95%	57%	67%	86%	90%

Quality indicator	Author →	Torres et al. (2018)	Giles & Markham (2017)	Akers et al. (2016)	Cheung et al. (2016)	Mills et al. (2016)	Kurkcuoglu et al. (2015)
Description of Participant and Setting		3/3	1/3	3/3	3/3	2/3	3/3
Dependent Variable		5/5	5/5	5/5	5/5	2/5	3/5
Independent Variable		3/3	3/3	3/3	2/3	2/3	3/3
Baseline		2/2	2/2	2/2	2/2	1/2	1/2
Experimental Control/Internal Validity		2/3	3/3	2/3	3/3	2/3	3/3
External Validity		1/1	1/1	1/1	1/1	1/1	1/1
Social Validity		3/4	1/4	1/3	3/4	1/4	3/4
TOTAL PERCENTAGE OF INCLUSION:		90%	76%	81%	90%	52%	81%

Quality indicator	Author→	Blum-Dimaya et al. (2010)	Schneider & Goldstein (2010)	Elicin & Volkan (2016)	Gadaire et al. (2020)	Lory et al. (2020)	Beaver et al. (2017)
Description of Participant and Setting		2/3	1/3	3/3	3/3	2/3	3/3
Dependent Variable		4/5	5/5	4/5	5/5	5/5	5/5
Independent Variable		3/3	3/3	3/3	2/3	3/3	3/3
Baseline		2/2	1/2	2/2	2/2	2/2	2/2
Experimental Control/Internal Validity		3/3	2/3	3/3	2/3	3/3	3/3
External Validity		1/1	1/1	1/1	1/1	1/1	1/1
Social Validity		3/4	1/4	3/4	2/4	2/4	4/4
TOTAL PERCENTAGE OF INCLUSION:		86%	81%	90%	81%	86%	100%

Quality indicator	Author→	Pierce et al. (2013)	Sprinkle & Miguel (2013)	Carlile et al. (2013)	Cuhadar & Diken (2011)	Cihak (2011)	White et al. (2011)
Description of Participant and Setting		2/3	2/3	2/3	3/3	2/3	2/3
Dependent Variable		2/5	5/5	4/5	3/5	5/5	5/5
Independent Variable		3/3	3/3	3/3	3/3	2/3	2/3
Baseline		2/2	0/2	2/2	2/2	2/2	2/2
Experimental Control/Internal Validity		3/3	3/3	3/3	3/3	2/3	2/3
External Validity		1/1	1/1	1/1	1/1	1/1	1/1
Social Validity		3/4	2/4	4/4	3/4	1/4	2/4
TOTAL PERCENTAGE OF INCLUSION:		76%	76%	90%	86%	71%	76%

Quality indicator	Author→	Liu & Breslin (2013)	Brodhead et al. (2014)	Mills & Chapparo (2017)	Budzinska et al. (2014)	Brodhead et al. (2018)
Description of Participant and Setting		2/3	2/3	1/3	3/3	1/3
Dependent Variable		1/5	5/5	2/5	4/5	5/5
Independent Variable		1/3	2/3	1/3	2/3	3/3
Baseline		0/2	2/2	1/2	1/2	2/2
Experimental Control/Internal Validity		2/3	2/3	2/3	2/3	2/3
External Validity		1/1	1/1	1/1	0/1	1/1
Social Validity		2/4	3/4	1/4	1/4	2/4
TOTAL PERCENTAGE OF INCLUSION:		43%	81%	43%	62%	76%