UTILIZING BEHAVIOR INTERVENTIONS TO INCREASE APPROPRIATE WAITING BEHAVIOR WITH INDIVIDUALS DIAGNOSED WITH ASD: A REVIEW OF THE LITERATURE

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ABSTRACT

Children diagnosed with Autism Spectrum Disorder (ASD) often engage in impulsive, dysfunctional, and maladaptive behaviors (Dawson, Matson, & Cherry, 1998). Research has shown the individuals diagnosed with ASD often exhibit problem behavior when they are required to wait for a preferred item. In fact, research has demonstrated that individuals diagnosed with ASD often choose smaller, immediate reinforcer over larger, delayed reinforcer. Most of the research conducted, however, has previously focused on teaching waiting for a preferred item within the ADHD population. The purpose of the current literature review was to evaluate recent research utilizing behavior interventions to increase socially appropriate waiting with individuals diagnosed with ASD. This review assessed the age of participants, setting(s), research design, independent variables, results, and effectiveness. This review also evaluated the rigor of those studies included utilizing the Quality and Rigor Checklist (Ledford, Lane, & Tate, 2018). Lastly, this review provides recommendations to clinicians currently practicing with the field.

Keywords: wait, delay, denied, reinforce, impulse, discount, tolerate, preferred item, ASD, systematic review

DEDICATION

This thesis is dedicated to my husband, Marcin, who's unconditional encouragement and support has allowed me to follow my dreams. Thank you for always having patience with me and offering your guidance when I needed it most. I could not have completed this without your love and support.

Thank you.

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CHAPTER 1

INTRODCUTION

It is common for individuals diagnosed with ASD to engage in socially inappropriate behaviors when being asked to wait (Dixon & Rehfeldt, 2003; Rung & Young, 2015). Though all young children are required to often wait for a caregiver's help or assistance, those children diagnosed with ASD may have even more difficulty understanding and self-regulating their behavior (Passage, Tincani, Hantula, 2012; Schweitzer & Sulzer-Azaroff, 1988; Vessells, Sy, Wilson, & Green, 2018). Individuals diagnosed with ASD may not communicate their emotions in an age appropriate manner. For example, a typical developing 16-year-old may communicate that they feel frustrated and impatient while waiting, whereas a 16-year-old diagnosed with ASD may begin screaming and engaging in aggression. Instead of engaging in potentially undesired, disruptive behavior, an appropriate replacement behavior can be taught.

Research has shown that individuals diagnosed with ASD can be taught to discriminate between different schedules of reinforcement when being asked to wait (Dixon, Hayes, Binder, Manthey, Sigman, & Zdanowski, 1998; Dixon et al., 2003; Vessells et al., 2018). Additionally, research has shown that individuals diagnosed with ASD can be taught to appropriately wait for extended periods of time (Dixon et al.1998; Dixon et al., 2003; Vessells et al., 2018). However, individuals diagnosed with ASD often engage in impulsive, dysfunctional, and maladaptive behaviors (Dawson, Matson, & Cherry, 1998). For example, when an individual with ASD is asked to wait, instead of reading a book, he/she may repeatedly throw the book. Such impulsive, dysfunctional, and maladaptive behaviors may be socially unacceptable to individual's communities, school staff, and caregivers. The literature focused on appropriate waiting expands across

several different conceptual areas of research. Research has been published in the areas of impulsivity (e.g., Chantiluke, Christakou, Murphy, Giampietro, Daly, Ecker, & Brammer, 2014), self-control (SC; e.g., Dixon et al., 1998, Schweitzer & Sulzer-Azaroff, 1988), and delayed discounting (e.g., Dixon et al., 1998; Schweitzer & Sulzer-Azaroff, 1988; Vessells et al., 2018). Waiting has been targeted through interventions which include signaled and non-signaled delayed reinforcement (e.g., Vessells et al., 2018) and intervening task contingencies (e.g., Dixon et al., 1998; Dixon et al., 2003; Ghaemmaghami, Hanley, & Jessel, 2016; Passage et al., 2012). Not only has research shown that waiting can be taught, but depending on the setting and context, waiting can be taught utilizing a variety of interventions (Falligant, 2020).

Research has been conducted evaluating self-control (SC) as selecting large, delayed reinforcers over small, immediate reinforcers following task completion. Dixon et al. (1998), conducted a study evaluating the effects of a progressive-duration schedules of reinforcement to teach SC. During baseline, the participants in Dixon et al.'s (1998) study displayed a lack of SC by consistently choosing the small, immediate reinforcer rather than completing an additional task to gain access to the larger reinforcer. When the conditions were altered so that both consequences produced immediate reinforcement, the participants consistently chose the larger reinforcer. Dixon et al. (1998) then taught SC by gradually increasing the delay for the larger reinforcer. During the delay, the participants were required to engage with an additional task. As delays increased, each participant continued to demonstrate SC by continuing to choose the larger reinforcer and engage with additional tasks.

Dixon et al.'s (1998) study was one of the first to use an intervening task to evaluate SC for delayed reinforcement. Since then, the literature has further evaluated whether or not intervening activities can increase on-task behaviors while also increasing toleration to delayed reinforcement. Dixon et al. (2003) conducted a study assessing SC by gradually increasing the delay to reinforcement. Expanding upon the work conducted by Dixon et al. (1998), Dixon et al. (2003) similarly incorporated an intervening activity schedule into the SC treatment package. The results of Dixon et al.'s (2003) study concluded that each participant demonstrated increased SC for trials in which he/she choose to wait for the larger reinforcer over the immediate, smaller reinforcer. Additionally, as time delays increased, participants showed an increased preference for the contingency that included the intervening activity. This may suggest that engaging in the activity encouraged SC and/or the activities began to function as a reinforcer on an inadvertent schedule for reinforcement (Dixon et al., 2003).

Although the participants' preference for the activity potentially encouraged SC, preferences within the natural environment are often changing. Regularly assessed preferences increase the likelihood of behavior change and more successfully promote preferred items to develop the properties of a reinforcer. Passage et al. (2012) utilized a multicomponent reversal design to examine the effectiveness of qualitatively different reinforcers when teaching SC. Their findings suggested individuals with intellectual disabilities can be taught to demonstrate SC for qualitatively different reinforcers. Additionally, individuals with intellectual disabilities can maintain responses as duration delays progressively increase. Passage et al. concluded their findings may lead to more effective reinforcement interventions as well as mirror more naturalistic choice

conditions. Furthermore, Passage et al. (2012) explained that SC may generalize to tasks in which no SC training occurred. Their findings explicitly support Dixon et al. (2003) in that participants from both studies preferred an intervening task for SC to access a larger, delayed reinforcer.

As Dixon et al. (2003) stated, SC may generalize within the natural setting in the absence of SC training. In the SC literature, choice is described as the behavior an organism makes when presented with reinforcers on differential schedules of reinforcement. Such differential schedules of reinforcement more adequately represent naturally occurring schedules of reinforcement. For example, an individual may prefer to work longer in order to gain access to a larger, more preferred reinforcer whereas another individual may prefer to complete their work quicker in order to receive a reinforcer faster. Such phenomenon surrounding differential schedules of reinforcement and the discrimination between two reinforcement schedules is often referred to as impulsivity throughout the literature.

In the behavior analytic literature, impulsivity, or choosing immediate reinforcement versus delayed reinforcement, is often associated with delayed discounting (Neef et al.,1992; Neef et al., 1993; Neef, Bicard, & Endo, 2001; Shead & Hodgins, 2009). Delayed discounting requires an organism to make a choice between immediate, smaller reinforcement and delayed, larger reinforcement. As the delay to the larger reinforcer increases, the value of the reinforcers decreases. When an organism discounts a delay, they are more likely to allocate responses to the reinforcement schedule that encompasses the immediate, smaller reinforcer (Green, 2004, 2007; Green & Myerson, 2013; Mace et al.,1990; Mace et al., 1990; Mace et al., 1994).

Shead and Hodgins (2009) evaluated the differences between delayed and probability discounting in order to further understand impulsivity. More specifically, they examined the relations between delay discounting gains and probability discounting gains and losses. Their experiment consisted of 60 human participants who were asked a series of questions on a computerized apparatus. Results indicated a clear discrimination between impulsive behavior and risk-taking behavior. Individuals who engaged in impulsive behavior did not consider losses but significantly considered immediate gains as more important. An additional study conducted by Chantiluke et al. (2014) assessed discounting in youth diagnosed with ADHD and autism spectrum disorder (ASD). Results indicated individuals diagnosed with ASD and individuals diagnosed with both ASD and ADHD (i.e., comorbid diagnoses) discounted delayed reinforcers on a steeper curve.

Numerous studies have been conducted evaluating the ability to SC and wait for delayed reinforcers in individuals diagnosed with ASD and ADHD (Dixon et al., 1998; Dixon et al., 2003; Vessells et al., 2018). However, little research has been conducted specifically evaluating waiting in the context of delayed reinforcement of preferred items. In addition, no previous research has evaluated the literature across all areas to compile a review of the literature and analyze those studies using applied behavior analytic methodologies. A review of the research is warranted that specifically reviews the current empirical literature on increasing waiting for a requested preferred item to provide clinicians with a tool for wide scale application. This review focused on research that taught waiting for a preferred item as the primary goal. The purpose of this thesis is to review recent research utilizing behavior interventions to increase contextually

appropriate waiting behavior with individuals diagnosed with ASD. This review assessed the age of participants, setting(s), research design, independent variables, results, and effectiveness. This review also evaluated the methodological rigor of relevant studies with the Quality and Rigor Checklist (Ledford, Lane, & Tate, 2018).

CHAPTER 2

METHOD

This systematic literature review examined the area of research aimed at increasing waiting with individuals who presented problem behaviors maintained by access to tangible reinforcement. For this review, appropriate waiting was defined as the absence of problem behavior and repeated requests for an originally denied item and/or the absence of targeted problem behavior, as outlined by the original study, when items are denied and/or delayed. In addition, waiting research included studies that implemented intervening tasks and/or encouraged active engagement with alternative tangible items (i.e., manipulating a toy, completing a puzzle).

Inclusion and Exclusion Criteria

Studies had to meet the following inclusion criteria in order to be included in this systematic review. Inclusion criteria included peer-reviewed applied empirical research studies, published in English. Applied research was defined as research that was conducted with human participants that utilized the principles of behavior analysis to improve socially significant behaviors. Moreover, applied research was defined as research that controlled for variables in order to identify a functional relation between the dependent and independent variables. In order to reduce the risk of publication bias, applied theses and dissertation were also included if they met inclusion criteria. The studies had to include participants who were diagnosed with ASD between the ages of 3-21 years-of-age. Lastly, studies must have used an independent variable that explicitly targeted waiting and utilized direct observations to measure the functional relationship between the dependent and independent variables.

Exclusion criteria were used to further filter inappropriate studies. Exclusion criteria included studies that did not utilize direct observation to measure the dependent and independent variables. In addition, translational studies that suggested potential interventions and treatments to be assessed within applied practice, and/or did not reflect single-subject research, were excluded from this review. Lastly, exclusion criteria included studies that targeted waiting behavior as a secondary procedure in order to further examine a research question.

Search and Screening Procedures

Articles for the current study were extracted utilizing procedures described in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Moher Liberati, Tetzlaff, Altman, & the PRISMA Group, 2009). The PRISMA diagram is depicted in Figure 1.

Database searches. This systematic review applied several different methods to search for candidate studies. The investigator incorporated database searches, reference examination of included studies and previous literature reviews, and evaluated cited studies. The investigator utilized Temple University's online library in order to access the database catalog. Within the database catalog, the primary investigator selected the following databases for examination: APA Psycinfo, ERIC, APA PsycArticles, and PubMed. In addition, the investigator examined The Journal of Applied Behavior Analysis through Temple University's online search engine. A combination of the following keywords were searched in each database: wait*, delay*, denied, reinforc*, impuls*, discount*, tolerat*, and preferred item. Asterisks were strategically placed behind root words. Placing an asterisk behind a root word, allowed the database to pull

all articles that contained the root word. For example, when entering "wait*" into the search bar, the database pulled results which included "waiting" and "waited." The keywords were systematically paired in order to create each possible combination of keywords. A table depicting each combination of keywords can be found in Appendix A. Each combination of keywords were paired with "autism" in order to further filter out unrelated studies. The combination of keywords were labeled as a search term. A search term was defined as a three-word phrase that included "autism" and encompassed two keywords separated by "AND." For example, "wait*" was paired with each additional keyword to create a list of 7 total search terms. Table 1 lists the keywords and depicts how each pair was created. A journal search is a narrower search that is limited to results published within a particular journal. Utilizing the primary keywords increased the likelihood of extracting all related studies. The following keywords were utilized when searching through a journal: wait*, delay*, denied, reinforc*, impuls*, discount*, tolerat*, and preferred item.

Prior to conducting the database searches, the investigator created a Microsoft Excel file, titled "Database Searches." The file included separate spreadsheets for each database with a corresponding title. Returns from the database search were entered a database with the date searched, the search term, and the number of returns. The investigator then combined databases for each search in order to create a master list. All duplicates were removed from the master list. Once the investigator had created a master list for each database, the investigator began assessing inclusion criteria. The investigator used the inclusion criteria listed above to determine whether or not each article met

criteria to be included within this review. Studies that met inclusion criteria were retained in the database for further review.

Ancestral search. The investigator examined references sections for each included study and applied the same inclusion criteria and procedures stated above to potentially relevant articles. Once the investigator was able to locate an abstract and/or an electronic copy of the study, the investigator evaluated the study using the inclusion criteria for the current review. The investigator took data on the total number of studies from each eligible study's reference list that met criteria. The total number of studies that met criteria were entered into the Microsoft Excel spreadsheet, next to the corresponding study. The investigator then completed this process for all references found within each eligible study's reference list. In the event that a database search identified previous review(s) targeting waiting behavior, the investigator utilized the previous review(s) in order to conduct a thorough reference examination. The investigator used the reference examination procedure and data collection method outlined above, in order to determine whether or not the references of the previous review, meet the current review's inclusion criteria. The investigator recorded data from the previous reference examination(s) in a separate Microsoft Excel spreadsheet titled "Previous Review." If more than one previous review was extracted, the investigator included the year of publication in the title.

Chain search. Lastly, the investigator conducted an additional search for articles that had cited studies included on the master lists. The investigator utilized the Google Scholar database in order to conduct the search. The investigator separately entered each citation into Google Scholar's search engine. The investigator used the "cited by" function in order to determine a total number of articles that had referenced each

extracted study. The investigator then utilized the reference examination procedure and data collection method outlined above, in order to determine whether or not the articles met the current review's inclusion criteria. The investigator used Microsoft Excel, and the procedures listed above, for creating a master list and highlighting articles that met inclusion criteria. A systematic examination, of references and cited studies, increases the validity of those studies included within the current review. Moreover, this allowed the investigator to make informed decisions regarding the limitations of the current literature and implications for future research.

Characteristic Coding

The data extracted were characterized and coded to address specific variables relevant to the current review. Study characteristics (i.e., coding categories) included the age of participants, setting(s), research design, establishing operations, independent variable, intervention components, results and effectiveness, social validity, and internal validity. A table was used to organize and store data. Each column of the table was titled to include a column for each coding category of interest. An additional column was added to include the article reference. The investigator then utilized the following coding definitions to collect data on the coding categories of interest. Age of participants was coded as either child/preteen or adolescent/young adult. Child/Preteen was defined as individuals between the ages of 3-13. Adolescent/young adult was defined as individuals between the ages of 14-21. Setting was coded as either home-based services, residential, school, community, inpatient hospital, or treatment center. Home-based services were defined as behavioral and/or academic services that are provided by an outside agency within an individual's residence.

A residential setting was defined as an alternative residential placement where an individual may have received 24-hour services from direct care staff. A residential setting excluded home-based services provided through a clinical agency. A school setting was defined as a day program which provided academic services up to five days a week either in-person, virtually, or a combination of the two (i.e., hybrid). A community setting was defined as research conducted in locations where unfamiliar members of the community were present and were not informed of the research. Examples of community locations include but were not limited to grocery stores, restaurants, shopping malls, movie theaters, etc. Community locations did not include simulated community settings located on a residential campus and/or within a school. An inpatient hospital was defined as a setting that provides behavioral and clinical supports to individuals who were admitted into a hospital. An inpatient hospital may have included settings which also provided academic support during the time of stay. An inpatient hospital setting did not include residential treatment facilities (see definition for residential setting). A treatment center was defined as an outpatient setting where clinical and/or academic services were provided on a regularly scheduled basis (i.e., one time per week, 2 times per week, etc.).

Research design was coded based on the single-subject design utilized within the study. Examples of single-subject designs included, but were not limited to, changing-criterion design, alternating treatment design, and multiple baseline design. Group design studies were excluded, which is a limitation of the current review. Establishing operations were coded as either contrived or natural. Contrived was defined as conditions and/or stimuli that had been specifically altered to increase the likelihood of evoking the target behavior which in turn allowed for implementation of the independent variable. Natural

was defined as opportunities that occurred when contingencies were presented, without planned alternations, and the independent variable was able to be implemented based on the availability of maintaining reinforcers.

Independent variables were coded as denied or delayed in regards to waiting for a desired item. Denied was defined as an arbitrary duration of time in which a desired item was not presented nor was a signal provided as to when that item would become available. Delayed was defined by systematically withholding a desired item for a duration of time with or without a signal of availability. Intervention components were coded to include variations of the implementation of the independent variable (e.g., signaled versus non-signaled, visual schedules, intervening activities). Results and effectiveness each study were analyzed utilizing the percentage of non-overlapping data (PND). A PND of 90% or higher was determined as highly effective, 70%-90% as effective, 50%-70% as questionably effective, and less than 50% as ineffective. Social validity was coded as either "yes" or "no" based on whether or not the extracted study measured social validity.

Characteristic Code Analysis

For each characteristic code, data were measured and summarized utilizing a total count and a percentage of studies. The investigator totaled the number of studies that met criteria for each subcategory of each characteristic code. Data were reported for each subcategory, respectively. For example, the investigator reported the total number of studies that were conducted within a residential, school, community, and treatment center. The investigator also reported the percentage of studies by multiplying the total number of studies included within each subcategory, by the total number of included

studies, and then multiplied by 100 in order to gain a percentage. To calculate the percentage of studies that evaluated social validity, the investigator divided the total number of studies coded as "yes," by the sum of "yes" and "no" studies, and then multiplied by 100%.

Internal Validity

Lastly, internal validity, also commonly referred to as rigor, was assessed for each extracted study utilizing The Quality and Rigor Checklist (Appendix A) published by Ledford et al. (2018). Rigor was defined as the manner in which research was conducted that supports the confidence in the results and conclusions, improvements for future research, and variable outcomes (Ledford et al., 2018). The 11-item Quality and Rigor Checklist assessed three domains: rigor, quality/generality, and reporting. For items 1-11, a yes/no question was asked pertaining to different criteria within each domain. For the purpose of the current review, the investigator evaluated the rigor of each extracted study by completing the Quality and Rigor Checklist. The percentage of rigor was calculated by dividing the total number of questions answered with "yes" by the total number of questions presented and was then multiplied by 100%. Those studies scoring 80% or above were considered to have high internal validity.

Interobserver Agreement

*Interobserver agreement for included studies***.** Interobserver agreement (IOA) was calculated in order to ensure that two or more independent investigators were collecting the same data based on the inclusionary criteria described above. IOA was independently collected by a graduate level professional who was currently practicing within the field of applied behavior analysis. IOA was collected across at least 37% of all search terms for

each database utilizing a point-by-point procedure. The primary investigator and the secondary investigator recorded the number of studies that they determined met inclusion criteria, as well as the number of studies they found to be excluded based on the criteria. The primary investigator divided the number of studies that each investigator determined should be included, by the number of included plus excluded studies, and then multiplied by 100% in order to obtain a percentage. Mean IOA for included studies as 100%.

Interobserver agreement for extracted studies. IOA was calculated in order to ensure that two or more independent investigators agreed that those studies that were extracted for review met inclusion criteria. IOA was collected for 100% of extracted articles utilizing a point-by-point procedure. The secondary investigator independently recorded the number of studies that they agreed met inclusion criteria, as well as the number of studies they found to meet exclusion criteria. The primary investigator divided the number of studies that each investigator determined should be included, by the number of included plus excluded, and then multiplied by 100 in order to obtain a percentage. Mean IOA for extracted studies was 100%.

Interobserver Agreement for Rigor Analysis. IOA was calculated in order to ensure that two more independent investigators agreed that those studies that were included within the review scored high in quality and rigor. The secondary investigator independently evaluated the internal validity of each extracted study by completing the Quality and Rigor Checklist (Ledford et al., 2018). The secondary investigator independently recorded the number of studies that they determined high in rigor, as well as the number of studies they determined low in rigor. The investigator divided the number of studies that each investigator determined as high, by the number of high plus

low studies, and then multiplied by 100 in order to obtain a percentage. Mean IOA for internal validity was 100%.

Secondary Investigator Training

A secondary investigator, or an individual who collected IOA, was a master's level graduate student from Temple University or a graduate level professional who was currently practicing within the field of applied behavior analysis. All secondary investigators received direct training on the data collection procedures with the investigator. First, the primary investigator vocally explained the procedures of the current review and explained the procedure for article extraction. Then, the secondary investigator and the primary investigator watched pre-recorded, mock sessions that depicted the process for navigating a database library, using the search engine, extracting articles based on entrance criteria, coding articles, and entering those data into a database. The secondary investigator repeated the same process utilizing a predetermine focus specified by the investigator. The primary investigator chose the area of literature and search terms. Once the secondary investigator had completed data collection, the primary investigator reviewed their data and determined their percentage of accuracy. Once the secondary investigator demonstrated 90% accuracy they were able to begin collecting data for the current review.

CHAPTER 3

RESULTS

The total number of hits for each search term, within each database, were totaled and evaluated in order to identify potential studies. APA Psychinfo generated the majority of hits (n= 1,029) followed by PubMed (n= 364), ERIC (n= 139), and APA PsychArticles (n=39), respectively. Additional studies that met inclusion criteria were extracted through the examination of reference lists of included studies (n=6). After analyzing all search results, 11 studies met inclusion criteria and were extracted from the online libraries (Figure 1). Eight out of the 11 studies assessed toleration of delayed reinforcement and evaluated the use of signaled and non-signaled delays. The additional three studies also assessed the toleration of delayed reinforcement and evaluated the use of concurrent activities implemented during the delay duration. Both area of research contributed to the literature focused on delayed reinforcement and waiting and will be discussed below.

PRISMA Flow Diagram

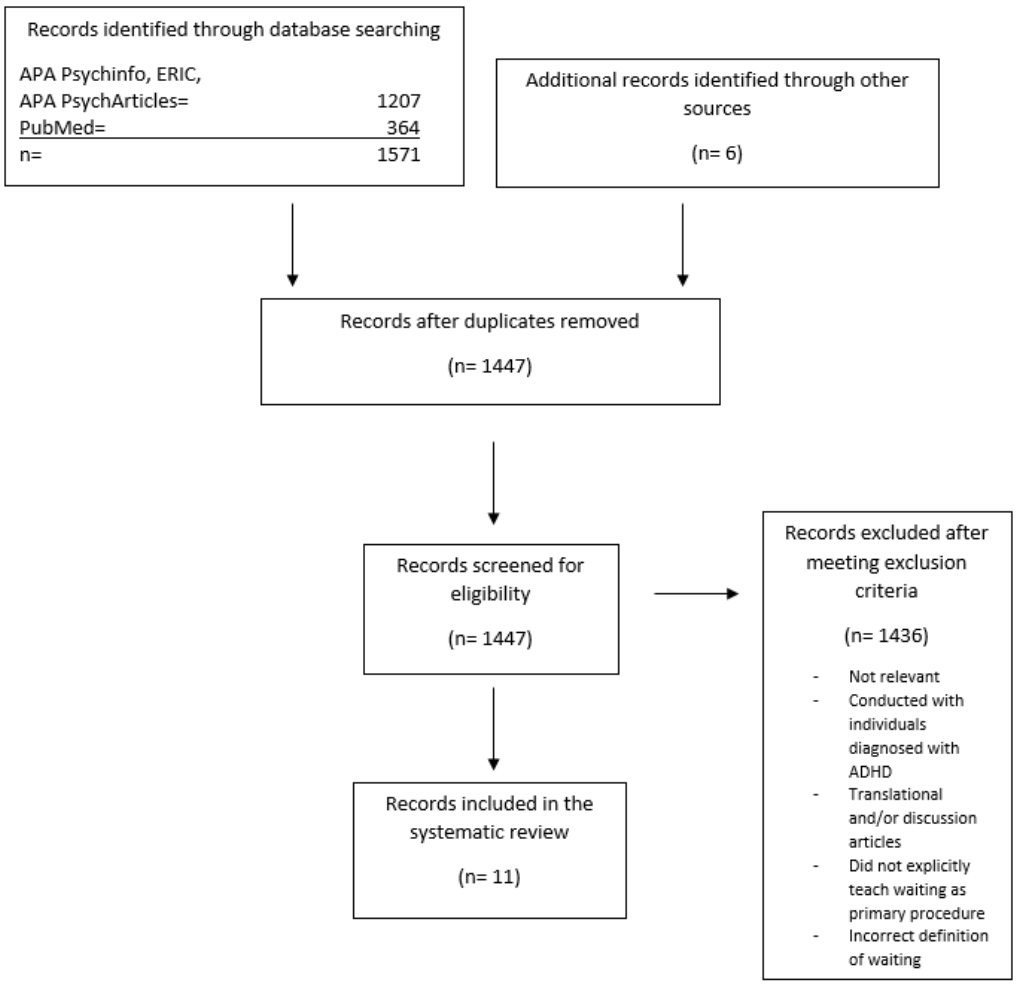

Figure 1. Process to determine included and excluded studies.

Narrative Summary of Included Studies

Signaled and non-signaled delays. Results of the current review identified eight studies that evaluated delayed reinforcement with the use of signaled and non-signaled delays (Kern, Carberry, & Haidara, 1997; Vollmer, Borrero, Lalli, & Daniel, 1999; Grey, Healy, Leader, & Hayes, 2009; Hong, Neely, Rispoli, Trepinski, Gregori, & Davis, 2015; Chen, McComas, Reichle, & Bergmann, 2015; Vessells, Sy, Wilson, & Green, 2018). Each of those studies expanded the research focusing on delayed reinforcement and contributed the literature in the area of waiting for preferred items. Kern et al. (1997) assessed delayed reinforcement in relation to problem behavior and waiting. The study was conducted with one 15-year-old participant who was receiving residential services. The participant's problem behavior was determined to be maintained by access to preferred items, specifically food. During baseline, the participant was verbally prompted to wait for 10 minutes before gaining access to the preferred food item. Problem behavior during baseline persisted at moderate levels. Following baseline, the intervention was implemented. The intervention consisted of a timer that signaled the duration of the delay, functional communication training, and gradually increased delays to reinforcement. The participant was required to wait, in the absence of problem behavior, in order to gain access to the preferred food item. During the intervention the participant was presented with a timer that depicted the duration of the delay. The delay was systematically increased by one minute each time the participant met criteria. After the timer sounded, the participant was prompted to exchange a picture card before the therapist provided the food item. During the delay, alternative tangible items were provided, however, the participant never interacted with them.

Kern et al. (1997) demonstrated that a signaled delay was effective in decreasing problem behavior and increasing waiting behavior during reinforcement delays. The participant demonstrated zero rates of problem behavior during the intervention phase when a stimulus was provided to depict the duration of the delay. When the intervention was removed a resurgence of problem behavior was observed. Although Kern et al. (1997) found positive results as delays were increased, their study consisted of several limitations and confound variables. First, the functional communication response was never assessed in the absence of signaled increasing delay. It is unknown to what extent functional communication training had on behavior because it was embedded into the treatment package. In addition, after the timer sounded, the participant was first required to exchange the icon before the preferred item was delivered. Although the participant exchanged the icon without engaging in increase problem behavior, there is potential that the response effect was increased. Moreover, the presence of alternative tangible items during the delay could have unintentionally influenced the results of the intervention. The contingency could have been misinterpreted in that the participant may have perceived a choice condition because engagement with those items was never required nor encouraged. Lastly, the initial sessions of the intervention condition targeted 30 sec. compared to the baseline session that targeted 10 min. These were reasons for it to be effective but slowly increasing the delay from seconds to minutes could have contributed to the immediate decrease in problem behavior during the intervention phase because the participant had the opportunity to learn the contingency and appropriate responses.

In comparison to Kern et al. (1997), Vollmer et al. (1999) also evaluated self-control and impulsivity in regards to problem behavior maintained by access to tangibles

(e.g., food, television). Participants were receiving inpatient care and were between the ages of 5-13 years-old. The intervention consisted of functional communication training in order to establish a reinforcement history for a functional equivalent replacement behavior (i.e., mand). Vollmer et al. (1999) addressed the limitation of Kern et al. (1999) by assessing functional communication training prior to assessment. After participants demonstrated success with allocating to a functional communication response verses engaging in problem behavior, a delay was added to the delivery of reinforcement. Vollmer et al. (1999) also assessed reinforcer magnitude in order to identify a baseline for reinforcement sensitivity. During the fourth phase, utilizing the results of the reinforcement sensitivity assessment, Vollmer et al. (1999) implemented concurrent reinforcement schedules for aggression, mands, and delay toleration.

Delays to reinforcement were assessed with both a signaled and non-signaled cue. During the non-signaled delay condition, the therapist stood still until the participant met the target duration before honoring a mand for food. During the signaled delay condition, the therapist placed their hand in the bag of food for the duration of the delay. If the participant met criteria, their behavior was reinforced with delivery of the preferred item that they had requested. For one participant, the delayed signal was incorporated with a digital clock that depicted a timer for when reinforcement was available. Furthermore, Vollmer et al. (1999) systematically increased the delay, for one participant, and successfully demonstrated a 10 min delay to reinforcement. Vollmer et al. (1999) demonstrated that participants were less likely to engage in problem behavior when mands produced larger, delayed reinforcers and when reinforcement delays were

signaled. Vollmer et al. (1999) demonstrated that stimuli signaling delayed reinforcement was a more effective treatment as delays to reinforcement were increased.

Although Vollmer at al. (1999) found positive results, their study was not conducted without limitations. The participants of Vollmer et al.'s (1999) study had no previous experience using picture cards to request for preferred items. Furthermore, Vollmer et al. (1999) did not mentioned what was displayed on the picture card (i.e., image of the item, name of the item), which presents an issue for future replications of the study and may be problematic for generalization in the natural setting. In addition, the preferred items that were used throughout the study remained constant, therefore the generalizability of the intervention across preferred items is unknown. It is also unknown whether or not levels of challenging behavior would have increased if the stimuli were faded from the contingency in order to depict a more natural maintenance context. Setting the limitations aside, Vollmer et al. (1999) contributed to the literature by demonstrating that functionally equivalent replacement behaviors could maintain low levels of challenging behavior when reinforcement is delayed. Although Vollmer et al. (1999) did not fade stimuli, they demonstrated that mands occurred more often even when both responses produced reinforcement which is arguably comparable to an inclusive school based setting when topographies of aggression are less likely to be ignored. The contribution of Vollmer et al. (1999) provided a replicable intervention that could be used within the applied setting to further evaluate waiting behavior and sensitivity to reinforcement.

Likewise, to Kern et al. (1997) and Vollmer et al. (1999) a study conducted by Grey et al. (2009), implemented a visual stimulus (i.e., Time Timer ™), to increase

waiting and delayed reinforcement of a tangible item. The study was conducted with one 11-year-old participant who was receiving academic and clinical services at a school setting. Unlike the previous studies, Grey et al. (2009) systematically transferred stimulus control from a red index card to a Time Timer ™. Results support findings of previous studies indicating that participants understood the schedule of reinforcement (Vollmer et al., 1999), and visual stimuli were effective in increasing toleration of delayed reinforcement (Kern et al., 1997; Vollmer et al. 1999). In addition, Grey et al. (2009) supported the literature by replicating that individuals diagnosed with autism were able to demonstrate waiting behavior when delays were increased to 10 min (Kern et al., 1997). Furthermore, Grey et al. (2009) addressed Vollmer et al.'s (1999) recommendation to replicate procedures within the applied setting. Grey et al. (2009) also successfully demonstrated increased task completion when a concurrent task demand was introduced. During Session 95, Grey et al. (2009) incorporated activities during the delay that required an increased response effort. Grey et al. (2009) wanted to ensure that the participant learned to not only wait but to continue to engage in tasks conducive to academic learning. When concurrent task demands were implemented, appropriate waiting behavior maintained at high levels even as duration delays increased (Grey et al., 2009). Grey et al. (2009) recommended that further studies evaluate the effectiveness of visual stimuli with and without the use of verbal cues.

Similar to the previous studies, Chen et al. (2015) also assessed the toleration of delayed reinforcement for tangible items and expanded the literature by addressing recommendations made by Grey et al. (2009). Chen et al. (2015) assessed signaled delays and compared visual stimuli and verbal cues. The participant was receiving residential

services and was 18 years old. During the first condition, a combination of a visual stimulus and verbal redirection was assessed. Following a request for a preferred item, the participant was required to wait for 10 min. During the delay, the participant received tokens every 30 sec in the absence of problem behavior. Verbal redirection was implemented in the event that the participant attempted to reach for the preferred item or engage in problem behavior. Following the completion of the toleration for delayed reinforcement condition, a component analysis of delay cues was introduced. The purpose of the component analysis was to assess the participant's ability to wait in the absence of a visual stimulus. A withdrawal design was utilized to further evaluate independent variable effects on toleration for delayed reinforcement. The results of Chen et al.'s (2015) study indicate that the participant was able to successfully wait for 10 min when both verbal redirection and a visual stimulus were incorporated. In addition, problem behavior decreased and remained at zero rates. When the visual stimulus was removed, problem behavior occurred across 35% of intervals. Chen et al.'s (2015) study was effective in reducing problem behavior while increasing appropriate waiting behavior for tangible items when both general and explicit delay cues were implemented.

Although Chen et al. (2015) produced positive results, there were limitations that should be addressed. Similar to studies conducted by Kern et al. (1997) and Grey et al. (2009) Chen et al. (2015) only included one participant which leads to question whether or not similar results would be replicated across multiple participants. In addition, sessions were conducted within one room of the residence. Sessions were not conducted within the living quarters of the residence or in rooms that the participant spent most of their time, therefore it is unknown if the effects of the treatment package would expand

across more familiar settings with stronger reinforcement histories. Lastly, Chen et al. (2015) did not conduct follow-up sessions following the completion of the study, therefore it cannot be assumed that the intervention would be sufficient to maintain treatment effects. Although the lack of generalization and follow-up are the primary limitations of Chen et al.'s (2015), diverse applications of similar studies have been conducted to further expand upon the existing literature.

Similar to Chen et al. (2015), Hong et al. (2015) also assessed problem behavior and general and explicit delay cues for delayed reinforcement for tangible items. The participants were receiving behavioral services at a treatment center and were between the ages of 5-13 years old. Throughout baseline sessions, participants were asked to choose a preferred item. During each baseline session, a participant and a therapist took turns every 30 sec engaging with the preferred item. When it was the therapist's turn to engage with the preferred item, the participant was expected to sit in their chair and wait in the absence of challenging behavior. Following baseline, participants were exposed to the general delay cue which utilized a visual stimulus (i.e., "wait" card) to depict delayed reinforcement. Throughout the condition, similar to baseline, the therapist and the participant took turns every 10 sec engaging with the preferred item. When it was the therapist's turn, the therapist presented the "wait" card. If the participant demonstrated problem behavior, verbal redirection was implemented by the therapist. The following condition incorporated the visual stimulus and implemented an auditory stimulus during the delay. The therapist set a 30-sec timer and counted aloud from 30 to zero. If the participant engaged in problem behavior, the therapist gestured to the "wait" card and provided verbal redirection indicating how many more seconds the participant was

required to wait. Results demonstrated that participants' problem behaviors decreased with the use of a visual stimulus and continued to decrease with the use of visual and auditory stimuli. Hong et al.'s (2015) findings are evidence to support that individuals diagnosed with ASD can be taught to wait for preferred items and tolerate delayed reinforcement utilizing a variety of interventions (Kern et al., 1997; Vollmer et al., 1999; Kelley, 2003; Grey et al., 2009; Lee et al. 2015).

An additional study conducted by Vessells et al. (2018) further expanded upon the existing literature by continuing to demonstrate that individuals with ASD can discriminate between schedules of reinforcement and can tolerate delayed reinforced as delays increase over time. Vessells et al. (2018) conducted a study to evaluate participant's ability to select larger, delayed reinforcers over smaller, immediate reinforcers after exposure to a self-control assessment where the contingencies were initially introduced. The intervention consisted of a self-control assessment, followed by a delay fading condition which incorporated a stimulus signaling delayed reinforcement. The intervention was implemented with four participants between the ages of 3-5 years of age. The participants were receiving speech and language services at a school setting. During the first condition, the participants were exposed to contingencies for both small, immediate reinforcement and large, delayed reinforcement. Following exposure to the contingencies, a delay fading condition was implemented which incorporated a stimulus to signal delayed reinforcement. If the participants choose the larger reinforcer, they were presented with a timer and were required to wait. Over the course of the condition, delays to reinforcement were systemically increased overtime.

Vessells et al. (2018) successfully demonstrated experimental control by representing shorter and longer delay requirements during the intervention condition. This demonstrates a potentially more natural schedule of reinforcement commonly found within a school setting and therefore expanding upon previous research that was conducted in highly controlled settings (Kern et al., 1997; Vollmer et al., 1999; Chen et al., 2015; Hong et al., 2015). Limitations should be considered when reviewing the results of Vessells et al. (2018). First, it is likely that sequencing effects did occur due to repeated testing during the intervention condition. In addition, when the delay signal was introduced, waiting durations were not reset to 5 sec. It is unknown if the signal would be as effective if it were introduced and delays were reset, however, it is likely that the signal continued to support positive results as duration delays continued increase.

Two additional dissertations were identified that addressed signaled delayed tangible reinforcement. Kelley (2003) evaluated delayed reinforcement for preferred items when signals were and were not implemented. The intervention was conducted with three participants between the ages of 8-14 years of age. The signals that were chosen for each participant were individualized to their impairments and parent preference (e.g., auditory stimulus, visual stimulus). In addition, participants were taught to exchange a stimulus in order to gain access to their preferred tangible item. Delays to reinforcement were systemically increased within both conditions. Results indicated that the signaled delay did not produce differentiated data in comparison to responses made during the non-signaled delay. During the signaled and non-signaled delay conditions responses were highly variable, however, the signaled delay maintained responses at a higher level compared to the non-signaled condition were responses depicted a

decreasing trend. The results of Kelley (2003) support the use of signaled delay cues when reinforcement is delayed for an extended period of time, however, the lack of overall positive results questions the application of intervention components. Limitations and confounding variables throughout the intervention could have alternated the effectiveness of the intervention. First, the conditions were implemented on an alternating schedule which may have produced carryover effects or difficulty discriminating between conditions. For example, when the signal was not present it is possible that the participant detected the delay duration because the signal supported the delay in the session prior. Second, delays were only faded to a duration of 5 min, therefore it is unknown if the signaled delay would have produced differential effects if delay durations would have continued to increase past 5 min. Prolonged exposures to the signaled delay, for increased periods of time, may have increased responding and the overall results of the study. Kelley (2003) supports previous work replicating that toleration for delayed reinforcement can be achieved.

In comparison, an additional dissertation conducted by Lee (2014) extended the research focused on delay reinforcement. Lee (2014) conducted a study to evaluate the differences between a fixed time delay, a progressive time delay and verbal praise, and a progressive time delay with visual cues. The purpose of the study was to teach tolerance for delayed reinforcement while decreasing problem behavior. The study was conducted with three children ranging from the ages of 3-5 years of age who all demonstrated disruptive tantrums. Initially, participants were exposed to functional communication training where they were taught an equivalent replacement behavior (i.e., functional communication response) based on the results of a functional behavior assessment

conducted during screening. Following the completion of functional communication training, participants moved on to the treatment phases. During the fixed-time delay condition, sessions were contrived where the therapist removed the participant's preferred item. The participant was required to wait 50 sec before they could have another turn with the item. Throughout the fixed-time delay condition, verbal prompts were provided (i.e., "you need to wait") if challenging behavior occurred. Reinforcement was not provided until the duration delay elapsed and was only provided if the participant did not demonstrate problem behavior.

Following the fixed-time delay condition, a progressive time-delay was implemented which incorporated verbal praise during the duration of the delay. The purpose of this condition was to evaluate whether or not verbal praise, provided before the onset of problem behavior, increased participant's success with tolerating delayed reinforcement. The duration delay was slowly increased from 5 sec to 50 sec. During the final condition, participants were exposed to a progressive time-delay which discontinued the use to verbal praise and instead incorporated visual stimuli. A token board was implemented that allowed participants the opportunity to receive tokens every 5 sec in the absence of problem behavior. Results of the study indicated that toleration for delayed reinforcement was achieved, and participants were more successful with toleration of delay tangible items when delays were signaled. All three participants demonstrated high levels of problem behavior during the fixed-delay condition. After the progressive delay with verbal praises was introduced, problem behavior decreased to moderate levels. Problem behavior continued to decrease, and was maintained at near zero rates when delays were signaled with a visual stimulus. Although problem behavior decreased across

sessions, the lack of control conditions between intervention conditions should be considered. In addition, evaluating the token board alone may confirm whether or not continuous exposures to a progressive time-delay are warranted or if the token board would support delayed reinforcement at varying durations.

The results of Lee (2014) expand previous findings suggesting that signaled delays are more effective than unsignaled when reinforcement is delayed. Lee (2014) demonstrated that signals were more effective, and that participants can be taught to deliver their own reinforcement with the use of a token board. These findings suggest their procedures generalized to settings where adult provided reinforcement is less consistent (e.g., inclusive classroom setting). In addition, Lee's (2014) findings further strengthen the positive results of Chen et al. (2015) demonstrating that a token board can function as a reinforcer as duration delays increase. Both Lee (2014) and Chen et al. (2015) demonstrated that signaled delays utilizing a token board were effective in increasing toleration for delayed reinforcement. The results of Kern et al. (1997), Vollmer et al. (1997), Kelley (2003), Grey et al. (2009), Lee (2014), Chen et al. (2015), Hong et al. (2015), and Vessells et al. (2018) support findings suggesting that visual stimuli are a successful intervention component when targeting waiting behavior in children diagnosed with ASD.

Concurrent activity demands. Additional intervention components have demonstrated success with increasing toleration for delayed reinforcement. Results of the current review identified three studies that evaluated delayed reinforcement with the use of concurrent activity demands implemented during the duration of the delay (Dixon & Cummings, 2001; Gokey, Wilder, Welch, Collier, & Mathisen, 2015; Ghaemmaghami,

Hanley, & Jessel, 2016). Dixon and Cummings (2001) examined self-control and delays to reinforcement in relation to problem behavior. Participants were receiving home-based services and were between the ages of 5-13 years-old. Dixon and Cummings (2001) intervention consisted of self-control training, a concurrent activity, and a progressive delay schedule of reinforcement. During a choice baseline, participants were given the choice to choose between an immediate smaller reinforcer and a delayed larger reinforcer. During the choice baseline, all participants chose the smaller immediate reinforcer. Following baseline, self-control training was implemented and a concurrent activity was introduced (i.e., free-choice condition). At the start of each session, participants were able to choose the contingency they preferred. Within the free-choice condition, and during the delay contingency, participants were presented with a task activity to complete while waiting for the reinforcer.

Results indicated participants were less likely to engage in problem behavior when they chose the contingency that incorporated the concurrent activity. When participants chose the delay contingency, but without the concurrent activity, problem behavior was observed and occurred at higher rates in comparison to baseline. Dixon and Cummings (2001) results demonstrate, and support additional findings (e.g., Lee, 2014), suggesting that increased self-control is established when participants are exposed to progressive delays. In addition, problem behavior decreases, as successful waiting behavior increases, when participants are given the choice to engage in a concurrent activity while waiting for reinforcement. Although Dixon and Cummings (2001) demonstrated positive results, a major limitation to their study was not assessing the function of problem behavior for each participant. Without knowing whether or not a

participant typically engaged in problem behavior to gain access to tangibles, it is unclear whether the intervention had a direct effect on behavior.

Similar to Dixon and Cummings (2001), Gokey et al. (2013) assessed self-control and a concurrent activity utilizing a fixed reinforcement delay while systematically fading the activity requirement. Participants were receiving academic and clinical services at a residential setting and were between the ages of 5-13 years-old. During baseline, sensitivity to reinforcement was examined when participants were asked to choose between a smaller immediate reinforcer and a larger delayed reinforcer. When given the choice, all participants showed a preference for the smaller immediate reinforcer in comparison to the larger delayed reinforcer. During the self-control condition, participants were able to choose between receiving the small reinforcer immediately, receiving a larger reinforcer after a delay, and receiving a large reinforcer after a delay while engaging with a concurrent activity. During the self-control condition, all participants showed a preference for the contingency that incorporated a concurrent activity and a large delayed reinforcer over the same reinforcer that was not associated with an activity requirement.

Following the self-control training condition, the delay to reinforcement remained at fixed duration and the activity was systematically faded during the delay. Throughout the condition, the participants were required to engage in the concurrent activity for a set duration. Once the duration elapsed, the items were removed and the participant was required to wait without engaging in problem behavior for the remained for the delay. The results of Gokey et al.'s (2013) extended the findings of Dixon & Cumming (2001) by demonstrating that self-control can be achieved and maintained as the concurrent

activity requirement is faded over time. These findings might be particularly beneficial during situations when concurrent activities are not available or when engaging in a concurrent activity might be disruptive to others (Gokey et al., 2013). However, because the progressive delay was exclusively implemented in the condition that incorporated a concurrent activity, it is unknown to what extent the concurrent activity alone had on behavior. It also is unknown whether additional exposures to the progressive-delay would have increased toleration of delayed reinforcement.

Lastly, a study conducted by Ghaemmaghami et al. (2016) compared a time-based progressive delay (TBPD) and a contingency-based progressive delay (CBPD). Although the study does not fully meet inclusionary criteria due to the age of one participant, the study was the first study to directly compare a TBPD and a CBPD in regards to tolerance of delayed reinforcement and an intervening activity. Ghaemmaghami et al. (2016) used a three part, single-subject study that included a functional assessment, a functional communication training, and a comparative analysis of tolerance training. Results demonstrated that the CBPD was more effective in increasing tolerance to delayed reinforcement. Additionally, the CBPD maintained its effects when the delay was increased up to 5min and when implemented by the participants' parents. Additional results included that during the TBPD, challenging behavior and collateral responses maintained and then increased as delays increased. Ghaemmaghami et al. (2016) concluded that a TBPD was not an effective treatment to produce tolerance for delayed reinforcement. Ghaemmaghami et al. (2016) suggested that intervening activities are a more effective treatment to increase tolerance for delayed reinforcement while maintaining low levels of challenging behavior. They extended Dixon and Cummings

(2001) and Gokey et al. (2013) findings that concurrent activities provided during the duration of a delay increase waiting and toleration for delayed reinforcement.

Characteristic Coding

Each included study is described by characteristic codes (e.g., age of participants, setting(s), research design, establishing operations, independent variable, intervention components, results and effectiveness, social validity, and internal validity) and is illustrated within Table 2. Additional studies assessing waiting behavior were identified through and reference examination for included studies as well as an examination of cited studies.

Age of participants. Nine out of 11 studies (82%) assessed waiting with child/preteen participants. Two out of 11 studies (18%) assessed waiting in adolescent/young adults. Across all included studies there was a total of 25 participants. On average, participants were 3.5 years of age. Participants' ages ranged from 3-18 years. The total number of participants included in each study varied (mean= 2.7).

Setting(s). Each study varied in the setting in which they were conducted. Settings included school (n= 2), residential (n= 2), home-based services (n=1), treatment center (n= 4), impatient care (n= 1), as well as a residential setting that provided academic services (n= 1).

Research design. Kern et al. (1997) and Chen et al. (2015) utilized an A-B-A withdrawal design in order to measure the independent variable. Ghaemmaghami et al. (2016) also utilized a withdrawal design but included an addition phase (i.e., A-B-A-C design), Dixon and Cummings (2001), Vessells et al. (2018), and Vollmer et al. (1999) utilized a multiple treatment reversal design, as did Gokey et al. (2013), however, they

did not incorporate a reversal phase. Kelley (2003) implemented a multi-element design and a reversal design to measure the independent variable. Grey et al. (2009) utilized a changing criterion design, and Lee (2014) utilized a multiple baseline design across participants. Lastly, Hong et al. (2015) implemented a multiple baseline design with an embedded alternating treatment design in order to assess two different treatment packages. To summarize, a total of three studies (27%) utilized a withdrawal design, four studies (36%) utilized a multiple treatment design, one study (9%) utilized a changing criterion design, two studies (18%) utilized a multiple baseline design, and one study (9%) utilized a multi-element design.

Establishing operations. All 11 studies (100%) were implemented specifically for the purpose to assess and increase toleration of delayed reinforcement. Ten out of 11 studies (91%) were implemented during contrived opportunities where the environment and variables were specifically controlled. One study (Kern et al., 1997) was implemented during naturally occurring opportunities. Unfortunately, none of the studies (0%) assessed maintenance of skill acquisition or generalization across contrived and naturally occurring opportunities.

Independent variable. All 11 studies (100%) assessed waiting for preferred tangible items that we were delayed for a specific amount of time. Eight studies conducted by Kern et al. (1997), Vollmer et al. (1999), Kelley (2003), Grey et al. (2009), Lee (2014), Chen et al. (2015), Hong et al. (2015), and Vessells et al. (2018) evaluated the use of signaled and non-signaled delays as reinforcement delays were increased. Conversely, three studies, Dixon and Cummings (2001), Gokey et al. (2013), and Ghaemmaghami et al. (2016) evaluated the use of concurrent activity demands during the

duration delay. Ghaemmaghami et al. (2016) also compared a TBPD and a contingency-based progressive delay CBPD.

Intervention components. Each study implemented slightly similar, yet unique intervention components. Chen et al. (2015) compared a combination of signaled delays and verbal prompts, to a combination of signaled delays, a visual stimulus, and verbal redirection at the onset of problem behavior. Dixon et al. (2001) implemented a choice condition in order to train self-control and then implemented a concurrent activity during a progressive delay. Gokey et al. (2013) also implemented a choice condition in order to train self-control but then implemented a concurrent activity during a fixed delay. The concurrent activity was systematically faded during the delay. Hong et al. (2015) assessed the differences between signaled delays and verbal redirection with and without an auditory stimulus. Lastly, Vollmer et al. (1999) utilized functional communication training prior to assessing singled versus non-signaled delays.

Results and effectiveness. The results and effectives of each study were analyzed utilizing the percentage of non-overlapping data (PND). A PND of 90% or higher was determined as highly effective, 70%-90% as effective, 50%-70% as questionably effective, and less than 50% as ineffective. All 11 studies (100%) demonstrated highly effective results. All studies demonstrated that problem behavior remained at low levels when reinforcement was delayed. In addition, those studies that systematically increased the duration of the delay, demonstrated that problem behavior remained at low levels as the delay to reinforcement was increased. Lastly, those studies that evaluated signaled delays found that explicit delays incorporating both visual and auditory stimuli were

more effective in maintaining low levels of problem behavior while reinforcement delays were increased.

Social validity. Lastly, only one out of the 11 included studies (9%) measured social validity. Lee (2014) assessed the social validity utilizing a 6-quesiton interview that the researcher gave to the primary investigator and secondary observer. The questions focused on the willingness to implement the intervention, acceptability and responsibility of the intervention procedures, and the overall effectiveness of the intervention. The social validity results indicated that the primary investigator and the secondary observer rated the intervention as acceptable and effective across participants. The participants' caregivers were not given the social validity interview but were debriefed following the conclusion of the study. All caregivers indicated the intervention was effective in increasing communication skills, the ability to wait, and produced an overall decrease in problem behavior when access to a tangible item was denied.

Rigor Analysis

Data were collected on internal validity utilizing the Quality and Rigor Checklist (Ledford et al., 2018). Each study that met inclusion criteria was rated in the areas of rigor, quality/generality, and reporting. Those studies (n= 9; 82%) that scored high in internal validity fulfilled a minimum of eight categories within the checklist, however, two of those studies did not include at least three demonstrations of the independent variable and received a "no" for the second checklist item. Those studies (n= 2; 18%) that scored low in internal validity did not include assessments for fidelity. In addition, the following areas were not assessed, or failed to meet criteria, in at least one of the studies: three demonstrations of the independent variable, insufficient amount of data, ecological

validity, and maintenance of behaviors in the absence of the independent variable. The sixth checklist item was applicable for one of the 11 included studies. The majority of studies (n= 9; 82%) scored high in internal validity, therefore supporting the confidence in the quality of the results and the need for future replications.

Table 1. Summary of Included Studies

Reference	Age of Participants	Setting(s)	Research Design	Establishing Operations	Independent Variable	Intervention Components	Results and Effectiveness	Social Validity	Internal Validity
Signaled and Non-signaled Delays									
Kern et al., 1997	Adolescent/young adult	Residential setting	A-B-A withdrawal design	Natural	Delayed	Signaled delay with visual stimulus, functional communication training	Positive	No	100%
Vollmer et al., 1999	Child/Preteen	Inpatient care	Multiple treatment reversal design	Contrived	Delayed	Functional communication training, signaled vs. non-signaled delay	Positive	No	70%
Kelley, 2003	Child/Preteen	Treatment center	Multi-element design, reversal design	Contrived	Delayed	Signaled vs. non-signaled delay	Positive	No	91%
Grey et al., 2009	Child/Preteen	School setting	Changing criterion design	Contrived	Delayed	Signaled delays with visual stimulus + verbal instruction, Concurrent task demands	Positive	No	90%
Lee, 2014	Child/Preteen	Treatment center	Multiple baseline across participants	Contrived	Delayed	Function communication training, fixed time delay, progressive time delay with verbal stimulus, progressive time delay with visual stimulus	Positive	Yes	100%
Chen et al., 2015	Adolescent/young adult	Residential setting	A-B-A withdrawal design	Contrived	Delayed	Signaled delays with verbal prompts vs. Signaled delays with visual stimulus +verbal	Positive	No	100%

						redirection, Token board			
Hong et al., 2015	Child/Preteen	Treatment center	Multiple baseline design with embedded alternating treatment design	Contrived	Delayed	Signaled delays with visual stimulus +verbal redirection vs. Signaled delays with visual and auditory stimuli+verbal redirection	Positive	No	80%
Vessells et al., 2018	Child/Preteen	School setting	Multiple treatment design	Contrived	Delayed	Self-control training, delay fading, signaled delays with visual stimulus	Positive	No	80%
Concurrent Activity Demands									
Dixon & Cummings, 2001	Child/Preteen	Home-based services	Multiple treatment reversal design	Contrived	Delayed	Self-control training (i.e., choice), concurrent activity, progressive delay	Positive	No	67%
Gokey et al., 2013	Child/Preteen	Residential setting + School setting	Multiple treatment design	Contrived	Delayed	Self-control training (i.e., choice), concurrent activity, fixed delay + fading	Positive	No	90%
Ghaemmaghami et al., 2016	Child/Preteen	Treatment center	A-B-A-C withdrawal design	Contrived	Delayed	Functional communication training, TBPD vs. CBPD	Positive	No	90%

Studies listed according to each category with age of participants, setting(s), research design, establishing operations, independent variable, intervention components, results and effectiveness, social validity, and internal validity.

CHAPTER 4

DISCUSSION

This review was conducted in order to evaluate the literature for interventions that have increased waiting behavior with individuals diagnosed with ASD. Studies were extracted from ERIC, APA Pscyhinfo, APA PsychArticles, PubMed, and additional online libraries. A total of seven keywords were systematically paired in order to create a list of search terms. A total of 11 studies met inclusion criteria and were identified from either the initial search or through the examination of included and cited studies. Unfortunately, no previous reviews were identified during the search. The studies that met inclusion criteria had reoccurring similarities in regards to the intervention components (i.e., visual and auditory stimuli, concurrent task demands, progressive time delays, fixed-time delays, functional communication training).

The results of this review indicate that individuals with ASD can be taught to wait for preferred items. In addition, problem behavior can remain at low levels as duration delays are systematically increased. This review identified several intervention components that have had positive effects on increasing waiting. For example, the use of signaled delay cues, with both auditory and visual stimuli, have been found to be successful when individuals are required to wait for a preferred item (Vollmer et al. 1999; Kelley, 2003; Lee, 2014; Vessells et al., 2018; Chen et al., 2015; Hong et al.,2015; Kern et al.,1997; Reichle et al., 2010). Furthermore, increased waiting has been demonstrated when concurrent activities are implemented during the delay (Dixon et al.,1999; Gokey et al., 2013; Ghaemmaghami et al., 2016). Gokey et al. (2013) also demonstrated that concurrent activities can be faded from the delay while maintaining low levels of

problem behavior when reinforcement is delayed. The results of Ghaemmaghami et al.'s (2016) study also suggests that intervening activities are a more effective treatment to increase tolerance for delayed reinforcement while maintaining low levels of challenging behavior.

Results of this review identified a very limited amount of studies that evaluated problem behavior as delays for preferred items were increased. In comparison, a large amount of research has been conducted in the area of self-control that has assessed similar contingencies. The majority of the self-control literature examines the choice an individual makes when given the ability to select a large, delayed reinforcer over a small, immediate reinforcer (e.g., Dixon et al., 1998, Schweitzer & Sulzer-Azaroff, 1988). Results of those studies discuss sensitivity to reinforcement but very rarely implement a behavior intervention to then increase self-control (i.e., waiting). Additionally, an overwhelming large proportion of those studies have been implemented with individuals who are diagnosed with attention deficit hyperactivity disorder (ADHD; Berry, Sweeney, Morath, Odum, & Jordan, 2014; Chantiluke, Christakou, Murphy, Giampiertro, Daly, Ecker, Brammer, Murphy, & Rubia, 2014; Rosch & Mostofsky, 2016; Wilson, Mitchell, Musser, Schimdt, Nigg, 2011; Yu, Sonuga-Barke, & Liu, 2018). Studies have found that children diagnosed with ADHD are likely to discount a larger delayed reinforcer over an immediate smaller reinforcer (Wilson et al., 2001). Additionally, children diagnosed with ADHD are more likely to demonstrate discounting as delay durations increase in comparison to contextual differences (Yu et al., 2018).

An additional study conducted by Chantiluke et al. (2014) assessed discounting in youth diagnosed with ADHD and Autism Spectrum Disorder (ASD). Results indicated

that individuals diagnosed with ASD and individuals diagnosed with both ASD and ADHD (i.e., comorbid diagnoses) demonstrated increased discounting (i.e., impulsivity). There is a lack of these studies being generalized and implemented within the ASD population. Little research has been conducted specifically evaluating discounting and impulsive behaviors in individuals with a single diagnosis of ASD. Many individuals on the autism spectrum engage in impulsive-like behavior and would potentially benefit from an intervention increasing waiting delays for preferred items (Grey et al., 2009). Moreover, there is a need for extended research within the ASD population in order to minimize the research-to-practice gap and increase widespread application.

The results of this review are constrained by the limited number of relevant studies, as well as the lack of social validity measures. Social validity was only measured in one of the 11 included studies. Future research should evaluate social validity in order to further support the quality and results of previous studies. Social validity should be directly measured utilizing questionnaires and rating scales, as well as debriefing formats with indigenous therapists as well as the participant's caregivers. Ecological and social validity should also continue to be examined to determine the preferences of teachers, parents, et cetera, as the effects of autism vary between individuals. Increased social validity measures would increase the potential for wide-spread application and potentially support in decreasing the delay between identifying the target behavior and implementing a function-based intervention.

Implications for Research and Practice

In addition, there is a need for more research in this area in order to establish an empirically validated intervention for increasing waiting in individuals with ASD. Future

research should continue to replicate studies already published as well as expand upon the existing research. It is recommended for future research to directly assess a CBPD, with and without visual stimuli, within the natural environment. Future research should also generalize results across settings, people, and behavior. Future studies should increase their focus on maintenance of skill acquisition by conducting follow-up probe sessions. Lastly, in order to further determine the generality and feasibility of existing research, it is recommended that future research focus on delay fading. Fading the delay and fading stimuli from the intervention increases individuals' independence and SC when preferred items are delayed.

Clinicians could be advised to use the results of the current review to guide their decisions making on how to target waiting and toleration of delayed reinforcement. Clinicians should use methods discussed with this review and individualize said interventions to best suit their clients. It is first recommended that clinicians identify their client's function(s) of problem behavior. Clinicians should then implement functional communication training in order to replace problem behavior with a functional response (e.g., requesting a break, requesting items and activities, etc.). It is recommended that clinicians incorporate signaled delays when reinforcement is delayed. It is also recommended that clinicians provide preferred, high-probability concurrent task demands during the duration of delay. Based on the findings discussed within this review, the use of a signaled delay and concurrent task activities could be an effective treatment package to increase waiting durations and decrease problem behavior associated with delayed reinforcement.

Limitations

Future reviews should use an increased number of online libraries and databases. It is also recommended that databases include professional publications within the field of special education as well as grey literature presented at conferences, colloquia, symposia, etc. A major limitation of current review was the inclusion and exclusion criteria which narrowed the search to a very limited area of research. It is recommended that future inclusion criteria include studies that targeted waiting behavior as a secondary procedure. In addition, the current review did not attempt to reach out to scholars within the field in order to gain information related to their studies and findings. This review has shown that individuals diagnosed with ASD can be taught to discriminate between different schedules of reinforcement when they are required wait. Additionally, this review identified research that demonstrated that individuals diagnosed with ASD can be taught to appropriately wait for extended periods of time.

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APPENDIX A

TABLE DEPICTING THE LIST OF PAIRED KEYWORDS

List of Paired Keywords	
	autism
wait* AND delay	
wait* AND denied	
wait* AND reinforc*	
wait* AND impuls*	
wait* AND discount*	
wait* AND tolerat*	
wait* AND preferred item	
delay* AND denied	
delay* AND reinforc*	
delay* AND impuls*	
delay* AND discount*	
delay* AND tolerat*	
delay* AND preferred item	
denied AND reinforc*	
denied AND impuls*	
denied AND discount*	
denied AND tolerat*	
denied AND preferred item	
reinforc* AND impuls*	
reinforc* AND discount*	
reinforc* AND tolerat*	
reinforc* AND preferred item	
impuls* AND discount*	
impuls* AND tolerat*	
impuls* AND preferred item	
discount* AND tolerat*	
discount* AND preferred item	
tolerat* AND preferred item	

APPENDIX B

QUALITY AND RIGOR CHECKLIST (LEDFORD ET AL., 2018)

Domain	#	Criteria
Rigor	1	Is the design appropriate for answering the research question?
	2	Are there at least three demonstrations of effect at three different points in time, between two adjacent conditions?
		SID: Four adjacent conditions are required to meet this requirement (e.g., B-C-B-C but not A-B-A-C-A-B-C).
		TLI: Concurrent baselines are required to meet this requirement.
		RIA: Five alternations are generally preferred in these designs (e.g., 10 total sessions when comparing two conditions).
	3	Do authors present sufficient evidence for reliability of dependent variables? Generally, this requirement is met if inter-observer agreement data were collected regularly and across conditions and are sufficiently high to increase confidence in results.
	4	Do authors present sufficient evidence for reliability of independent variable implementation? Generally, this requirement is met if data were collected regularly and across conditions, data were collected on independent and control variables, and adherence is sufficiently high to indicate conditions were implemented as planned.
	5	Is there a sufficient amount of data in all primary comparison conditions? A minimum of three is required, but more are needed when data are variable or trends are present; five is not always sufficient.
	6	If applicable, is randomization used to decrease bias? Applicability varies based on design, but generally includes randomization (with and without restrictions) in RIA designs and random assignment to tiers in TLI designs.
Quality/Generality	7	Is the study ecologically valid? Criteria for this item may vary depending on your research question, but may include the use of typical settings, indigenous implementers, and meaningful outcomes.
	8	Is the study socially valid? Criteria for this item may vary depending your research questions, but evidence of social validity include feedback from direct

		consumer (participants), indirect consumers (e.g., parents/teachers of participants), or other stakeholders (e.g., practitioners) and measures less subject to bias are valued more highly.
	9	Does the study adequately assess response and/or stimulus generalization? Generally, assessment in the context of a single case design is preferable; pre/post assessment provide some information but do not allow for experimental evaluations.
	10	Does the study adequately assess maintenance of behaviors in the absence of interventions? Note that we might not expect maintenance of reversible behaviors in the absence of intervention.
Reporting	11	Does the study include all relevant information regarding participant characteristics, condition description, depend variable definitions, and recording procedures?

SDI= sequential introduction and withdrawal designs (e.g., withdrawal, multitreatment)
TLI= time-lagged implementation designs (e.g., multiple baseline, multiple probe designs)
RIA= rapid iterative alternation designs (ATD, AATD)