Case Study 1: An Evidence-Based Practice Review Report

Theme: School (setting) based interventions for children with special educational needs (SEN)

How effective are joint attention interventions in children aged eighteen months to five years with a diagnosis of Autism Spectrum Disorder?

Summary

Joint attention involves two or more individuals coordinating their attention to the same thing (Baldwin, 1995), and has been found to be a deficit in children with Autism Spectrum Disorder (ASD) (Meindl & Cannella-Malone, 2011). Such abilities are strongly associated with language (Scaife & Bruner, 1975) and social development (Kim & Mundy, 2012). Consequently, they are pertinent to address in the preschool years and of significant relevance to Educational Psychologists (EPs) as early intervention has been found to improve social-communication outcomes for children with ASD (Howard et al., 2005; McEachin, Smith & Lovaas, 1993; Sallows & Graupner, 2005).

This systematic literature review explored the effectiveness of joint attention interventions in preschool aged children (2-5 years old) with ASD. A literature search identified a total of ten studies which were critically appraised using Gough's (2007) Weight of Evidence Framework. Six studies were given medium weightings and four received low ratings. Findings revealed a mix of small, medium and large effect sizes.

Overall, findings indicate a positive effect of intervention on joint attention, however weaknesses were identified in study methodologies. As such, future research may wish to address the limitations discussed in this review. For

example, whether joint attention improvements are maintained and if interventions are also effective in a UK setting.

Introduction

Joint attention and impairments in ASD

Joint attention has been defined as "simultaneous engagement of two or more individuals in mental focus on one and the same external thing." (Baldwin, 1995, p. 132). This coordinated attention can be initiated by verbal means or through gaze, gestures or sounds. Joint attention behaviours typically develop from the ages of six to twelve months (Charman, 2003). Joint attention is a key area of social-communication skills deficits found in children with ASD (Mundy, 1995), with difficulties being found in both responding to joint attention attempts from others and initiating joint attention (Meindl & Cannella-Malone, 2011).

Research has shown joint attention plays a significant role in the development of language in children (Scaife & Bruner, 1975) and is regarded as central to social-cognitive development in children (Kim & Mundy, 2012). Therefore, deficits in joint attention skills pose a notable barrier to children with ASD in their abilities to learn language (Mundy et al., 1990) and socially communicate with others (Sigman & Ruskin, 1999). As a result, interventions have been developed to address these deficits.

Such interventions vary in their method and approach (Murza et al., 2016), the aspect of joint attention they target (responses and initiations

simultaneously or separately) and the intervention agent they use (such as parents or peers) (Meindl & Cannella-Malone, 2011).

Joint attention Interventions and Psychological basis

Most joint attention interventions are carried out in a play context (White et al., 2011), as this is a natural context for young children and one which has been shown to be a crucial medium for learning (Broadhead et al., 2010). Moreover, developing skills in a play setting may lead to increased generalisation of skill development to other settings where children play such as home and school (White et al., 2011).

Interventions in this area tend to adopt a developmental approach which specifically tailors the intervention to the child's current level of development, in line with Vygotsky's zone of proximal development (1978) which the intervention aims to work within.

To create change in joint attention, interventions often adopt strategies relating to a behaviourist approach using reinforcement to increase the desired behaviour. The use of discrete trial training is also common (White et al., 2011) and involves an individual receiving positive reinforcement such as a reward for jointly attending to an appropriate prompt. In this way, individuals learn to differentiate between instances which should elicit joint attention and those that should not. Joint attention interventions by their nature must involve a communication partner, such as a parent, sibling or peer. Many interventions chose a communication partner who is familiar to

the child or present in their natural home setting as this enables joint attention skills to be practised beyond the intervention sessions (White et al., 2011).

Rationale and Relevance

While a systematic review of joint attention interventions for children with ASD was conducted in 2016 (Murza et al.), this review included studies of children from eighteen months to eight years old. Therefore, this review aims to not only update this previous review but to look at a more specific age range of two-five year olds (preschool age) with the hope of ascertaining whether early intervention in joint attention is effective. Moreover, Muzra et al.'s (2016) review concluded that while joint attention interventions appear effective for this population it is unclear for whom such interventions are more or less effective for. Exploring the narrower age range of the preschool years enables this to be investigated.

This area is also of particular importance for EPs as early interventions can be cost effective by reducing the support and intervention those with ASD need later in life (Jacobson et al., 1998) and increasing "the likelihood of improved long-term outcomes" for children with ASD (Koegel et al., 2014, p. 52). Such early intervention has been associated with significant reductions in ASD symptoms and improved outcomes (Howard et al., 2005; McEachin, Smith & Lovaas, 1993; Sallows & Graupner, 2005). This may be due to the brain being primed to learn social skills in the early years, meaning early

intervention facilitates the further development of these skills later in a child's life (Franz & Dawson, 2019).

Furthermore, as there is an increasing number of children being diagnosed with ASD (Roman-Urrestarazu et al., 2021), the pressure on educational settings to use interventions which have been shown to be successful in this group has increased (Ali & Frederickson, 2006). Therefore, it is crucially relevant for EPs to know joint attention interventions for those with ASD are effective and evidence-based (Greenway, 2000) to appropriately and successfully support settings catering for these individuals.

Review Question:

How effective are joint attention interventions in children aged eighteen months to five years with a diagnosis of Autism Spectrum Disorder?

Critical Review of the Evidence

Literature Search and Screening

Literature searches were conducted on the 19th December 2021 using the online databases: PsycINFO (Ovid), Education Resource Information Centre (ERIC, EBSCO) and Web of Science (EBSCO). The search terms for this literature search are shown in table 1. The search term "Bucket time" was used as this is a named attention intervention for ASD which is part of the Attention Autism approach developed by Gina Davies (n.d.).

The search returned 119 text results (PsycINFO, 35; ERIC, 15; Web of Science, 69), of which 56 were removed as duplicates. The remaining 63

were then screened (titles and abstracts) based on the inclusion and exclusion criteria (Table 2) which led to 38 studies being excluded from the review. For the remaining 25, full text screening was conducted with 15 of these studies being excluded (Appendix A). Figure 1 shows a flow diagram to illustrate this process. Table 3 lists the final 10 studies included in the review; with a summary of the key characteristic of these studies provided in Appendix B.

Table 1

Literature search terms

Intervention	Participants	Outcome measure
"Attention Autism" OR "Bucket time" OR "Attention training" OR "Attention intervention"	"ASD" OR "autism" OR "autis* spectrum disorder*"	"Joint attention" OR "Shared attention"

Note. Quotation marks were used to ensure all words in the phrase are included. An Asterix symbol enables truncated words with alternative endings to be searched for. Each column was combined with 'AND'.

Table 2

Inclusion and Exclusion Criteria

	Factor	Inclusion Criteria	Exclusion Criteria	Rationale
1	Participants	All participants aged 18 months to 5 years	Some or all participants aged 0-17 months, or older than 5 years	This review is looking at outcomes for children aged 18 months to 5 years.
2	Diagnosis	All participants have a diagnosis of Autism Spectrum Disorder	Some or all participants do not have a formal Autism Spectrum Disorder diagnosis or have a diagnosis other than Autism Spectrum Disorder e.g. Attention deficit hyperactivity disorder	This review is looking at outcomes for children with a diagnosis of Autism Spectrum Disorder.
3	Type of Intervention	Includes Joint Attention components	Interventions not including Joint Attention components	This review is specifically looking at the effectiveness of Attention interventions.

	Factor	Inclusion Criteria	Exclusion Criteria	Rationale
4	Methodology	Quantitative methodology	Qualitative methodology	This review is looking to explore the effectiveness of Attention interventions & quantitative methodology is most appropriate for this purpose.
5	Type of publication	Articles from peer reviewed journals	Articles published in non-peer reviewed journals e.g. theses or dissertations	Studies that have been peer-reviewed have received higher levels of inspection and therefore seen as higher quality research.
6	Location	Organisation for Economic Co-operation and	Countries not members of the Organisation for Economic Co-	To be able to generalise findings to

	Factor	Inclusion Criteria	Exclusion Criteria	Rationale
		Development member countries	operation and Development	countries similar to the UK.
7	Outcome	Joint attention outcomes are reported	Joint attention outcomes are not reported (e.g. focus on spontaneous communication)	This review question is considering the effectiveness of Attention interventions on joint attention.
8	Language	Written in English	Not written in English	The author is monolingual and time/ cost restraints do not allow for translation.

Figure 1

Flow Chart of the Literature Search

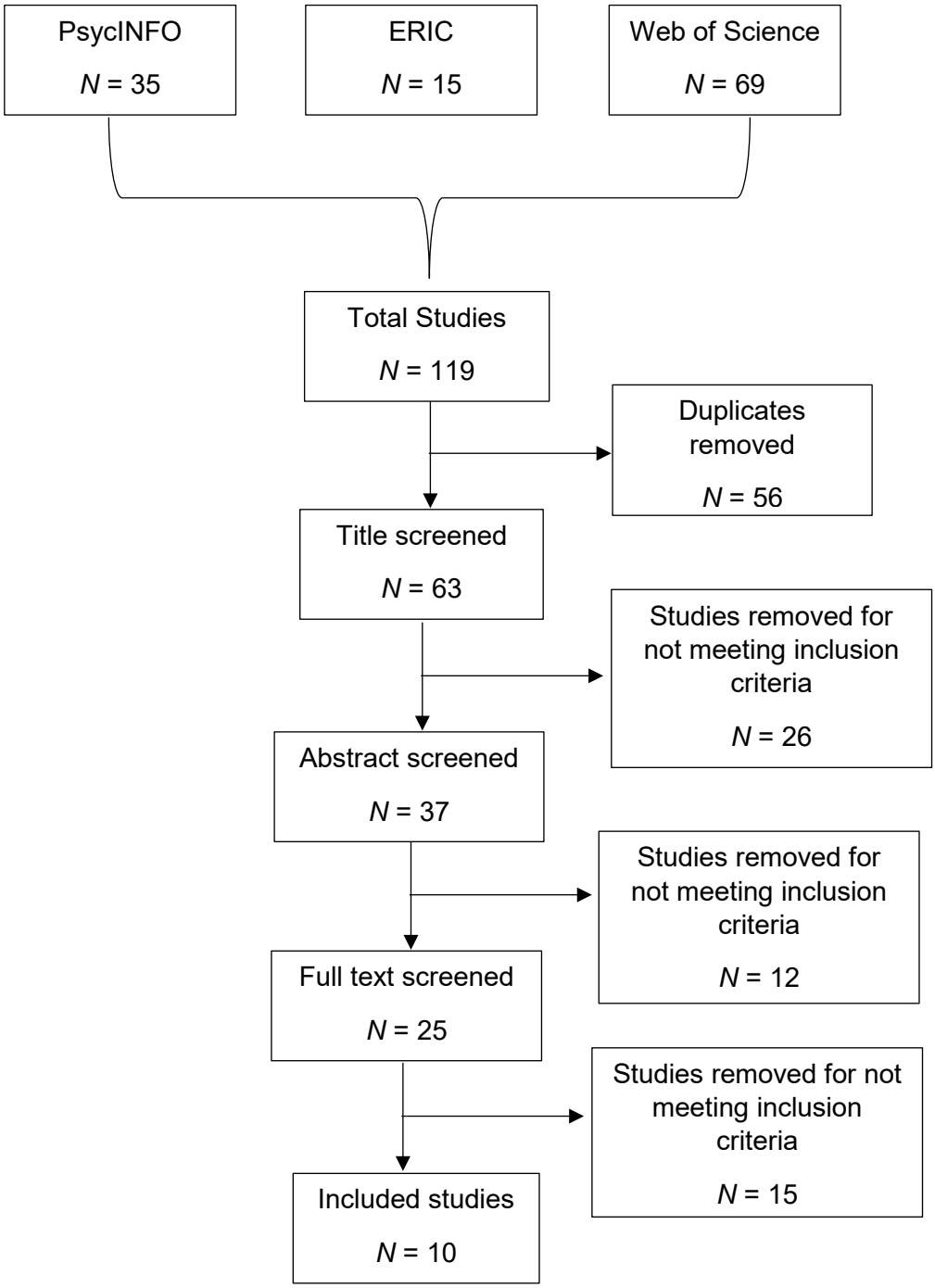

Table 3

Final List of Studies included

	Reference
1	Boyd, B., Watson, L., Reszka, S., Sideris, J., Alessandri, M. & Baranek, G. (2018). Efficacy of the ASAP Intervention for Preschoolers with ASD: A Cluster Randomized Controlled Trial. *Journal of Autism and Developmental Disorders, 48*(9), 3144-3162.
2	Gulsrud, A., Kasari, C., Freeman, S. & Paparella, T. (2007). Children with autism's response to novel stimuli while participating in interventions targeting joint attention or symbolic play skills. *Autism, 11*(6), 535-546.
3	Kasari, C., Freeman, S. & Paparella, T. (2006). Joint attention and symbolic play in young children with autism: a randomized controlled intervention study. *Journal of Child Psychology and Psychiatry, 47*(6), 611-620.
4	Kasari, C., Gulsrud, A., Wong, C., Kwon, S. & Locke, J. (2010). Randomized Controlled Caregiver Mediated Joint Engagement Intervention for Toddlers with Autism. *Journal of Autism and Developmental Disorders, 40*, 1045-1056.

	Reference
5	Kasari, C., Gulsrud, A., Paparella, T., Hellemann, G. & Berry, K. (2015). Randomized Comparative Efficacy Study of Parent-Mediated Interventions for Toddlers With Autism. *Journal of Consulting and Clinical Psychology, 83*(3), 554-563.
6	Lawton, K. & Kasari, C. (2012). Brief Report: Longitudinal Improvements in the Quality of Joint Attention in Preschool Children with Autism. *Journal of Autism and Developmental Disorders, 42,* 307-312.
7	Lawton, K. & Kasari, C. (2012). Teacher-Implemented Joint Attention Intervention: Pilot Randomized Controlled Study for Preschoolers With Autism. *Journal of Consulting and Clinical Psychology, 80*(4), 687-693.
8	Rocha, M., Schreibman, L. & Stahmer, A. (2007). Effectiveness of Training Parents to Teach Joint Attention in Children With Autism. *Journal of Early Intervention, 29*(2), 154-172.
9	Whalen, C. & Schreibman, L. (2003). Joint attention training for children with autism using behaviour modification procedures. *Journal of Child Psychology and Psychiatry, 44*(3), 456-468.
10	Zheng, Z., Nie, Guangtao., Swanson, A., Weitlauf, A., Warren, Z. & Sarkar, N. (2020). A Randomized Controlled Trial of an Intelligent Robotic Response to Joint Attention Intervention System. *Journal of Autism and Developmental Disorders, 50*, 2819-2831.

Weight of Evidence

The Weight of Evidence Framework (Gough, 2007) was used to critically appraise the quality and relevance of each study included in the review across three dimensions. WoE A measured the methodological quality of each study in relation to quality standards for studies of that design. An amended version of the group design coding protocol (Kratochwill, 2003) was used for eight studies, and the single-case design protocol by Horner et al. (2005) for the other two studies. The amendments and rationale are detailed in Appendix C (Table 1). An example of a completed coding protocol for one group design study and one single-case design study can be found in Appendices D and E.

WoE B assessed the methodological relevance of each study based on the appropriateness of the chosen design for addressing review questions regarding effectiveness. Criteria were based on the Petticrew and Roberts' (2003) Hierarchy of Evidence. WoE C measured the relevance of the focus of study to the review question. WoE A-C were averaged for each study to give an overall Weight of Evidence D (WoE D). Additional information on how WoE A-C were calculated is found in Appendix C. Table 4 shows WoE A-D for all ten studies.

Table 4

Overall Weight of Evidence Ratings

Study	WoE A	WoE B	WoE C	WoE D
Boyd et al. (2018)	2.3	2	2.4	2.2 (Medium)

Study	WoE A	WoE B	WoE C	WoE D
Gulsrud et al. (2007)	1.6	1	2.2	1.6 (Low)
Kasari et al. (2006)	2.3	2	2.2	2.2 (Medium)
Kasari et al. (2010)	1.7	3	2	2.2 (Medium)
Kasari et al. (2015)	2	1	1.8	1.6 (Low)
Lawton & Kasari (2012a)	1.9	3	2.2	2.4 (Medium)
Lawton & Kasari (2012b)	2.7	2	2.4	2.4 (Medium)
Rocha et al. (2007)	2.7	0	2	1.6 (Low)
Whalen et al. (2003)	2.6	0	2	1.5 (Low)
Zheng et al. (2020)	2.3	2	2.2	2.2 (Medium)

Note. WoE D ratings are described as 'Low' for scores 0-1.7, 'Medium' for scores 1.8-2.4, and 'High' for scores 2.5-3.

Participants

A total of 476 participants, aged two to five years, took part in the included studies. Eight studies reported the mean age of participants and the standard deviations (Boyd et al., 2018; Gulsrud et al., 2007; Kasari et al., 2006; Kasari et al., 2010; Kasari et al., 2015; Lawton & Kasari, 2012a; Lawton & Kasari, 2012b), resulting in a high rating for the WoE C criterion E 'Age of Participants'. The two single case design studies (Rocha et al., 2007; Whalen et al., 2003) reported the age of participants but did not include a mean age which resulted in a medium rating. However, participants in these two studies were within the age range of two-five years. Therefore, the generalisability of the findings from this review to children of preschool age is high, as all participants were also of preschool age.

All ten studies reviewed took place in the USA. They were therefore all deemed relatively applicable to the UK education system, resulting in a medium rating for the WoE C criterion B 'Location'.

Design

Two studies (Kasari et al., 2010; Lawton & Kasari, 2012a), used a randomised control trial (RCT) design which is considered the gold standard for providing evidence on the effectiveness of interventions (Higgins et al., 2011). Therefore, these studies received a 'high' WoE B rating. While four other studies randomised participants to groups and included a control group (Boyd et al., 2018; Kasari et al., 2006; Lawton & Kasari, 2012b; Zheng et al., 2020), they did not report follow-up measures resulting in 'medium' WoE B ratings.

Four studies included a second intervention group involving a symbolic play intervention (Gulsrud et al., 2007; Kasari et al., 2006; Lawton & Kasari, 2012a) and a parent only psychoeducational intervention (Kasari et al, 2015). In contrast, Kasari et al. (2010) and Wheng et al. (2020) implemented a wait list control design.

The other two studies (Rocha et al., 2007; Whalen et al., 2003) both used a single subject, multiple baseline design across participants which has been criticised for lacking external validity as findings can only be confidently related to the included participants and are not generalisable (Engel & Schutt, 2008). As a result, these two studies received a 'very low' WoE B rating. However, single case designs are suitable for use in heterogenous populations (Horner et al., 2005), of which the population of this review (those with ASD) is (Hassan & Mokhtar, 2019). Moreover, Plavnick and Ferreri (2013) argue these designs are particularly appropriate for use in educational research as they lead to greater understanding of who a particular intervention is and is not effective for and why. Furthermore, as these studies were rated 'High' for WoE A 'Methodological Quality' the findings of these studies are of significant relevance to the review in question.

All studies included pre- and post- intervention measures, however follow up data was only included for four studies (Kasari et al., 2010; Lawton & Kasari, 2012a; Rocha et al., 2007; Whalen et al., 2003). As the latter two studies (Kasari et al., 2010; Lawton & Kasari, 2012a) were also RCTs they were awarded the highest rating for WoE B.

Intervention

The majority of studies reviewed used a researcher- developed joint attention intervention (Gulsrud et al, 2007; Kasari et al, 2006; Kasari et al. 2010; Lawton & Kasari, 2012a; Rocha et al., 2007; Whalen et al., 2003). Two studies (Kasari et al., 2015; Lawton & Kasari, 2012b) used JASPER (joint attention symbolic play, engagement and regulation) intervention, while one study used ASAP (advancing social-communication and play) intervention (Watson et al., 2011). In contrast to the other nine studies reviewed, Zheng et al. (2020) used a robot mediated intervention. All ten studies included a joint attention component in the intervention, however in three studies (Boyd et al., 2018; Kasari et al., 2015; Lawton & Kasari, 2012b) this was not the sole focus of the intervention leading to lower WoE C ratings for criteria A 'Intervention'.

Interventions were carried out by a variety of individuals with three studies using trained external professionals only (Kasari et al. 2006; Lawton & Kasari, 2012a; Whalen et al., 2003), and two studies using them in conjunction with caregivers (Kasari et al., 2010; Kasari et al., 2015). Trained caregivers were solely used as interventionalists in Rocha et al. (2007) and two studies used trained professionals from within the setting (Boyd et al., 2018; Lawton & Kasari, 2012b). Finally, Zheng et al. (2020) used a humanoid robot to deliver the intervention.

The average duration of joint attention interventions reviewed was 6.8 weeks, however three studies were excluded from this calculation (Boyd et al., 2018; Rocha et al., 2007; Whalen et al., 2003). The former as the intervention lasted a minimum of six months which would have significantly skewed the average, and the latter two as due to their design the intervention duration

varied between participants. With regards to frequency of intervention, nine studies delivered the intervention more than once a week with four of these (Gulsrud et al., 2007; Kasari et al., 2006; Lawton & Kasari, 2012a; Lawton & Kasari, 2012b) delivering the intervention daily. One study did not provide information on exact intervention frequency (Zheng et al., 2020), only that four sessions were delivered over the course of three-nine weeks.

For further detail regarding the interventions used in the ten reviewed studies, see Appendix B.

Measures

All the studies reviewed had at least one measure of joint attention. Four of the studies (Kasari et al., 2006; Lawton & Kasari, 2012a; Lawton & Kasari, 2012b; Whalen et al. 2003) used the Early Social Communication Scales (ESCS) (Mundy et al., 1996), a structured observational measure. A researched-developed coding system to analyse observations was used by five studies (Boyd et al. 2018; Gulsrud et al., 2007; Kasari et al., 2010; Kasari et al., 2015; Whalen et al., 2003). An adaption of the Unstructured Joint Attention Assessment (UJAA) (Loveland & Landry, 1986) was used by the two single case studies (Rocha et al., 2007; Whalen et al., 2003) and the Screening Tool for Autism in Toddlers and Young Children (STAT) used by one study (Zheng et al., 2020).

Four studies used multiple methods to measure joint attention. Whalen et al. (2003) used an adapted version of ESCS, a researcher developed coding system and an adaptation of the UJAA. Kasari et al. (2006) used ESCS and a taped mother-child interaction. Lawton & Kasari (2012b) used ESCS and a

classroom observation and Zheng et al. (2020) used STAT and a within system (computer) measurement. This is reflected in their higher WoE A ratings for 'Measurement/ Dependent Variable(s)'.

Reliability and validity of measures were also evaluated, with the extent to which these were discussed being reflected in WoE A 'Measurement' ratings.

Findings and Effect Sizes

Only two studied reported effect sizes (Boyd et al., 2018; Kasari et al., 2006). The effect sizes calculated for the other six RCTs was the standardised mean difference (Cohen's d) (see table 4 for descriptors of effect size values). These were calculated from reported F test data or means and standard deviations using the Campbell Collaboration online calculator (Wilson, n.d.). The effect sizes calculated for the two single case design studies (Rocha et al., 2007; Whalen et al., 2003) was Tau-U (baseline corrected) (see table 5 for descriptors of effect size values). For these studies, data for calculating effect sizes was not available in the paper directly. Therefore, WebPlotDigitizer (Rohatgi, 2020) was used to enable means and standard deviations to be calculated through extracting data points from the graphs. This data was then inputted into the Baseline Corrected Tau Calculator online (Tarlow, 2016) to calculate effect sizes for each participant. Calculated effect sizes for all ten studies are reported in table 7. The effect sizes reported for the group intervention studies are between group (pre-post effect sizes). Effect sizes varied between the studies reviewed from small to large, as well as within the studies reviewed.

This suggests interventions had different effects on different measures of joint attention. One study (Kasari et al., 2006) had large effect sizes for all three outcome measures, and one study had large effect sizes at all three times the outcome was measured (Lawton & Kasari, 2012b). Whalen et al. (2003) also had some large effect sizes, however this study had an overall 'Low' rating for WoE due to its design and small sample size therefore these findings should be interpreted with caution.

Two of the included studies (Boyd et al., 2018; Zheng et al., 2020) did not find significant improvement in joint attention following intervention. Boyd et al. (2018) cite intervention implementation issues as a possible reason for this, with Zheng et al. (2020) arguing significant changes in joint attention for subgroups of participants, suggesting it is difficult to establish a clear pattern of response to interventions in this heterogenous group (ASD). The other eight studies reviewed all found improvements in joint attention, with Whalen et al. (2003) and Kasari et al. (2006) finding these improvements generalized from intervention sessions to the natural environment for the former, and to play interactions with a caregiver for the latter. In addition, two studies reported sustained improvements in joint attention at follow up (Kasari et al., 2010; Kasari et al. 2012a; Kasari et al., 2015).

There is a mixed picture with regards to the effects found on different measures of joint attention. For example, Kasari et al. (2015) found larger improvements for duration of joint engagement compared to joint attention initiations. Whereas, Gulsrud et al. (2007) found larger effects for quantity of joint attention than duration of joint attention. Such differences could again be attributable to the heterogeneity of the population being studied. Moreover,

there appear no clear difference in study findings between different settings such as preschool classrooms or Early Intervention Program centres. However, the two studies (Boyd et al., 2018; Lawton & Kasari, 2012b) conducted in educational settings did receive higher WoE ratings for criterion L 'Site of Implementation' due to their higher ecological validity.

Table 5

Effect Size Descriptors for Cohen's d (Cohen, 1988)

Effect Size	Descriptor
0.2	Small
0.5	Medium
0.8	Large

Table 6

Effect Size Descriptors for Tau-U (Parker et al., 2011)

Effect Size	Descriptor
0-0.31	Small
0.32-0.84	Medium
0.85-1	Large

Table 7

Effect sizes for Joint Attention outcomes

Study	Sample Size	Research Design	Outcome Measure	Effect Size	*p*	Descriptor	WoE D
Boyd et al. (2018)	155	Cluster randomized trial (CRT)	Joint Attention (responses and initiations)	*d*= 0.11	0.476	Small	2.2
Gulsrud et al. (2007)	35	Randomized controlled intervention study	Quantity of Joint Attention (responses)	*d*= 0.82	>0.05	Large	1.9
			Duration of Joint Attention (responses)	*d*= 0.48	>0.05	Small	
Kasari et al. (2006)	58	Randomized controlled intervention study	Responding to Joint Attention (Early Social Communication Scales)	*d*= 1.20	>0.05	Large	2.0

Study	Sample Size	Research Design	Outcome Measure	Effect Size	*p*	Descriptor	WoE D
			Coordinated joint looks (Early Social Communication Scales)	*d*= 1.32	>0.05	Large	
			Child-initiated Joint Engagement (Early Social Communication Scales)	*d*= 1.38	>0.05	Large	
Kasari et al. (2010)	38	Randomized wait list control study	Joint Engagement (Early Social Communication Scales)	*d*= 0.58	>0.05	Medium	2.2
			Responsiveness to Joint Attention	*d*= 0.66	>0.05	Medium	
			Joint Engagement at 1y follow up	*d*= 0.56	>0.05	Medium	
			Responsiveness to Joint Attention at 1y follow up	*d*= 0.11	>0.05	Small	
	86	Randomized comparative	Duration of Joint Engagement at exit	*d*= 1.42	>0.05	Large	1.7

Study	Sample Size	Research Design	Outcome Measure	Effect Size	*p*	Descriptor	WoE D
Kasari et al. (2015)		intervention efficacy study	Duration of Joint Engagement at follow up	*d*= 0.77	>0.05	Medium	
			Initiations of Joint Attention at exit	*d*= 0.16	>0.05	Small	
			Initiations of Joint Attention at follow up	*d*= 0.26	>0.05	Small	
Lawton & Kasari (2012a)	52	Randomized controlled intervention study	Joint Attention & shared positive affect at exit (Early Social Communication Scales)	*d*= -.20	>0.05	Small	2.2
			Joint Attention & shared positive affect at 6m follow up (Early Social Communication Scales)	*d*= 0.60	>0.05	Medium	
			Joint Attention & shared positive affect at 12m follow up (Early Social Communication Scales)	*d*= 0.61	>0.05	Medium	

Study	Sample Size	Research Design	Outcome Measure	Effect Size	*p*	Descriptor	WoE D
Lawton & Kasari (2012b)	16	Randomized controlled trial	Initiations of Joint Attention (Early Social Communication Scales)	*d*= 1.85	>0.05	Large	2.4
			Object engagement (Early Social Communication Scales)	*d*= 1.41	>0.05	Large	
			Supported engagement (Early Social Communication Scales)	*d*= 1.24	>0.05	Large	
Rocha et al. (2007)	3	Single subject, multiple baseline design across participant pairs	Joint Attention responses (Unstructured Joint Attention Assessment)	Lindsay: Tau-U= -0.567	0.000	Medium	1.4
				Jacob: Tau-U= -0.080	0.233	Small	
				Adam:	0.000	Medium	

Study	Sample Size	Research Design	Outcome Measure	Effect Size	*p*	Descriptor	WoE D
				Tau-U= -0.706			
Whalen et al. (2003)	10	Single subject, multiple baseline design across participants	Joint Attention responses (Early Social Communication Scales & Unstructured Joint Attention Assessment)	Carrie: Tau-U= 0.319	0.175	Small	1.5
				David: Tau-U= -0.610	0.000	Medium	
				Alex: Tau-U= -0.495	0.000	Medium	
				Brandon:	0.000	Medium	

Study	Sample Size	Research Design	Outcome Measure	Effect Size	*p*	Descriptor	WoE D
				Tau-U= -0.451			
			Joint Attention initiations (Early Social Communication Scales & Unstructured Joint Attention Assessment)	Carrie: Tau-U= 0.856		Large	
				David: Tau-U= 0.535	0.002	Medium	
				Alex: Tau-U= 0.879	0.000	Large	
				Brandon: Tau-U= 0.852	0.000	Large	

Study	Sample Size	Research Design	Outcome Measure	Effect Size	*p*	Descriptor	WoE D
Zheng et al. (2020)	23	Randomized controlled trial	Screening Tool for Autism in Toddlers and Young Children score	*d*= -.23	>0.05	Small	2.2
			Response to Joint Attention prompts by robot	*d*= 0.13	>0.05	Small	

Conclusions & Recommendations

Summary

This review updated and refined a previous systematic review and aimed to investigate the effectiveness of joint attention interventions in preschool aged children with ASD. Of the ten studies reviewed, six received a medium WoE D rating, and four received a low rating (Gulsrud et al., 2007; Kasari et al., 2015; Rocha et al., 2007; Whalen et al., 2003;). All studies measured joint attention using observational measures, with one study also using a computerised measure (Zheng et al., 2020).

Overall, evidence for the effectiveness of joint attention interventions in this population appears moderate and mixed with two studies finding no effects (Boyd et al., 2018; Zheng et al., 2020) and the other eight studies finding small to large effects. This demonstrates the significant variability in the effects of joint attention interventions in the ten studies reviewed. Furthermore, the studies reviewed varied in the type of joint attention evaluated, the setting in which the intervention was delivered and who by and the joint attention outcome/s measured. Despite this variation, all ten studies reviewed had a common aim of increasing joint attention in young children with ASD.

Limitations

The ten studies reviewed varied significantly, making it difficult to determine the overall effectiveness of joint attention interventions evaluated in this review. Furthermore, four studies did not include a control group (Gulsrud et al., 2007; Kasari et al., 2006; Kasari et al, 2015; Lawton & Kasari, 2012a) but

instead included a second intervention group meaning changes cannot be solely attributed to joint attention intervention and may be due to other factors (Gopalan et al., 2020). In addition, two studies adopted a single case design (Rocha et al., 2007; Whalen et al., 2003) which has been criticised for producing findings which cannot be generalised to wider populations (Engel & Schutt, 2008). However, these were included in the review as they have been described as suitable for use in heterogenous populations (Horner et al., 2005) so are appropriate when exploring the ASD population as this is a heterogenous group (Hassan & Mokhtar, 2019). Furthermore, such designs are of relevance for educational research (Plavnick & Ferreri, 2013).

Two studies reviewed (Kasari et al., 2015; Lawton & Kasari, 2012b) used the JASPER intervention developed by Kasari and colleagues. Therefore, their findings should be viewed with caution as the researchers may have been biased to produce positive results that support the intervention they developed being effective.

All studies reviewed used observational methods, however many lacked triangulation through the use of multiple measures which led to WoE A penalties by lowering reliability and validity (Annan et al,. 2013; Moon, 2019). Moreover, only five of the ten studies reviewed included follow up data (Kasari et al., 2010; Kasari et al., 2015; Lawton & Kasari, 2012a; Rocha et al., 2007; Whalen et al., 2003). As interventions have been associated with later improvements in social communication (Howard et al., 2005; McEachin, Smith & Lovaas, 1993; Sallows & Graupner, 2005), ascertaining whether improvements are maintained over time is important. Thus, future research

could explore the effects of joint attention interventions over time and use multiple methods to monitor impact on outcomes.

With regards to specificity, five studies targeted responses to joint attention bids only (Gulsrud et al., 2007; Kasari et al., 2010; Lawton & Kasari, 2012a; Rocha et al., 2007, Zheng et al., 2020), while the other five targeted both responses to and initiations of joint attention (Boyd et al., 2018; Kasari et al., 2006; Kasari et al., 2015; Lawton & Kasari, 2012b; Whalen et al., 2003). Therefore, as interventions focused on different aspects of joint attention and found differing effects, further research is needed to explore if these behaviours can be effectively targeted simultaneously or if specific separate intervention is needed.

Finally, all ten studies reviewed were conducted in the USA, so research is needed in the UK setting to assess whether similar effects are seen within the UK population and educational settings.

Implications for EP practice

EPs should work in collaboration with not only children and young people but the adults who care for them (Gutkin & Curtis, 2009) as such collaboration increases the likelihood of interventions being implemented and sustained (Reynolds et al., 2017). Three of the studies reviewed involved parents implementing the intervention (Kasari et al., 2010; Kasari et al., 2015; Rocha et al., 2007), with small to large effects being found. This suggests, parents could be effective agents to improving joint attention skills in young children with ASD. This is of importance for EPs when considering interventions which are collaborative and feasible. Moreover, parental involvement has

been linked to benefits in learning and academic outcomes in childhood (Fan & Chen, 2001) and beyond (Feinstein & Symons, 1999), with research finding reduced behaviour problems in children whose parents promote pro-social behaviour (Edwards et al., 2007), of which joint attention is. Therefore, EPs may wish to highlight the interventions to parents and carers as a cost-effective way of improving joint attention in their children early, which will subsequently lead to further positive outcomes in the long-term.

Moreover, Kasari et al. (2012b) trained preschool staff to use and deliver joint attention strategies which led to improvements in children's levels of joint attention. This suggests staff in educational settings can also be successful agents of change, and as such EPs could encourage and empower existing staff in a preschool to deliver such intervention through training.

In summary, joint attention interventions seem a promising early intervention programme for preschool aged children with ASD. However, further research in the UK and including long-term follow up is required to strengthen the evidence-base for their use in preschool settings. Considering these limitations and suggestions for future research, it is recommended that EPs work to increase research into joint attention in young children with ASD and ensure the implementation of cost-effective early intervention, to improve social communication in the short and long term (Howard et al., 2005; Koegel et al., 2014; McEachin, Smith & Lovaas, 1993; Sallows & Graupner, 2005).

References

Ali, S. & Frederickson, N. (2006). Investigating the Evidence Base of Social Stories. *Educational Psychology in Practice, 22*(4), 355-377.

Annan, M., Chua, J., Cole, R., Kennedy, E., James, R., Markusdottir, I., Monsen, J., Robertson, L. & Shah, S. (2013). *Further iterations on using the Problem-analysis Framework. Educational Psychology in Practice, 29*(1), 79-95.

Baldwin, D. (1995) Understanding the Link Between Joint Attention and Language. In C. Moore & P. Dunham (Eds.), *Joint Attention It's Origins and Role in Development* (pp.131-158) Psychology Press.

Broadhead, P., Howard, J. & Wood, E. (Eds.) (2010). *Play and Learning in the Early Years.* Sage.

Charman, T. (2003). Why is joint attention a pivotal skill in autism? *Philosophical Transactions of the Royal Society, 358*, 315-324.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). Erlbaum.

Davies, G. (n.d.). Practical Help with Autism. Retrieved March 22, 2022, from https://www.ginadavies.co.uk/

Edwards, R., Ceilleachair, A., Bywater, T., Hughes, D. & Hutchings, J. (2007). Parenting program for parents of children at risk of developing conduct disorder: cost effectiveness analysis. *British Medical Journal, 334*(7595), 682-685.

Engel. R. & Schutt, R. (2008). *The practice of Research in Social Work.* Sage.

Fan, X. & Chen, M. (2001). Parental involvement and students' academic achievement: A meta-analysis. *Educational Psychology Review, 13*(1), 1-22.

Feinstein, L. & Symons, J. (1999). Attainment in secondary school. *Oxford Economic Papers, 51*, 300-321.

Franz, L. & Dawson, G. (2019). Implementing early intervention for autism spectrum disorder: a global perspective. *Pediatric Medicine, 2*, 1-3.

Gopalan, M., Rosinger, K. & Ahn, J. (2020). Use of Quasi-Experimental Research Designs in Education Research: Growth, Promise, and Challenges. *Review of Research in Education, 44*(1), 218-243.

Gough, D. (2007). Weight of Evidence: a framework for the appraisal of the quality and relevance of evidence. *Research Papers in Education, 22*(2), 213-228.

Greenway, C. (2000). Autism and Aspergers syndrome: Strategies to promote prosocial behaviours. *Educational Psychology in Practice, 16(*4), 469-486.

Gutkin, T, & Curtis, M. (2009). School-based consultation: The science and practice of indirect service delivery. In Gutkin, T. & Reynolds, C. (Eds.), *Handbook of school psychology* (pp.591-635). John Wiley & Sons.

Hassan, M. & Mokhtar, H. (2019). Investigating autism etiology and heterogeneity by decision tree algorithm. *Informatics in Medicine Unlocked, 16*, 1-8.

Higgins, J., Altman, D., Gotzsche, P., Juni, P., Moher, D., Oxman, A., Savovic, J., Schulz, K., Weeks, L., Sterne, J. , Cochrane Bias Methods Group & Cochrane Statistical Methods Group (2011). *BMJ, 343*, 1-9.

Horner, R., Carr, E., Halle, J., McGee, G., Odom, S. & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional children, 71*(2), 165-179.

Howard, J., Sparkman, C., Cohen, H., Green, G. & Stanislaw, H. (2005). Comparisons of intensive behavior analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities, 26,* 359-383.

Jacobson, J., Mulick, J. & Green, G. (1998). Cost-benefit estimated for early intensive behavioral intervention for young children with autism: General model and single state case. *Behavioral Interventions, 12*, 201-226.

Kim, K. & Mundy, P. (2012). Joint attention, social-cognition, and recognition memory in adults. *Frontiers in Human Neuroscience, 6*, 172-182.

Koegel, L., Koegel, R., Ashbaugh, K. & Bradshaw, J. (2014). The importance of early identification and intervention for children with or at risk for autism spectrum disorders. *International Journal of Speech-Language Pathology, 16*(1), 50-56.

Kratochwill, T. (2003). Evidence-Based Practice: Promoting Evidence-Based Interventions in School Psychology. *School Psychology Quarterly, 18*(4), 389-408.

Loveland, K. & Landry, S. (1986). Joint attention and language in autism and developmental language delay. *Journal of Autism and Developmental Disorders, 16*, 335-349.

McEachin, J., Smith, T. & Lovaas, O. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American journal of Mental Retardation, 97*, 359-372.

Meindl, J. & Cannella-Malone, H. (2011). Initiating and responding to joint attention bids in children with autism: A review of the literature. *Research in Developmental Disabilities, 32*, 1441-1454.

Moon, M. (2019). Triangulation: A Method to Increase Validity, Reliability, and Legitimation in Clinical Research. *Journal of Emergency Nursing, 45*(1), 103-105.

Mundy, P. (1995). Joint attention, social-emotional approach in children with autism. *Development and Psychopathology, 7*, 63-82.

Mundy, P., Hogan, A. & Doelring, P. (1996). *A preliminary manual for the abridged Early Social Communication Scales.* University of Miami.

Mundy, P., Sigman, M. & Kasari, C. (1990). A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and Developmental Disorders, 20*, 115-128.

Murza, K., Schwartz, J., Hahs-Vaughn, D. & Nye, C. (2016). Joint attention interventions for children with autism spectrum disorder: a systematic review and meta-analysis. *International Journal of Language & Communication Disorders, 51*(3), 236-351.

Parker, R., Vannest, K., Davis, J. & Sauber, S. (2011). Combining Nonoverlap and Trend for Single-Case Research: Tau-U. *Behavior Therapy, 42*(2), 284-299.

Petticrew, M. & Roberts, H. (2003). Evidence, hierarchies, and typologies: horses for courses. *Journal of Epidemiology and Community Health, 57*, 527-529.

Plavnick, J. & Ferreri, S. (2013). Single-Case Experimental Designs in Educational Research: A Methodology for Causal Analyses in Teaching and Learning. *Educational Psychology Review, 25*(2), 549-569.

Reynolds, A., Hayakawa, M., Ou, S., Mondi, C., Englund, M., Candee, A. & Smerillo, N. (2017). Scaling and Sustaining Effective Early Childhood Programs Through School-Family-University Collaboration. *Child Development, 88*(5), 1452-1465.

Rohatgi, A. (2020). WebPlotDigitizer. https://apps.automeris.io/wpd/

Roman-Urrestarazu, A., van Kessel, R., Allison, C., Matthews, F., Brayne, C. & Baron-Cohen, S. (2021). Association of Race/Ethnicity and Social Disadvantage With Autism Prevalence in 7 Million School Children in England. *JAMA Pediatrics, 175*(6), 1-11.

Sallows, G. & Graupner, T. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal of Mental Retardation, 110*, 417-438.

Scaife, M. & Bruner, J. (1975). The capacity for joint visual attention in the infant. *Nature, 253*(5489), 265-266.

Sigman, M. & Ruskin, E. (1999). Continuity and change in the social competence of children with autism, Down syndrome and developmental delays. *Monographs of the Society for Research in Child Development, 64,* 1-114.

Tarlow, K. (2016). Baseline Corrected Tau Calculator. Retrieved January 28, 2021, from http://ktarlow.com/stats/tau/

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Watson, L., Boyd, B., Baranek, G. & Crais, E. (2011). *Advancing social-communication and play: An intervention program for pre-schoolers with autism manuals.* The University of North Carolina.

White, P., O'Reilly, M., Streusand, W., Levine, A., Sigafoos, J., Lancioni, G., Fragale, C., Pierce, N. & Aguilar, J. (2011). Best practices for teaching joint attention: A systematic review of the intervention literature. *Research in Autism Spectrum Disorders, 2*, 1283-1295.

Wilson, D. (n.d.). Campbell Collaboration Effect Size Calculator. Retrieved January 28, 2021, from https://www.campbellcollaboration.org/research-resources/effect-size-calculator.html

Appendices

Appendix A- Excluded Studies

List of Excluded studies at full review

Reference	Criteria number	Rationale
Alotaibi, A. (2020). The effect of teacher implemented Joint Attention intervention on improving teacher-child communication and social interaction among children with ASD. Amazonia Investiga, *9*(26), 228-235.	6	Study conducted country that is not member of Organisation for Economic Co-operation and Development: Saudi Arabia.
Becker, S. (2014). *Evaluating the Feasibility and Effects of the Complexity Account of Treatment Efficacy (CATE) for Joint Attention Intervention with Children with ASD.* [Doctoral dissertation, University of Kansas]. KU ScholarWorks. *https://kuscholarworks.ku.edu/handle/1808/16841*	5	Study is a dissertation and so not published in a peer-reviewed journal.
Chiang, C., Chu, C. & Lee, T. (2016). Efficacy of caregiver-mediated joint engagement intervention for young	6	Study conducted country that is not member of

Reference	Criteria number	Rationale
children with autism spectrum disorders. *Autism, 20*(2), 172-182.		Organisation for Economic Co-operation and Development: Taiwan.
Eissa, M. (2015). The Effectiveness Of A Joint Attention Training Program On Improving Communication Skills Of Children With Autism Spectrum Disorder. *International Journal of Psycho-Educational Sciences, 4*(3), 3-12.	1	Some participants aged 6 years and above.
Ferraioli, S. & Harris, S. (2011). Teaching Joint Attention to Children with Autism Through A Sibling-Mediated Behavioral Intervention. *Behavioral Interventions, 27*, 261-281.	1	Some participants aged above 5 years.
Hansen, S., Raulston, T., Machalicek, W. & Frantz, R. (2018). Caregiver-mediated joint attention intervention. *Behavioral Interventions, 33*, 205-211.	1	Some participants aged above 5 years.
Hansen, S., Raulston, T., Machalicek, W., Frantz, R., Drew, C., Erturk, B. & Squires, J. (2019). Peer-Mediated Joint Attention	2	Some participants did not have formal diagnosis of

Reference	Criteria number	Rationale
Intervention in the Preschool Classroom. *The Journal of Special Education, 53*(2), 96-107.		Autism Spectrum Disorder.
Jones, E., Carr, E. & Feeley, K. (2006). Multiple Effects of Joint Attention Intervention for Children with Autism. *Behaviour Modification, 30*(6), 782-834.	2	Some participants did not have formal diagnosis of Autism Spectrum Disorder.
Jones, E., Feeley, K. (2007). Parent Implemented Joint Attention Intervention for Preschoolers with Autism. *The Journal of Speech and Language Pathology – Applied Behavior Analysis, 2*(3), 253-268.	5	Article published in non-peer reviewed journal.
Kaale, A., Smith, L. & Sponheim, E. (2012). A randomized controlled trial of preschool-based joint attention intervention for children with autism. *Journal of Child Psychology and Psychiatry, 53*(1), 97-105.	6	Study conducted country that is not member of Organisation for Economic Co-operation and Development: Norway.

Reference	Criteria number	Rationale
Kryzak, L. & Jones, E. (2015). The Effect of Prompts within Embedded Circumscribed Interests to Teach Initiating Joint Attention in Children with Autism Spectrum Disorders. *Journal of Developmental and Physical Disabilities, 27*, 265-284.	1	Some participants aged 6 years and above.
Nordahl-Hansen, A., Fletcher-Watson, S. & McConachie, H. (2016). Relations between specific and global outcome measures in a social-communication intervention for children with autism spectrum disorder. *Research in Autism Spectrum Disorders, 29-30*, 19-29.	6	Study conducted country that is not member of Organisation for Economic Co-operation and Development: Norway.
Prelock, P., Calhoun, J., Morris, H. & Platt, G. (2011). Supporting Parents to Facilitate Communication and Joint Attention in Their Young Children With Autism Spectrum Disorders. Two Pilot Studies. *Topics in Language Disorders, 31*(3), 210-234.	3	One of two studies described does not include Joint Attention component.
	7	Joint Attention outcomes only

Reference	Criteria number	Rationale
		measured & reported for one of two studies described.
Whalen, C., Schreibman, L. & Ingersoll, B. (2006). The Collateral Effects of Joint Attention Training on Social Initiations, Positive Affect, Imitation, and Spontaneous Speech for Young Children with Autism. *Journal of Autism and Developmental Disorders, 36,* 655-664.	7	Joint attention outcomes not reported.
Wong, C. (2013). A play and joint attention intervention for teachers of young children with autism: A randomized controlled pilot study. *Autism, 17*(3), 340-357.	1	Some participants aged 6 years and above.

Appendix B- Details of included studies

Overview of the Included Studies- Mapping the Field

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
1	Boyd et al. (2018) USA	Cluster randomized trial	155	3–5-year-olds with clinical diagnosis of ASD	ASAP (advancing social-communication and play). The social-communication aspect involves developing the follow skills: social interaction, requesting & joint attention.	Educational teams in public preschool classrooms	1 school year (minimum 6 months)	Joint attention at pre, midpoint & post

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
2	Gulsrud et al. (2007) USA	Randomized controlled intervention study	35	2-4-year-olds with clinical diagnosis of ASD	Joint attention involving the activation of auditory-visual and auditory probes.	Trained interveners in Early intervention program centre	5-8 weeks	Quantity and duration of joint attention at beginning, midpoint & end
3	Kasari et al. (2006) USA	Randomized controlled intervention study	58	3–4-year-olds with clinical diagnosis of ASD	Joint attention using discrete trial training (with a hierarchy of different prompts and positive reinforcement). Intervention was based	Trained Educational Psychology graduate students (experienced with children with	5-6 weeks	Responding to joint attention, coordinated joint looks and joint engagement

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
					on applied behaviour analysis and developmental approach of responsive and facilitative interaction.	ASD) in Early intervention program centre		initiations at pre & post
4	Kasari et al. (2010) USA	Randomized wait list control study	38	21-36 month olds with clinical diagnosis of ASD	Joint attention involving 10 modules (over 24 sessions) which were individualised to each parent-child dyad. Intervention was based	Trained Educational Psychology graduate students (experienced with children with	8 weeks	Joint engagement and response to joint attention at pre, post & follow-up

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
					on applied behaviour analysis and developmental approach of responsive and facilitative interaction.	ASD) & Caregiver in child's home		
5	Kasari et al. (2015) USA	Randomized comparative intervention efficacy study	86	22-36 month olds with clinical diagnosis of ASD	JASPER (joint attention, symbolic play, engagement and regulation) focusing on increasing joint attention gestures and play skills and	Trained Psychology students & parent in Outpatient Early intervention program centre	10 weeks	Duration of joint engagement and initiations of joint attention at

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
					maintaining periods of joint engagement. Involved 2 30-minute sessions a week for 10 weeks.			pre, post & 6m follow-up
6	Lawton & Kasari (2012a) USA	Randomized controlled intervention study	52	3–4-year-olds with clinical diagnosis of ASD	Joint attention using discrete trial training (with a hierarchy of different prompts and positive reinforcement). Intervention was based on applied behaviour	Trained Educational Psychology graduate students (experienced with children with ASD) in Early	5-6 weeks	Joint attention and shared positive affect at pre, post & 6m follow-up

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
					analysis and developmental approach of responsive and facilitative interaction.	intervention program centre		
7	Lawton & Kasari (2012b) USA	Randomized controlled trial	16	3–5-year-olds with clinical diagnosis of ASD	JASPER (joint attention, symbolic play, engagement and regulation) focusing on increasing joint attention gestures and play skills and maintaining periods of	Teachers in public preschool classrooms	6 weeks (including 1 week of training)	Initiations of joint attention, object engagement and supported

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
					joint engagement. Involved 2 30-minute sessions a week for 5 weeks.			engagement at pre & post
8	Rocha et al. (2007) USA	Single subject, multiple baseline design across participant pairs	3	2-4 year olds with clinical diagnosis of ASD	Joint attention training for parents using behaviour analytic techniques to increase parents joint attention initiations and subsequently responses in children.	Trained parents in playroom in clinic & child's home	N/A	Responses to joint attention at pre, post & follow-up

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
9	Whalen at el. (2003) USA	Single subject, multiple baseline design across participants	10	4 year olds with diagnosis of ASD	Joint attention using aspects of discrete trial training and pivotal response training (to increase responses to and initiations of joint attention).	Experimenters in University Autism Research Laboratory	N/A	Responses to joint attention and initiations of joint attention at pre, post & 3m follow-up
10	Zheng et al. (2020) USA	Randomized controlled trial	23	1-3 year olds with clinical diagnosis of ASD	Using humanoid robot which attempted to direct the child's attention to a monitor in the room (increase	Humanoid robot in University experiment room	3-9 weeks	Screening Tool for Autism in Toddlers and Young Children

	Author & Location	Design	N	Participants	Intervention	Interventionalist & Setting	Duration	Outcome & Measures
					responses to joint attention initiations).			(STAT) score and response to Joint Attention bids at pre & post

Appendix C- Weight of Evidence

Weight of Evidence A- Methodological Quality

WoE A assessed the methodological quality of studies. The group design coding protocol from Kratochwill (2003) that has been used in this review for the eight studies which adopted a group design was amended. The amendments and rationale are detailed in Table 1. The single case design coding protocol from Horner et al. (2005) was used to review the other two studies which adopt this form of research design. The WoE A ratings for the eight group design studies are shown in Table 2 and for the two single case designs in Table 3.

Table 1

Amendments to the group design coding protocol

Section heading		Section removed	Rationale
I.	General Study Characteristics	A: General Study Characteristics	This is discussed in detail in the review.
		B: General Design Characteristics	This is discussed in detail in the review.
		C: Data Analysis	This is not relevant for the current review.
		D: Type of Program	All studies included in this review are intervention programmes.

Section heading		Section removed	Rationale
		E: Stage of Program	This is not relevant for the current review.
		F: Concurrent or Historical Intervention Exposure	This is not relevant for the current review.
II.	Key Features for Coding Studies and Rating Level of Evidence/ Support	A1. Characteristics of the data collector	This is not relevant for the current review.
		A2. Characteristics of Participants	This is not relevant for the current review.
		B.6: Cultural appropriateness of the Measures	This is not relevant for the current review.
		D: Primary/ Secondary Outcomes are Statistically significant	This is discussed in detail in the review.
		E: Cultural Significance	This is not relevant for the current review.
		F: Educational/ Clinical significance	This is discussed in detail in the review.
		G1.5 Recruitment procedures congruent with target group	This is not relevant for the current review.

Section heading	Section removed	Rationale
	G2: Participant Characteristics Specified for Treatment and Control Group	This is not within the scope of the current review.
	G6 Participant perceptions of benefits of intervention (treatment group)	This is discussed in detail in the review.
	H: Durability/ Generalization of Intervention and Outcomes	This is discussed in detail in the review.
	J4.1 Characteristics of the Implementer	This is not relevant for the current review.
	J4.5 Length of Intervention	This is discussed in detail in the review.
	J4.6 Intensity/ dosage of Intervention	This is discussed in detail in the review.
	J4.6 Dosage Response	This is discussed in detail in the review.
	J4.8 Program Implementer	This is discussed in detail in the review.

Section heading	Section removed	Rationale
	J4.9 Intervention Style or Orientation	This is discussed in detail in the review.
	J4.10 Cost Analysis Data	This is not relevant for the current review.
	J4.11 Training and Support Resources	This is discussed in detail in the review.
	J4.12 Feasibility	This is discussed in detail in the review.
	K: Replication	This is not relevant for the current review.

Table 2

Summary of WoE A Ratings for Group Design studies

Study	A: Research Methodology	B: Measurement	G1: Sampling Procedures	G3-6: External Validity	J1-3: Implementation Fidelity	J4: Identifiable Intervention Components	L: Site of Implementation	Overall WoE A rating (average)
Boyd et al. (2018)	3	2	2	2	2	2	3	2.3
Gulsrud et al. (2007)	2	1	1	1	3	2	1	1.6
Kasari et al. (2006)	3	3	2	3	2	2	1	2.3

Study	A: Research Methodology	B: Measurement	G1: Sampling Procedures	G3-6: External Validity	J1-3: Implementation Fidelity	J4: Identifiable Intervention Components	L: Site of Implementation	Overall WoE A rating (average)
Kasari et al. (2010)	2	2	2	2	2	1	1	1.7
Kasari et al. (2015)	3	2	1	3	2	2	1	2
Lawton & Kasari (2012a)	2	2	2	2	2	2	1	1.9
Lawton &	3	3	2	3	3	2	3	2.7

Study	A: Research Methodology	B: Measurement	G1: Sampling Procedures	G3-6: External Validity	J1-3: Implementation Fidelity	J4: Identifiable Intervention Components	L: Site of Implementation	Overall WoE A rating (average)
Kasari (2012b)								
Zheng et al. (2020)	3	3	2	2	3	3	0	2.3

Note. WoE A ratings are described as 'Low' for scores 0-1, 'Medium' for scores 1-2, and 'High' for scores 2-3.

Table 3

Summary of WoE A Ratings for Single-participant design studies

Study	Description of participants & settings	Dependent variable(s)	Independent variable	Baseline	Experimental control/ Internal validity	External validity	Social validity	Overall WoE A rating (average)
Rocha et al. (2007)	2	3	3	3	3	2	3	2.7
Whalen et al. (2003)	2	3	3	3	3	1	3	2.6

Note. WoE A ratings are described as 'Low' for scores 0-1, 'Medium' for scores 1-2, and 'High' for scores 2-3.

Weight of Evidence B: Methodological Relevance

WoE B assesses how appropriate the type of study is in relation to the review question being addressed. Petticrew and Roberts (2003) propose a Hierarchy of Evidence which assigns Randomised Control Trials (RCT) as the 'gold standard' of designs measuring the effectiveness of interventions. This is followed by quasi-experimental and cohort studies being of lower quality in addressing such questions. Criteria to evaluate WoE B were developed based on Petticrew and Roberts (2003) recommendations as to the research most suitable for answering these types of questions, with each study being assigned a rating of 0-3 as shown in Table 4 and Table 5.

Table 4

WoE B Criteria

Rating	Criteria	Example
3 (High)	• Included a control group • Random assignment to treatment or control groups • Pre- and post- intervention and follow up measures reported	RCT
2 (Medium)	• Included a control group • Pre- and post- intervention measures reported	Quasi-experimental designs with a control group
1 (Low)	• Did not include a control group	Quasi-experimental designs without a

Rating	Criteria	Example
0 (Very Low)	• Pre- and post- intervention measures reported • Did not include a control group • No random assignment • Pre- and post- intervention measures may or may not be reported	control group & cohort studies Qualitative research, case-control studies, surveys & non-experimental evaluations

Table 5

WoE B ratings for studies

Study	WoE B rating
Boyd et al. (2018)	2 (Medium)
Gulsrud et al. (2007)	1 (Low)
Kasari et al. (2006)	2 (Medium)
Kasari et al. (2010)	3 (High)
Kasari et al. (2015)	1 (Low)
Lawton & Kasari (2012a)	3 (High)
Lawton & Kasari (2012b)	2 (Medium)
Rocha et al. (2007)	0 (Very Low)
Whalen et al. (2003)	0 (Very Low)
Zheng et al. (2020)	2 (Medium)

Weight of Evidence C: Topic Relevance

WoE C is a review-specific judgement about the relevance of the focus of the study to the review question being explored. The criteria in Table 6 were developed and each study was assigned a rating of 0-3 for each of the five criteria identified. These ratings were then averaged to produce an overall WoE C rating as shown in Table 7.

Table 6

WoE C Criteria and Rationale

Criteria	Rating	Descriptor	Rationale
A: Intervention	3	Joint Attention is the only focus of the intervention.	This review is looking at the effectiveness of interventions targeting joint attention. Therefore, interventions focusing on other areas are not suitable.
	2	Joint Attention is one of the foci of the intervention.	
	1	Joint Attention is not the focus of intervention.	
B: Location	3	Study is conducted in the UK.	To increase the generalisability of the findings to the UK, it is important the study has taken place in a location
	2	Study is conducted in a location which is economically similar to the UK.	

Criteria	Rating	Descriptor	Rationale
	1	Study is conducted in a location which is not economically similar to the UK.	with a comparable education system.
C: Intervention description	3	The intervention is clearly described, with accompanying materials provided.	To allow for the intervention to be replicated, information regarding the content and implementation of the intervention should be given.
	2	The intervention is clearly described, but no accompanying materials are provided.	
	1	The intervention is not clearly described and no accompanying materials are provided.	
D: Intervention delivery	3	The intervention is delivered by existing staff working in the educational setting.	Findings are higher in external validity in studies where existing staff working in the educational setting e.g. school, have delivered the intervention.
	2	The intervention is delivered by researchers in an educational setting.	

Criteria	Rating	Descriptor	Rationale
	1	The intervention is delivered by researchers outside an educational setting.	
E: Age of Participants	3	Participants are of preschool age, and the mean age of participants is included with standard deviations.	This review is looking at the effectiveness of joint attention interventions on preschool aged children; findings from studies which included participant outside of the 2-5-year age range may not be generalisable to preschool age children.
	2	Participant are of preschool age, but no mean age of participants is included.	
	1	The age (including mean age) of participants is unspecified.	

Table 7

Summary of WoE C Ratings

Study	Criteria A	Criteria B	Criteria C	Criteria D	Criteria E	Overall WoE C Rating
Boyd et al. (2018)	2	2	2	3	3	2.4 (Medium)
Gulsrud et al. (2007)	3	2	2	1	3	2.2 (Medium)
Kasari et al. (2006)	3	2	2	1	3	2.2 (Medium)
Kasari et al. (2010)	3	2	1	1	3	2 (Medium)
Kasari et al. (2015)	2	2	1	1	3	1.8 (Medium)
Lawton & Kasari (2012a)	3	2	2	1	3	2.2 (Medium)

Lawton & Kasari (2012b)	2	2	2	3	3	2.4 (Medium)
Rocha et al. (2007)	3	2	2	1	2	2 (Medium)
Whalen et al. (2003)	3	2	2	1	2	2 (Medium)
Zheng et al. (2020)	3	2	2	1	3	2.2 (Medium)

Note. WoE C ratings are described as 'Low' for scores 0-1, 'Medium' for scores 1.1-2.5, and 'High' for scores 2.6-3.

Appendix D- Example of a completed Weight of Evidence A coding protocol for one group design study

[Adapted from the Procedural Manual of the Task Force on Evidence-Based Interventions in School Psychology, American Psychology Association, Kratochwill, T.R. (2003)]

Coding Protocol

Domain:

- ☐ **School- and community-based intervention programs for social and behavioral problems**
- ☐ **Academic intervention programs**
- ☐ **Family and parent intervention programs**
- ☒ **School-wide and classroom-based programs**
- ☐ **Comprehensive and coordinated school health services**

Name of Coder:_XXXXX Date: 18/1/22

Full Study Reference in proper format: Boyd, B., Watson, L., Reszka, S., Sideris, J., Alessandri, M. & Baranek, G. (2018). Efficacy of the ASAP Intervention for Preschoolers with ASD: A Cluster Randomized Controlled Trial. Journal of Autism and Developmental Disorders, 48(9), 3144-3162.

Intervention Name (description of study): ASAP Intervention (Advancing social communication & play)

Study ID Number:_____

Type of Publication:

☐ Book/Monograph

☒ Journal Article

☐ Book Chapter

☐ Other (specify):

II. Key Features for Coding Studies and Rating Level of Evidence

(3= Strong evidence, 2=Promising evidence, 1=Weak evidence, 0=No evidence)

A. Research Methodology

A.3 Sample appropriate to research methods. Research methods guide sampling procedures.

☒3 Clear links established between research methods and sampling, and sampling is appropriate to the research methods.

☐2 Vague or no links established between research methods and sampling, but sampling is appropriate to the research methods

☐1 Links established between research method and sampling, but sampling is inappropriate to the research method.

☐0 No links are established and sampling is inappropriate to research methods.

A4. Operationalization. Specifying the link between key abstract constructs (variables) and data collection methods (operations).

☐3 Clear links established between constructs and methods, and all key constructs are clearly operationalized.

☒2 Some, but not all, key constructs are clearly operationalized.

☐1 Vague reference to link between constructs and methods.

☐0 No evidence that key constructs are operationalized.

A5. Integration of data from multiple sources, methods, and investigators

☒3 Used multiple sources, methods, and investigators.

☐2 Used two of the following: multiple sources, multiple methods, multiple investigators

☐1 Used one of the following: multiple sources, multiple methods, multiple investigators

☐0 No evidence of multiple sources, methods, or investigators

Overall Rating for Research Methodology 3

3= Strong Evidence 2=Promising Evidence 1=Weak Evidence 0=No Evidence

B. Measurement (Estimating the quality of the measures used to establish effects)

B1 The use of the outcome measures produce reliable scores for the majority of the primary outcomes

☐Yes

☐No

☐Unknown/unable to code *(reliability coefficient only reported for 1 measure)*

B2 Multi-method (at least two assessment methods used)

☐ Yes

☐ No

☐ N/A

☐ Unknown/unable to code

B3 Multi-source (at least two sources used self-reports, teachers etc.)

☐ Yes

☐ No

☐ N/A

☐ Unknown/unable to code

B4 Extent of Engagement--The researchers conduct data collection in a manner that guarantees sufficient scope and depth through prolonged

engagement (data collection over a sufficient time period to ensure accuracy of representation) and persistent observation (progressively focused to ensure thorough understanding of consistency and variation), respectively.

☐ 3 Provided evidence for high level of engagement to ensure deep and accurate representation.

☐ 2 Provided evidence for some level of engagement to ensure deep and accurate representation.

☐ 1 Provided evidence of minimal level of engagement to ensure deep and accurate representation.

☐ 0 Provided no evidence for level of engagement to ensure deep and accurate representation.

B5 Validity of measures reported (well-known or standardized or norm-referenced are considered good, consider any cultural considerations)

☐ Yes validated with specific target group

☐ In part, validated for general population only

☐ No

☐ Unknown/unable to code

B7 Measures of key outcomes are linked to the conceptual model.

☐ 3 Clear links established between the conceptual model and key outcome indicators

☐ 2 Some, but not all, key outcomes are clearly linked to conceptual model.

☐ 1 Vague reference to links between key outcomes and conceptual model

☐ 0 No evidence that key outcomes are linked to conceptual model.

Overall Rating for measurement 2

3= Strong Evidence 2=Promising Evidence 1=Weak Evidence 0=No Evidence

G. External Validity Indicators

G1. Sampling Procedures

G1.1 Sampling procedures described in detail

☒ 1 Yes

☐ 0 No

G1.2 Rationale for sample selection specified

☐ 1 Yes
Specify:

☒ 0 No

G1.3 Rationale for sample size specified

☐ 1 Yes
Specify:

☒ 0 No

G1.4 Evidence provided that sample represents target population

☒ 1 Yes

☐ 0 No

G1.5 Recruitment procedures congruent with target cultural group. Researcher used culturally appropriate ways/methods to contact, recruit, inform, and maintain participation.

☒ 1 Yes

☐ 0 No

G1.6 Inclusion/exclusion criteria specified

☒ 1 Yes

☐ 0 No

G1.7 Inclusion/exclusion criteria similar to school practice

☒ 1 Yes

☐ 0 No

G1.8 Specified criteria related to concern

☒ 1 Yes

☐ 0 No

Overall Rating for Sampling Procedures 2

3= Strong Evidence 2=Promising Evidence 1=Weak Evidence 0=No Evidence

G3 Adequately reported characteristics of participants/sample. Adequate level of detail in description of participants

☒ 1 Yes

☐ 0 No

G4 Details are provided regarding variables that:

G4.1 Have differential relevance for intended outcomes

☒ 1 Yes

☐ 0 No

G4.2 Have relevance to inclusion criteria

☒ 1 Yes

☐ 0 No

G5 Transferability of the intervention.

☐ 3 Complete and detailed description of the context within which the intervention occurs

☒ 2 Detailed description of some but not all contextual components

☐ 1 Provides overview of contextual components but lack details

☐ 0 No description of context

G6 Participant perceptions of benefits of intervention (treatment group)

☐ 3 Provided evidence of perceived benefits from the intervention for all participant groups.☐ 2 Provided evidence of perceived benefits from the intervention for some participant groups.

☐ 1 Provided evidence that participants did not perceive benefits from the intervention

☐ 0 Did not investigate participants' perceptions of benefits.

Overall Rating for External Validity 2

3= Strong Evidence 2=Promising Evidence 1=Weak Evidence 0=No Evidence

J. Implementation Fidelity

J1. Evidence of Acceptable Adherence (answer J1.1 through J1.3)

☐ 1 Ongoing supervision/consultation

☐ 2 Coding intervention sessions/lessons or procedures

☐ 3 Audio/video tape implementation (select J1.3.1 or J1.3.2):

☐ 1 Entire intervention

☐ 2 Part of intervention

J2 Manualization (select all that apply)

☐ 1 Written material involving a detailed account of the exact procedures and the sequence in which they are to be used

☐ 2 Formal training session that includes a detailed account of the exact procedures and the sequence in which they are to be used

☐ 3 Written material involving an overview of broad principles and a description of the intervention phases

☐ 4 Formal or informal training session involving an overview of broad principles and a description of the intervention phases

J3 Adaptation procedures are specified (select one)

☐ Yes

☐ No

☐ Unknown

Rating for Implementation fidelity 2

3= Strong Evidence 2=Promising Evidence 1=Weak Evidence 0=No Evidence

J4. Implementation Context (Conditions of Implementation)

J4.2 Adaptations in Implementation

☐ 3 Detailed account of the implementation and adaptations to fit the context or target population

☐ 2 Detailed account of the implementation but not of the adaptations to fit the context or target population

☐ 1 Partial description of the implementation and/or the adaptations to fit the context or target population

☐ 0 Vague or no account of the implementation

J4.3 Relationship of Researcher to Intervention

☐ 3 Detailed description of the researcher's level of involvement and safeguards used to minimize the bias of the researcher.

☐ 2 Detailed description of the researcher's level of involvement, but minimal description of safeguards to minimize the bias of the researcher

☐ 1 Minimal description of the researcher's level of involvement and of safeguards to minimize the bias of the researcher.

☐ 1 No information provided

J4.4 Relationship of Implementer/to Participants

☐ 3 Detailed description regarding the interpersonal processes used to establish and maintain the relationship between implementer and participants.

☐ 2 Detailed description of relationship development procedures, but lacking detail on some aspects of the relationship processes.

☐ 1 Provides overview of relationship development procedures and processes, but lack details

☐ 0 No description of relationship processes provided.

J. Overall Rating for Identifiable Intervention Components 2

3= Strong Evidence 2=Promising Evidence 1=Weak Evidence 0=No Evidence

L. Site of Implementation

L1. School (if school is the site, select one of the following options)

L1.1 ☐ Public

L1.2 ☐ Private

L1.3 ☐ Charter

L1.4 ☐ University Affiliated

L1.5 ☐ Alternative

L1.6 ☐ Not specified/ unknown

L2. Non School Site (if it is a non school site, select one of the following options)

L2.1 ☐ Home

L2.2 ☐ University Clinic

L2.3 ☐ Summer Program

L2.4 ☐ Outpatient Hospital

L2.5 ☐ Partial inpatient/ day Intervention Program

L2.6 ☐ Inpatient Hospital

L2.7 ☐ Private Practice

L2.8 ☐ Mental Health Center

L2.9 ☐ Residential Treatment Facility

L2.10 ☐ Other (specify): _____

L2.11 ☐ Unknown/ insufficient information provided

J. OVERALL Rating for Site of Implementation (select 0, 1, 2 or 3): 3

3= Strong Evidence 2=Promising Evidence 1=Weak Evidence 0=No Evidence

Summary of Evidence for Group-Based Design Studies

Indicator	Overall Evidence Rating (0-3)	Description of Evidence (Strong, Promising, Weak or No/limited evidence)
Key Features		
Research Methodology	3	Strong
Measurement	2	Promising
Sampling	2	Promising
External Validity	2	Promising
Implementation Fidelity	2	Promising
Identifiable Intervention Components	2	Promising
Site of Implementation	3	Strong
Average	2.3	Promising

Appendix E- Example of a completed Weight of Evidence A coding protocol for one single-case design study

Reference: Rocha, M., Schreibman, L. & Stahmer, A. (2007). Effectiveness of Training Parents to Teach Joint Attention in Children With Autism. *Journal of Early Intervention, 29*(2), 154-172.

Horner et al. (2005): Quality Indicators Within Single-Subject Research

Scoring criteria:

- All criteria fulfilled = 3
- Majority of criteria fulfilled= 2
- Half or less of criteria fulfilled= 1

Description of Participants and Settings	Participants are described with sufficient detail to allow others to select individuals with similar characteristics e.g. age, gender, disability, diagnosis	X
	The process for selecting participants is described with replicable precision	
	Critical features of the physical setting are described with sufficient precision to allow replications	X
Total		2
Dependent Variable	Dependent variables are described with operational precision	X
	Each dependent variable is measured with a procedure that generates a quantifiable index	X
	Measurement of the dependent variable is valid and described with replicable precision	X
	Dependent variables are measured repeatedly over time	X
	Data are collected on the reliability or interobserver agreement associated with each dependent variable, and IOA levels meet minimal standards e.g. IOA= 80%; Kappa= 60%	X
Total		3

Independent Variable	Independent variable is described with replicable precision	X
	Independent variable is systematically manipulated and under the control of the experimenter	X
	Overt measurement of the fidelity of implementation for the independent variable is highly desirable	X
Total		3
Baseline	Baseline phase provides repeated measurement of the dependent variable	X
	The baseline establishes a pattern of responding that can be used to predict the pattern of future performance, if introduction or manipulation of the independent variable did not occur	X
	Baseline conditions are described with replicable precision	X
Total		3
Experimental control/ Internal validity	The design provides at least 3 demonstrations of experimental effect at 3 different points in time	X
	The design controls for common threats to internal validity e.g. permits elimination of rival hypotheses	X
	The results document a pattern that demonstrates experimental control	X
Total		3
External validity	Experimental effects are replicated across participants	X
	Experimental effects are replicated across settings	X
	Experimental effects are replicated across materials	
Total		2
Social validity	The dependent variable is socially important	X
	The magnitude of change in the dependent variable resulting from the intervention is socially important	X

	Implementation of the independent variable is practical and cost effective	X
	Social validity is enhanced by implementation of the independent variable over extended time periods, by typical intervention agents, in typical physical and social contexts	X
Total		3
Average		**2.7**

Indicator	**Overall Evidence Rating (0-3)**	**Description of Evidence (Strong, Promising, Weak or No/limited evidence)**
Description of participants & settings	2	Promising
Dependent variable(s)	3	Strong
Independent variable	3	Strong
Baseline	3	Strong
Experimental control/ Internal validity	3	Strong
External validity	2	Promising
Social validity	3	Strong
Average	**2.7**	**Strong**