THE EFFECTS OF USING VISUAL ACTIVITY SCHEDULES FOR INDIVIDUALS WITH AUTISM: A SYSTEMATIC REVIEW

by

EMILY CHATLEN

(Under the Direction of Rachel Cagliani)

ABSTRACT

A systematic review of the literature was conducted for articles published between 2014 and 2020 to evaluate the effects of using visual activity schedules (VAS) for individuals with autism spectrum disorder (ASD). A total of 20 studies met inclusion criteria for the current literature review. Studies included participants ranging from ages 3-19 years old. Studies were conducted across the school, community, clinic, and home settings. All studies utilized a single-case design. Dependent variables were categorized into four skill areas which included behavioral, daily living, vocational, or social skills. Independent variables were coded for VAS type, teaching method, and use of technology. Primary, generalization, and maintenance outcomes were evaluated for quality and rigor utilizing the Single Case Analysis and Review Framework (SCARF; Ledford, Chazin, Lane, Zimmerman & Ayres, 2020). Results suggest that using visual activity schedules for individuals with ASD show high quality evidence of positive effects.

INDEX WORDS: Visual activity schedule, Autism Spectrum Disorder

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DEDICATION

I dedicate this lifetime accomplishment to my mother, father, sister, and brother. I would not have been able to complete this degree without their continuous love and support. It was my mother's advice I could rely on when something tricky arose. It was my father's voice I could listen to in order to calm my nerves. It was my sister's patience that allowed me to vent my anxieties. It was my brother's sense of humor that would erase my stresses. It was all of the phone calls made, text messages sent, and voicemails left by my ever-loving family that encouraged me to finish what I started. Thank you so much.

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LITERATURE REVIEW

Introduction

Individuals with autism spectrum disorder (ASD) display deficits in the areas of social communication and behavior; therefore, the use of various supports is necessary in order for an individual with ASD to make progress on targeted skill areas and become more independent. Visual supports are one type of resource that can be implemented in a variety of settings in order to assist a person with ASD. Visual supports are defined as objects that can be seen and held, which are used to provide information visually to enhance an individual's understanding of the physical environment (Rutherford et al., 2020). Steinbrenner et al. (2020) lists visual supports as an evidence-based intervention practice in the NCAEP Report: Evidence-Based Practices for Children, Youth, and Young Adults with Autism. The report lists 65 articles, published between 1990-2017, which serve as empirical support under the category of visual supports. The studies included participants ages 0-22 years old and targeted a wide variety of outcome areas including communication, social, play, academic, adaptive, behavioral, etc. Based on the NCAEP report, visual supports have evidence of efficacy in promoting positive outcomes for learners with ASD (Steinbrenner et al., 2020).

A published literature review, completed by Rutherford, Baxter, Grayson, Johnston, and O'Hare (2020) provides an overview of relevant research regarding the use of visual supports by families of individuals with ASD in the home setting. The review, focused specifically on the use of visual supports in the home setting, included articles published between 1993 and 2016 with participants ranging in age from 1-44 years old. The review listed the various terminology used

to describe 12 types of visual supports such as visual schedule, activity schedule, written list, etc. Although Rutherford et al. (2020) provided beneficial information related to visual supports being used in the home and community setting, further research is needed to evaluate the use of visual supports in additional settings such as schools and clinics.

One example of a common visual support that can be used for individuals with developmental disabilities are visual activity schedules. Knight, Sartini and Spriggs (2015) define visual activity schedules (VAS) as a sequence of visual cues such as pictures, written words and objects including work systems with visual prompts for instruction of chained tasks. Knight et al. (2015) included articles published between 1993 and 2013 to evaluate the quality of VAS literature using the Horner et al. (2005) criteria for identifying evidence-based practices. From the 31 studies that met inclusion criteria, only 16 met the criteria for "acceptable" standards; therefore, only results from the acceptable studies were included in their findings (Knight et al., 2015). The review included a total of 56 participants with ASD ranging from ages 3-21 years old. The efficacy of VAS was determined using intervention phases only, since generalization and maintenance were not included in all studies. Results determined that VAS were highly effective in 73% of studies, fairly effective in 15%, and questionable for 12%. Although the Knight et al. (2015) provided valuable information about the use of VAS for individuals with ASD, replication and extension of this review is necessary in order to provide the most up-to-date research on the effects of VAS.

Due to advancements in technology, a more current literature review, including studies published from 2013 and beyond is necessary to effectively evaluate the effects of VAS. Out of the 16 studies included in Knight et al. (2015), seven used a VAS that was technology-based. Current examples of technology-based VAS include the use of devices such as iPods, iPads,

tablets, etc., that can be easily accessed across a variety of settings. Structured work systems are another type of visual support that require further evaluation due to lack of inclusion in the Knight et al. (2015) review, specifically, one of 16 studies. Hume, Plavnick, and Odom (2012) described the structured work system as a visually organized area where learners independently practice acquired skills. In accordance with the definition provided by Knight et al. (2015) as well as purposes of the current review, structured work systems have been categorized as a type of VAS. The current literature review will further evaluate the efficacy of structured work systems.

The final extension of the current review will aim to address effects of VAS as it relates to generalization and maintenance of the dependent variable. The current literature review also serves to compare the type of schedules, mode of presentation, and method of teaching the VAS. Therefore, the purpose of the current literature review is to systematically review and synthesize extant literature studying the effects of using visual activity schedules for individuals with a diagnosis of autism spectrum disorder.

Method

Search Procedures

The author conducted a literature search following guidelines recommended by Moher, Liberati, Tetzlaff, Altman, and the PRISMA Group (2009). The author used a list of search terms identical to the terms used in the Knight et. al (2015) literature review. In order to update and expand upon the research of VAS, the author used a multi database search engine to conduct an electronic search of relevant articles published between 2014 and 2020. The author used the following search engines: Educational Research Information Center (ERIC), MEDLine, Academic Search Complete, and Directory of Open Access Journals.

Search Terms

A list of six terms (visual schedule, picture activity schedule, schedule, picture prompts, visual cues, work system) was used in combination with four descriptors of the population (Autis*, ASD, Aspergers, PDD). The terms used mirror the search terms in Knight et al. (2015).

Inclusion and Exclusion Criteria

For inclusion in the review, articles were examined against the following inclusion criteria: (1) published in a peer reviewed journal, (2) published in English, (3) focused on intervention practice, (4) intervention practices had to generate behavioral, developmental, academic, vocational, or social/communication outcomes, (5) study design used a single case design that included a graph or visual analysis of data, (6) participant had a diagnosis or eligibility of ASD, Asperger syndrome, pervasive developmental disorder (PDD), pervasive developmental disorder-not otherwise specified (PDD-NOS), or high-functioning autism (HFA).

Studies were excluded from the review if: (1) article was not peer-reviewed, (2) published in a non-English journal, (3) studies only reported medical and/or health outcomes, (4) study design was a group design or meta-analysis, (5) participants were identified as "at risk for autism" or diagnosed as having an "intellectual disability."

Search Results

After removing duplicates, the initial search provided 1,665 studies. An initial abstract and title review resulted in 54 potential eligible articles. The full text screening excluded 34 articles with a remaining 20 articles meeting inclusion criteria. The final search resulted in a total of 20 articles included in the review. Figure 1 displays the literature search process in a flow diagram as recommended by Moher et al. (2019).

Coding Procedures

The author coded descriptive characteristics of all included studies, which included 31 variables. The coding template included participants, settings, method, independent variables, dependent variables, results, generalization and maintenance characteristics.

Participant and Setting Characteristics

Participant characteristics included gender, age, diagnosis and/or eligibility. When coding participants' ages, authors used the following categories: between 0 to 5 years old, 6 to 10 years old, 11 to 17 years old, and 18+ years old. Participants had to have a diagnosis or eligibility of one of the following disorders: autism spectrum disorder (ASD), Asperger, pervasive developmental disorder (PDD), dervasive developmental disorder-not otherwise specified (PDD-NOS), or multiple diagnoses. Experimental setting characteristics included school, community, clinic, and home.

Study Characteristics

Study characteristics included single-case design, independent variables, VAS types (e.g. photographic schedule) instructional methods, and recorded the use of technology. The experimental design was coded based on what type of single case design was used in the study and whether or not the study included measures of fidelity and validity. Social and ecological validity is measured by ratings via interviews, questionnaires, or surveys. Single case design categories included: multiple baseline design, multiple probe design, alternating treatment design, or reversal design. Multiple baseline and probe designs were conducted across participants, settings, or routines. Independent variables focused on VAS type and teaching method. Additionally, studies were coded based on whether or not the visual activity schedule included the use of technology.

Study Outcomes

Study outcomes were coded for dependent variables, results, generalization, maintenance, and overall quality and rigor. Dependent variables outcomes/effects were coded based on the following categories: behavioral, academic, daily living, vocational, social skills. Results were coded to show the number of participants who showed positive effects related to the VAS over the total number of participants in each study (e.g. 1/3 increased independent playground behaviors). Participants who showed positive effects were determined from a visual analysis of the data and at least three demonstrations of effect. The Single Case Analysis and Review Framework (SCARF; Ledford, Chazin, Lane, Zimmerman & Ayres, 2020). were used to determine study outcomes and overall quality and rigor. Study outcomes include the results of the SCARF (Ledford et al., 2020) assessment in the following categories: generalization, maintenance, and overall quality and rigor. Studies receive scores for 13 characteristics in three domains. The three domains include: rigor, quality of measurement, and outcomes (Ledford et al., 2020). The first domain, rigor, includes assessment of dependent variable reliability, independent variable reliability, and sufficiency of data. The second domain, quality of measurement, includes assessment of social validity, description of participants and condition, and measurement. In the third domain, outcomes, reviewers assess outcomes in the following categories: primary, maintained, and generalized outcome (Zimmerman & Ledford, 2017).

When coding for the first domain, rigor, the first three components are regarding believability and sufficiency of the dependent variables, procedures, and fidelity. These three components are also most highly weighted when assessing SCARF outcomes (Zimmerman & Ledford, 2017). Reliability, fidelity, and data are the three areas that make up the first section: rigor. The second section, quality of breadth of measurement, includes seven components

regarding author descriptions necessary to replicate the study, presence of social validity indicators, and measurement of response of stimulus generalization (Zimmerman & Ledford, 2017).

The final section, outcomes, are regarding the primary, generalization, and maintenance outcomes. The evaluations are given a score on a one to four-point scale (Gast & Ledford, 2014). The scores are coded by the researcher based on a visual analysis of the data. In regard to scoring, a four is scored if there are at least three demonstrations and no weak effects or non-effects. A score of three indicates at least three demonstrations and no non-effects. A score of two indicates at least three demonstrations but at least one non-effect. A score of one is fewer than three demonstrations, with one non-effect. A score of zero shows at least one demonstration of no behavior change. Primary outcomes also include the measurement for overall quality and rigor of the study which can be represented by the following formula: [2 x (average rigor score) + (average quality and breadth of measurement score)] / 3 (Gast & Ledford, 2014). The overall quality and rigor score also fall on a one to four-point scale. After coding for quality and rigor, a visual analysis of the data is presented.

Interobserver Agreement

A second graduate student coded 20% (n=4) of included articles using the participant, setting, characteristics, and outcome coding procedures described above. There was a total of 31 variables coded per study. Interobserver agreement was calculated by diving agreements by the number of agreements plus disagreements and multiplying by 100. The coding procedure completed by the second graduate student resulted in a 97.58% overall interobserver agreements for participant, setting, study characteristics and study outcomes.

Results

According to the inclusion criteria, a total of 20 studies were deemed eligible for data extraction and coding. Figure 1 displays the PRISMA diagram search process. Each study was then assessed for quality and rigor utilizing SCARF (Ledford et al., 2020). There were two articles that were not included in the quality and rigor assessment results due to less than three demonstrations of effect presented. In the following sections, the results of study variables as well as measures of quality and rigor are presented.

Participant and Setting Characteristics

Overall, 55 participants were included in the review (See Table 1). Participants included female (n=14) and male (n=41) individuals with the majority of individuals being male (74.55%). The majority of participants were less than 10 with 38.18% in the 0-5 range and 45.66% in the 6-10 age range. Six participants ranged in ages 11-17 (10.91%) and three participants were 18 years of age or older (5.45%). Overall, participants ranged in age from 3 years old to 19 years old with the majority of participants falling below the age of 11 (84%). The review included participants diagnosed with ASD (n=53), PDD-NOS (n= 1), or multiple disabilities (n= 1). In Kucharczyk (2019), the single participant coded for multiple disabilities was diagnosed with ASD as well as vision impairment. There were four different settings that were used within the studies. Thirty-seven studies were conducted in the school setting (67.27%). Thirteen studies were conducted in the clinical setting (23.64%). Two studies were conducted in the community setting (3.64%). Three studies were conducted in the home setting (5.45%). Cheung (2016) was conducted across two settings, but because the intervention took place in the school setting, while generalization probes were conducted in the community setting, the study was coded to represent the school setting.

Study Characteristics

Study characteristics included design, independent variable, use of technology, and teaching methods (See Table 2). Study designs used included reversal, adapted alternating treatment design (AATD), multiple probe across settings, multiple probe across participants, multiple baseline across participants, and multiple baseline across routines. Due to the Giles (2017) inclusion of multiple designs which included both AATD and multiple baseline across participants, a total of 21 designs were coded. There was a total of five reversal designs (23.81%), three AATD (13.29%), one multiple probe across setting (4.76%), four multiple probe across participants (19.05%), six multiple baseline across participants (28.57%), and two multiple baseline across routines (9.52%).

Independent variables, otherwise known as VAS type, were divided into four categories: text-based activity schedule, photographic/pictorial activity schedule, video-enhanced activity schedule, and structured work system. Due to the Burckley (2015) inclusion of two VAS types, photographic and video-enhanced activity schedules, a total of 21 VAS types were coded. Photographic/pictorial activity schedules were used in thirteen studies (61.90%), text-based activity schedules were used in two studies (9.52%), video activity schedules were used in three studies (14.29%), and structured work systems were used in three studies (14.29%). Therefore, the majority of studies used a photographic activity schedule as the independent variable. Independent variables were also coded to include information related to the use of technology. There were a total of ten studies that used technology and ten studies that did not. Therefore, the use of technology related to the independent variables was seen in 50% of included studies.

The final characteristics coded included the teaching methods used in each study. Teaching methods used included graduated guidance, manual guidance, least-to-most (LTM)

prompting, most-to-least (MTL) prompting, total task, forward chaining, and non-specified cues/prompts. Giles (2017) included total task and MTL prompting procedures, therefore, teaching methods were coded out of a total of 21. Five studies used graduated guidance (23.81%), two studies used manual guidance (9.52%), six studies used LTM (28.57%), one study used MTL (4.76%), one study used total task (4.76%), one study used forward chaining procedures (4.76%), and five studies used non-specified cues/prompts (23.81%).

Study Outcomes

Study outcomes included dependent variables, results, and outcome evaluations (See Table 3). Dependent variables were coded based on four categories: behavioral, daily living, social skills, or vocational. There were a total of eight dependent variables related to behavior (40%), seven DVs related to social skills (35%), four DVs related to daily living (20%), and one DV related to vocational skills (5%). Therefore, the majority of dependent variables targeted behavioral and social skills.

Study results are displayed by coding the number of participants that showed positive effects related to the intervention over the number of total participants included in the study (i.e. 3/3 increased independent playground behavior). Based on the author's report of results, visual analysis of data, and outcomes of the SCARF (Ledford et al., 2020) evaluations, out of the total 55 participants included, 47 participants displayed positive effects related to the intervention. VAS led to improvements in daily living, vocational, and social skills for 85.45% of participants.

Outcomes evaluations are divided into three categories: primary, generalization, and maintenance. Each design was evaluated separately; therefore, some studies display multiple scores related to SCARF evaluations. There was a total of three studies that contain more than one 'design': Gadiare (2018), Gadaire (2020), and Jiminez (2020). The studies identified

previously are all reversal designs; therefore, they require multiple evaluation on SCARF. The other two reversal designs included in the evaluation, Judge (2015) and Sanches (2018), included only one participant; therefore, it only requires one evaluation related to outcome, quality, and rigor. The studies with multiple design scores are divided by a comma (i.e. 1,1,1). There was a total of 25 designs for each primary, generalization, and maintenance outcomes.

Quality and Rigor Assessment

A total of 18 articles, including 24 experiments and 48 participants, were included in the SCARF (Ledford et al., 2020) evaluation. The Danveshar (2019) and Beaver (2017) studies were left out of the SCARF coding process due to limited demonstrations of effect. The results of the overall study quality and rigor can be seen in Figure 2. These are the results for primary data measurement of the included studies. The upper right quadrant indicates studies with high quality evidence of positive effects (n=15). The lower right quadrant indicates studies with high quality evidence of minimal or negative effects (n=8). The lower left quadrant indicates studies with low quality evidence of minimal or negative effects (n=1). The upper, left quadrant indicates studies with low quality evidence of positive effects (n=0). When visually analyzing the data in the upper right quadrant, the author can see that positive effects exist with high quality evidence; therefore, the outcomes can be read with confidence. When viewing data in the lower right quadrant, data show high quality of evidence with minimal or negative effects; therefore, although there is high quality of evidence, there are some limitations. The single study in the lower left quadrant, Sanches (2018), displays low quality and rigor; therefore, the results should be accepted with minimal confidence. Overall, out of the 24 included studies, the majority of studies were deemed to have high quality evidence of positive effects (62.5%). The results of generalized and maintained outcomes can be seen in Figure 3.

Discussion

The purpose of this literature review was to determine the effects of using VAS for individuals with ASD. The current review included 20 peer-reviewed articles. From the included articles, a total of 24 experiments were evaluated for characteristics, results, quality and rigor. Overall, the age of participants diagnosed with ASD ranged from three to 19 years old with the majority of participants falling under the age of 11. The majority of studies took place in the school setting (67.27%). The most used VAS type involved photographic and/or pictorial activity schedules. The majority of dependent variables measured skills in the areas of behavior and social skills. Study outcomes reported that 47 out of 55 participants showed positive effects related to the VAS intervention. In conclusion, results of the current literature review suggest that visual activity schedules, both technology and non-technology based, have a positive effect across a variety of skill sets for individuals with ASD.

The findings of the current literature review corroborate the results of the Knight et al. (2015) review due to the majority of participants displaying positive effects through the use of VAS. Knight et al. (2015) reported that VAS were highly effective in 73% of studies. The current literature review reported high quality evidence of positive effects in 62.5% of studies. Based on these results, the use of VAS for individuals with ASD shows a positive effect. The current review reported results of the effect of VAS based on primary outcomes as well as generalization and maintenance outcomes while the Knight et al. (2015) review only evaluated intervention effects. In the Knight et al. (2015) review, VAS types which included the use of technology was coded in seven out of 16 studies while the current review included 10 out of 20 studies. The current review also evaluated three studies that utilized structured work systems while the Knight et al. (2015) review only included the use of one structured work system.

Although the reviews differ in regard to how effects were measured and what types of VAS were included, both reviews display strong evidence that the use of VAS has positive effects for individuals with ASD.

Future Research

Future studies should address the limitations to participants and setting. The majority of participants fell below the age of 11 (84%). Participants ages 11-17 made up 10.91% while participants 18 years of age or older made up 5.45%. Therefore, future research is needed in order to examine the effects of VAS for adolescents and adults with ASD. In addition, many of the studies did not report formal test results of the participants (e.g., IQ). Future studies should report on differing severity levels of participant diagnosis or disability in order to further examine the effects of VAS. The majority of studies were conducted in a school setting (67.27%) and clinical setting (23.64%). Therefore, the findings from the current literature review expand upon Rutherford et al. (2020) results which focused on the home and community settings, but future research may be needed in order evaluate the efficacy of VAS as it relates to setting. Future research is also needed in order to compare the effects of technology and non-technology VAS. Although the current literature review reports on both types of VAS, future research is needed to further compare the decision to use technology or not when implementing VAS.

Limitations

Although 15 out of 20 studies included in this literature review were deemed to show high quality evidence, some limitations do exist. Search terms may not have resulted in a comprehensive list of experiments. The search terms used, identical to the Knight et al. (2015) review, included various terminology related to VAS such as picture activity schedule, schedule, and picture prompts, but due to specific selection of terms, the current review may not be fully

comprehensive. For example, the search did not include the terms photographic schedule or pictorial schedule. The final limitations of the current literature review are reports of fidelity and social and ecological validity. From the 20 included studies, 13 studies reported data related to fidelity of implementation. Ten studies reported data related to social and ecological validity. Future research reviews will want to report on studies that include fidelity and social validity in order to lower the risk of bias and determine if outcomes were socially significant.

Table 1

Participant and Setting Characteristics

Characteristics	N	%
Gender		
Female	14	25.45%
Male	41	74.55%
Age		
0-5	21	38.18%
6-10	25	45.45%
11-17	6	10.91%
18+	3	5.45%
Diagnosis/Eligibility		
ASD	53	96.36%
PDD-NOS	1	1.82%
Multiple	1	1.82%
Setting		
School	37	67.27%
Community	2	3.64%
Clinic	13	23.64%
Home	3	5.45%

Note. N= 55. ASD= Autism Spectrum Disorder, PDD-NOS= Pervasive Developmental Disorder Not Otherwise Specified

Table 2

Study Characteristics

Citation	Study Design	IV (VAS Type)	Use of Technology		Teaching Method
			Yes	No	
Akers (2016)	multiple baseline across participants	Photographic activity schedule		x	Graduated guidance
Akers (2018)	multiple baseline across participants	Activity schedule with embedded scripts		x	Graduated guidance
Beaver (2017)	adapted alternating treatment design	Text-based activity schedule on iPod touch	x		Manual guidance
Broadhead (2018)	multiple baseline across participants	Activity schedule on Keynote App	x		Manual guidance
Burckley (2015)	multiple probe across settings	Book Creator™ software on iPad2™	x		Verbal cue followed by prompting procedures
Cheung (2016)	multiple baseline across participants	Activity schedule on iPhone	x		LTM prompt hierarchy
Daneshvar (2019)	adapted alternating treatment design	Photo activity program		x	Forward chaining procedure
Gadaire (2018)	ABAB reversal design	Pictorial activity schedule		x	LTM prompt hierarchy
Gadaire (2020)	ABAB reversal design	Photographic activity schedule		x	LTM prompt hierarchy
Giles (2017)	multiple baseline across participants/ AATD	Book-based & tablet-based picture activity schedule	x		Total task chaining and MTL prompting
Goldman (2018)	multiple baseline across routines	visual schedule		x	LTM prompt hierarchy
Hu (2019)	multiple probe across participants	Individual work systems		x	LTM prompt hierarchy (no physical prompts)
Jiminez (2020)	ABCABC reversal	wearable activity schedule (Octopus watch)	x		device prompts
Judge (2015)	ABAB reversal design	computer based fitness schedule (CBFS)	x		verbal prompts, praise, feedback
Kucharczyk (2019)	multiple baseline across routines	parent-implemented structured work system		x	CTD; prompt hierarchy

Kurkcuoglu (2015)	multiple probe across participants	computer-assisted activity schedule	x		Graduated guidance
Ledbetter (2020)	multiple probe across participants	video-enhanced activity schedule	x		prompts (no specific hierarchy)
O'Hara (2014)	multiple baseline across participants	structured work system		x	Graduated guidance
Sanches (2018)	A-B1-B2-A	picture activity schedule		x	LTM prompt hierarchy
Torres (2018)	multiple probe across participants	video-enhanced schedule on iPad	x		Graduated guidance

Table 3

Study Outcomes

Citation	DV	Results	Outcome Evaluations		
			Primary	Generalization	Maintenance
Akers (2016)	SS	3/3 increased independent playground bx	3	0	4
Akers (2018)	SS	3/3 increased hide and seek bx	3	0	4
Beaver (2017)	B	3/3 increased independent schedule completion	n/a	n/a	n/a
Broadhead (2018)	B	3/3 increased varied application use	3	0	0
Burckley (2015)	DL	1/1 increased independent shopping skills	1	2	2
Cheung (2016)	DL	2/2 increased % of steps preformed correctly	1	3	3
Daneshvar (2019)	SS	3/4 increased social skills	n/a	n/a	n/a
Gadaire (2018)	SS	3/3 increased peer play skills	1, 1, 1	0, 0, 0	0, 0, 0
Gadaire (2020)	SS	4/4 increased peer play skills	0, 3, 2, 2	0, 0, 0, 0	0, 0, 0, 0
Giles (2017)	B	3/3 increased number of ind. correct responses	3	0	4
Goldman (2018)	B	1/2 increased independent transitions	2	0	3
Hu (2019)	B	3/3 increased task engagement	4	0	4
Jiminez (2020)	B	1/3 increased independence	2, 2, 0	0, 0, 0	0, 0, 0
Judge (2015)	DL	1/1 increased independent transitions	3	0	0
Kucharczyk (2019)	DL	1/1 increased independence across routine	4	3	4
Kurkcuoglu (2015)	SS	3/4 increase role-play skills	3	2	3
Ledbetter (2020)	B	4/5 increased % of TA steps completed	3	2	2
O'Hara (2014)	SS	2/3 increased % engaged at recess	3	0	0
Sanches (2018)	V	0/1 increased completion of TA	1	0	0
Torres (2018)	B	3/3 increased schedule-following & on-task bx	4	4	4

Note. B= Behavioral, DL= Daily Living, SS= Social Skills, V= Vocational

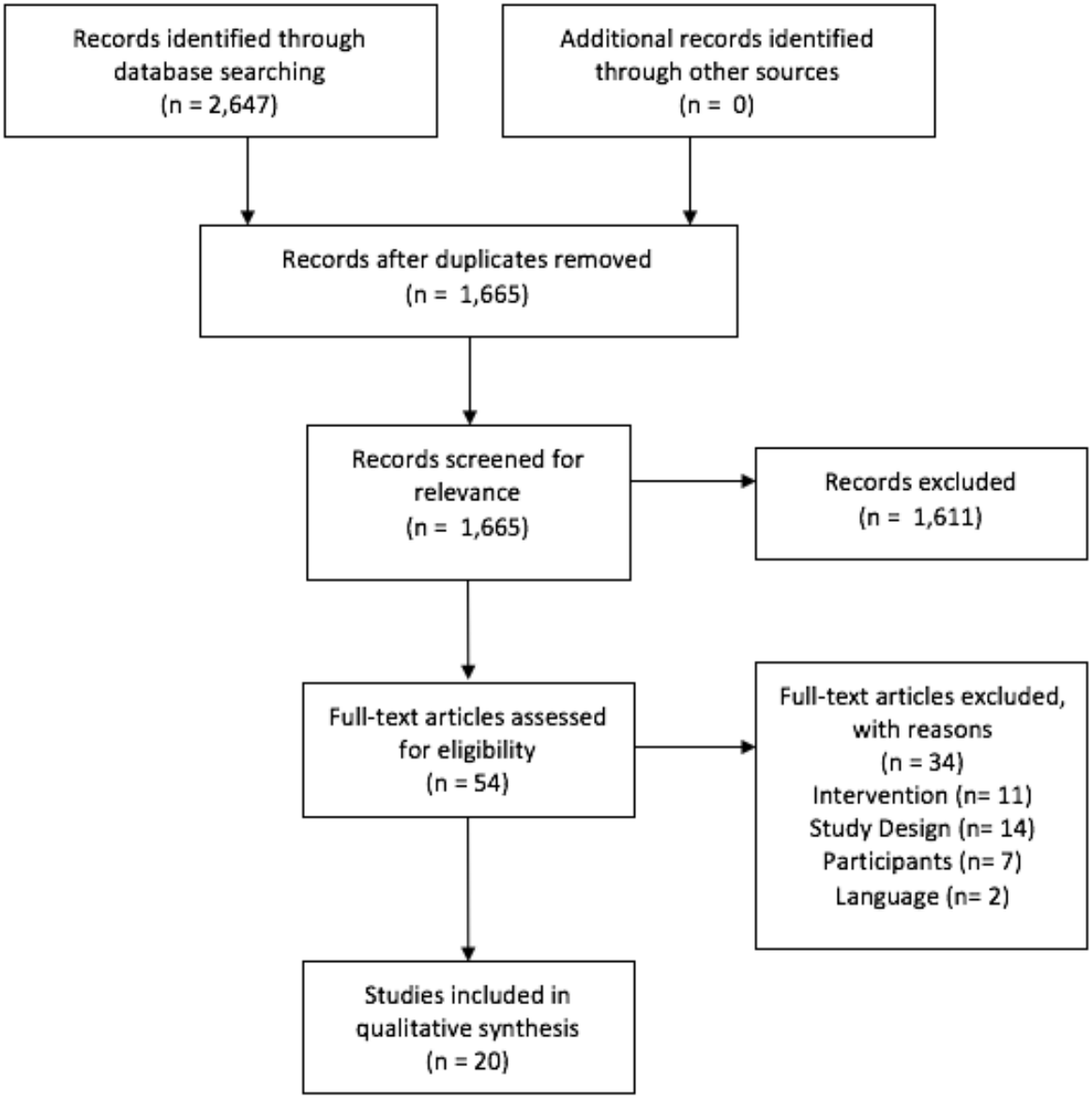

Figure 1. PRISMA diagram showing search process

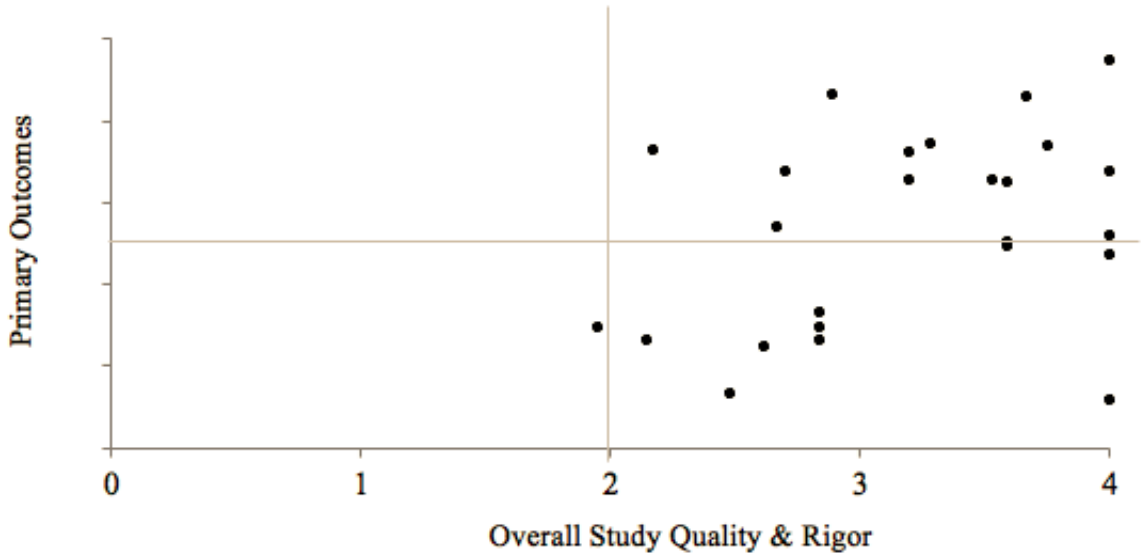

Figure 2. Primary outcomes for each study

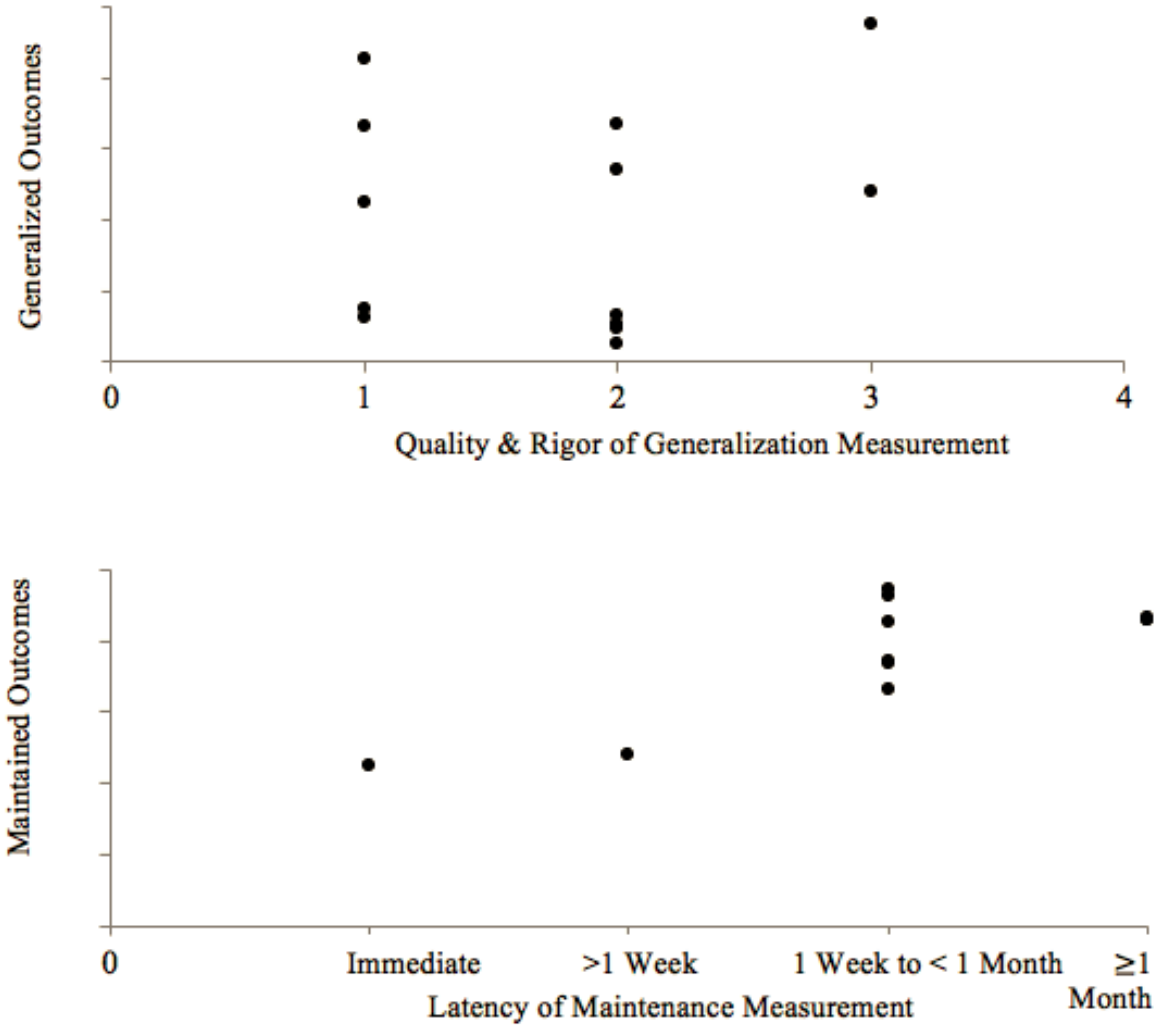

Figure 3. Generalized (upper panel) and maintained (lower panel) outcomes for each study

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