Case Study 1 – An Evidence-Based Practice Review Report

How effective is the DIR/Floortime programme in improving the social-emotional functioning of infants and children with an autistic spectrum disorder?

Summary

Developmental, Individual-Difference, Relationship-Based (DIR)/Floortime is a developmental social-pragmatic (DPS) intervention for infants and children with an autistic spectrum disorder (ASD). The programme is implemented by parents or carers in the child's home environment. Through structured play sessions, the child is supported to achieve important developmental milestones, which are intended to improve the child's ability to think and relate to others.

The purpose of this review was to determine whether DIR/Floortime is an effective home programme for developing infants' and children's social-emotional functioning. A systematic literature search revealed five studies for review. Using Gough's (2007) Weight of Evidence Framework, these studies were critically appraised for their methodological quality and relevance, as well as their relevance to the review question. The results revealed some support for the efficacy of this intervention. But caution should be used when generalizing findings, given some concerns over reliability and validity. The implications for professional practice are considered.

Introduction

DIR/Floortime

DIR/Floortime is a home-based intervention programme for infants and children who have been diagnosed with an autistic spectrum disorder (ASD). ASDs are a collection of related neuro-developmental disorders, characterised by deficits in social interaction, communication and imagination, which are now viewed in the context of adherence to rigid thought patterns

and behaviour (American Psychiatric Association, 2013; Frederickson and Cline, 2009). Developed by Wieder and Greenspan (2003), DIR/Floortime is designed to improve infants' and children's social and emotional skills, as well as their language and cognition, through interactions with adults. The acronym 'DIR' is used to highlight three important components of the programme. The 'D' for 'developmental' refers to the core aim of the programme, which is to enable children to reach important developmental milestones so that they 'move up' the developmental ladder. The 'I' refers to recognising 'individual-difference(s)' in children's processing abilities. The 'R' for 'relationship-based' refers to the mode of delivery, as it is through meaningful interactions with adults that the child's development is supported.

Floortime is initiated by parents or carers who 'get down on the floor' and play with their child for a period of twenty to thirty minutes. Following the child's lead, the adult tries to elicit and extend reciprocal interactions, using gestures and words, and, by so doing, supports the child to develop skills in thinking and relating to others. Thus the intervention capitalises on the child's own interests and motivations, harnessing these to promote social-emotional development. Six to ten sessions of floortime are recommended per day. The flexible nature of sessions means that these can take place at various times of day, during play times or daily routines, such as dressing or bathing. Training is delivered through workshops and one-on-one sessions in the family home with a therapist. Parents and carers learn effective strategies to engage with their child and promote cognitive development though structured play. They are also assisted in identifying appropriate developmental goals for their child (Liao et al., 2014).

Psychological basis

DIR/Floortime is one of several developmental social-pragmatic (DSP) programs for ASDs, which target core deficits within a child at an early stage of life. The focus is upon enabling the infant or child to develop positive and meaningful interactions with adults, which will promote the acquisition of social and emotional skills. DSP approaches differ from behavioural-based interventions for ASDs, such as Applied Behaviour Analysis, which seek to modify behaviour through the use of rewards (Research Autism, 2014). DSP programmes are gaining in popularity, particularly as they take place in a child's natural setting, which increases ecological validity. In contrast, many behavioural approaches take place in highly structured and artificial environments which may make it harder for children to generalize the skills they have learned to more 'real world' settings (Solomon et al., 2007).

At the core of the DIR/Floortime model is the conceptualization of ASDs as a form of maladaptive processing, which can be ameliorated through early intervention. Autistic traits are seen to be linked to deficits in early developmental pathways (pattern-recognition, joint attention, language and cognition), which make it difficult for individuals to connect emotions or intent with motor planning and verbal communication (Greenspan & Wieder, 1997). As a result, individuals with an ASD may have difficulties with abstract thinking, functional language, empathy and understanding another person's perspective (theory of mind). Greenspan and Wieder labelled this the 'affect diathesis hypothesis' (Greenspan & Wieder, 2000). The aim of DIR/Floortime is to promote the repair of (or the brain's ability to compensate for) these processing difficulties through intensive two-way interactions. Thus, DIR/Floortime may be viewed in the context of neuro-scientific research and the ideas surrounding brain plasticity (Zimmerman & Gordon, 2000). In this respect, early intervention is crucial, as the brain's capacity for repair (or compensation) is thought to be greatest in the early years of life.

In Wieder and Greenspan's (2003) model social-emotional development is centred on six developmental milestones or levels (illustrated in Table 1). DIR/Floortime begins by targeting the first milestone which the child may have missed. This may well be the first milestone, which is self-regulation and joint attention. In this case, the initial goal is to help the child to work around his or her processing difficulties so that he or she can re-establish affective contact with the parent or carer (Greenspan & Wieder, 1997). Once this has been achieved, structured play sessions are used to create opportunities for the child to achieve the successive developmental levels. Flexibility in the model means that earlier levels can be returned to, should the child's capacity in a particular area decline. Once this is restored, progression 'up' the ladder becomes the focus again (Pilarz, 2009).

Table 1

Developmental milestones for social-emotional functioning

Developmental milestone/level	**Chronological age (normally developing child)**	**Description**
1. Self-regulation and joint attention	0-3 months	Uses five senses to stay calm and regulated and to establish shared interest with others (joint attention).
2. Engagement and relating	2-7 months	Forms special relationship with parent or carer.
3. Two-way intentional communication	3-10 months	Demonstrates purposeful communication with parent or carer, using gestures, vocalisations and facial expressions.
4. Purposeful complex problem solving communication	9-18 months	Engages in continuous flow of interactions with parent or carer, experiencing emotions, such as, closeness, pleasure, assertive curiosity, fear, and anger.
5. Creating and elaborating symbols (ideas)	18-30 months	Learns that things and feelings can be named and mentally represented. Develops pretend play.

6. Building bridges between symbols (ideas)	30-48 months	Forms logical bridges between ideas and feelings. Develops abstract thinking (what, when, how and why questions).

Note. Adapted from Dionne and Martini (2011) and Wieder and Greenspan (2003).

Initial support for the DIR method came from an observational study of two hundred pupils who were enrolled in Greenspan and Wieder's intervention programme. After a period of two years, fifty-eight per cent of the pupils showed improved functioning and no longer met the criteria for an ASD. The authors reported that many of the children developed healthy peer relationships and demonstrated the capacity for empathy and abstract thinking (Greenspan & Wieder, 1997).

Rationale

Autistic Spectrum Disorders are estimated to affect around one per cent of children (Baird et al., 2006). In light of this, educational psychologists can expect to be consulted on ASD intervention programmes. Knowledge about the effectiveness of early intervention programmes may be especially pertinent, as an ASD is usually visible in behaviour before the age of three (Oono et al., 2003). Parents may be keen to begin an immediate intervention programme, especially if they are experiencing difficulties with their infant or child at home. Moreover, early intervention is at the heart of educational policy, with the new Code of Practice instructing health workers, social workers and early years providers to 'start early' so that families receive the 'right support' (Department for Education, 2014). This is seen to be critical for long term outcomes as it is believed that, with early and adequate support, individuals with special educational needs will have a better chance of finding work, participating in their community and achieving some degree of independence.

Home intervention programmes may be more advantageous than clinical therapies as they support both the child and the care-giver, strengthening the adult-child bond and reducing parental levels of stress. Parental training programmes may also be more cost-effective. With clinic-based therapies typically requiring twenty to forty hours of specialist input, their implementation may come at a premium to funding bodies (Jacobson and Mulick, 2000). Furthermore, parental training programmes may be used to complement specialist school or nursery programmes, adding an additional dimension to the child's care.

A previous review found some evidence for the effectiveness of parent-implemented early intervention programmes, but highlighted the need for further research (Oono et al., 2013). A systematic review of the evidence base for DIR/Floortime is currently not available, despite its use in America and other countries. For this reason, DIR/Floortime was selected as an appropriate intervention to review. As the model centres on developing the child's social-emotional capacities, this aspect of cognition formed the focus for the following review question:

How effective is the DIR/Floortime programme in improving the social-emotional functioning of infants and children with an autistic spectrum disorder?

Critical Review of the Evidence Base

Literature Search

In January 2015 three electronic databases were searched using the search term 'DIR Floortime'. The search in 'Anywhere' in ERIC (EBSCO) produced five studies. 'Keyword' searches in PsychINFO and Medline yielded fifteen and five studies respectively. Once duplicates had been removed, twenty-one studies remained. The titles and abstracts of these studies were screened using specific inclusion criteria (refer to Appendix A). Thirteen were excluded for failing to meet the inclusion criteria. The remaining eight were selected for a full

review of the text and, of this number, a further three were excluded (see Appendix B). This left five studies for systematic review, which are listed in Table 2. A summary of each study may be found in Appendix C. Figure 1 outlines the search process.

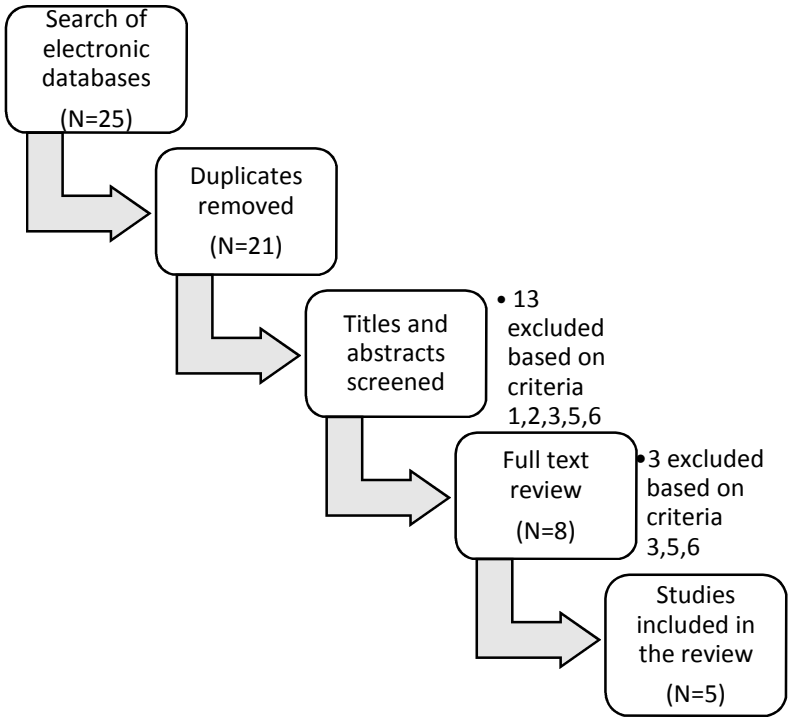

Figure 1: Diagram outlining the literature search.

Table 2

Studies for systematic review

Study ID number	Full APA reference
1	Solomon, R., Necheles, J., Ferch, C., & Bruckman, D. (2007). Pilot study of a parent training program for young children with autism: the PLAY project home consultation program. *Autism:The International Journal of Research and Practice*, *11*(3), 205–24.
2	Pilarz, K. (2009). *Evaluation of a seven week public school curriculum based DIR/Floortime parent training program for parents of children on the autistic spectrum*. Unpublished doctoral thesis, Temple University, Philadelphia.
3	Pajareya, K., & Nopmaneejumruslers, K. (2011). A pilot randomized controlled trial of DIR/Floortime parent training intervention for pre-school children with autistic spectrum disorders. *Autism:The International Journal of Research and Practice*, *15*(5), 563–77.

4 Pajareya, K., & Nopmaneejumruslers, K. (2012). A one-year follow-up study of a DIR/Floortime parent training intervention for pre-school children with autistic spectrum disorders. *Journal of the Medical Association of Thailand, 95* (9), 1184-93.

5 Liao, S.T., Hwang, Y.S., Chen, Y.J., Lee, P., Chen, S.J., & Lin, L.Y. (2014). Home-based DIR/Floortime intervention program for pre-school children with autism spectrum disorders: preliminary findings. *Physical & Occupational Therapy in Pediatrics*, *34* (4), 356–67.

Critical appraisal for quality and relevance

To consider the overall quality of the evidence presented in the five studies and its relevance to the review question, a method of critical appraisal was adopted, which was based on Gough's (2007) Weight of Evidence Framework. This involved rating the five studies in the following three areas; methodological quality (Weight of Evidence A), methodological relevance (Weight of Evidence B) and topic relevance (Weight of Evidence C) and then evaluating the ratings to make a judgement about the overall weight of evidence (Weight of Evidence D). Figure 2 illustrates the process.

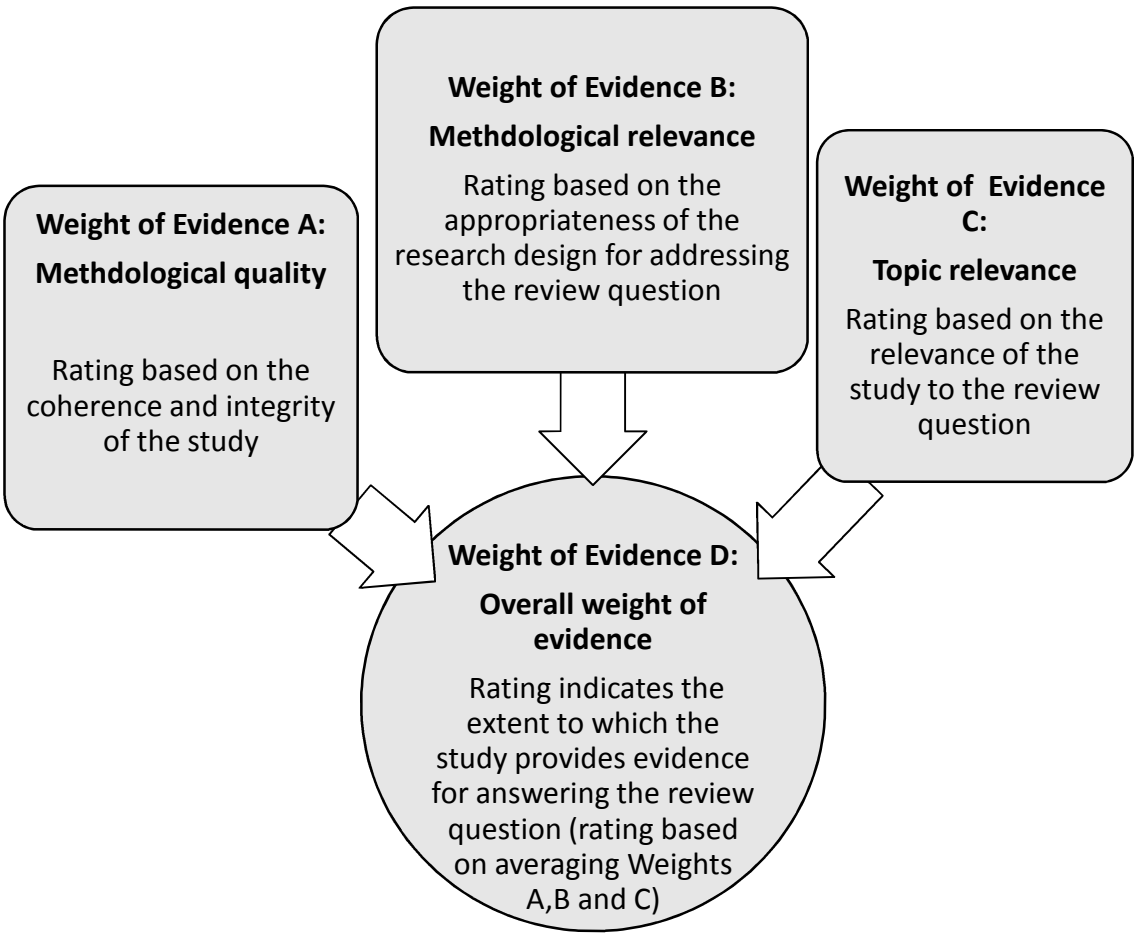

Figure 2: Diagram to show Gough's (2007) Weight of Evidence Framework.

Methodological quality (Weight of Evidence A)

The methodological quality of each study was evaluated using an adapted version of Kratochwill's (2003) Coding Protocol. (Changes to the original format are explained in Appendix D. The completed coding protocols may found in Appendix G.) Upon completion of the coding protocols, each study was awarded a single score (from '0' to '3'), which was then used to determine its weighting for methodological quality. Scores in the range '2.6' to '3' were awarded a 'high' weighting, those in the range '1.5' to '2.5' achieved a 'medium'

weighting and scores falling at '1.4' or below were given a 'low' weighting (for a summary of scores refer to Appendix D).

Methodological relevance (Weight of Evidence B)

The methodological relevance of each study was determined by its research design. 'High', 'medium', and 'low' weightings were awarded in line with Guyatt et al.'s (1995) Grades of Recommendation. Randomised controlled trials were given the highest weighting, as these sought to minimize researcher and selection bias through random allocation to groups. Studies which lacked a comparison group were given the lowest rating, as these did not permit for the control of confounding variables, such as the effect of developmental maturation. Appendix E gives a full description of the criteria for methodological relevance weightings. Each study was also awarded a numerical score to reflect its weighting. Studies of 'high' methodological relevance were awarded a score of '3'. Studies with a 'medium' weighting were given a score of '2' and those with a 'low' weighting were given a score of '1'.

Topic relevance (Weight of Evidence C)

A judgement about the relevance of the evidence to the review question was made based on the following information from each study: type of sample, context in which the intervention was delivered and the method of assessment. Weightings reflect the extent to which findings may be generalized to answer the review question (Gough, 2007). Appendix F gives a full description of the criteria for topic relevance weightings. Numerical scores were obtained from weightings, using a similar procedure as before , where studies with a 'high' weighting achieved a score of '3', those with a 'medium' weighting were given a score of '2' and studies with a 'low' weighting were given a score of '1'.

Weight of evidence findings

Table 3 presents the weight of evidence findings for each study, including the overall weight of evidence (Weight of Evidence D). Findings are presented as numerical scores as well as weightings. Scores for the overall weight of evidence were calculated by averaging the three scores from Weights of Evidence A, B and C. Studies with scores in the range '2.6' to '3' were awarded a 'high' overall weighting, those with scores between '1.5' and '2.5' were given a 'medium' overall weighting and studies with scores falling at '1.4' or below were given a 'low' overall weighting.

Table 3

Weight of evidence findings

Study ID number	**Authors (date)**	**Methodological quality (WoE A)**	**Methodological relevance (WoE B)**	**Topic relevance (WoE C)**	**Overall (WoE D)**
1	Solomon et. al. (2007)	2 medium	1 low	2 medium	1.7 **medium**
2	Pilarz (2009)	2.2 medium	2 medium	2 medium	2.1 **medium**
3	Pajareya & Nopmaneejumruslers (2011)	2.4 medium	3 high	2 medium	2.5 **medium**
4	Pajareya & Nopmaneejumruslers (2012)	2 medium	1 low	2 medium	1.7 **medium**
5	Liao et al. (2014)	1.6 medium	1 low	2 medium	1.5 **medium**

Critical review

Participants

Demographics

Collectively, the studies represent participants from two continents – North America and Asia. Two studies were conducted in the United States (Pilarz, 2009; Solomon et al., 2007), one in Taiwan (Liao et al., 2014) and two in Thailand (Pajareya & Nopmaneejumruslers, 2011; Pajareya & Nopmaneejumruslers, 2012). The international nature of this research lends support to the relevance of this intervention to children from different cultural backgrounds.

In advance of commencing the research, all the participants had received a diagnosis of an ASD according to the American Psychiatric Association's Diagnostic and Statistical Manual (1994). In four of the studies, participants were drawn from a similar age range (aged two to six years), with the fifth study using an older cohort (aged three to twelve years) (Pilarz, 2009). Males were over-represented in each study, with samples ranging from all male (Pilarz, 2009) to sixty-seven per cent male (Solomon et al., 2007). However, this gender imbalance may reflect sex differences in the prevalence of ASDs, with males three or four times more likely to have an ASD than females (Frederickson, 2008).

Only one study gave some information relating to participants' ethnicities (Solomon et al., 2007), where three children were reported to be African-American, one of whom was of mixed race. (The rest were presumably White American.) In four studies, the level of parental education was reported to be high, with the majority of mothers educated to degree-level (Liao et al., 2014; Pajareya & Nopmaneejumruslers, 2011; Pajareya & Nopmaneejumruslers 2012; Solomon et al., 2007). Overall, participants appeared to come from more socially advantaged backgrounds with only one study being carried out on a predominantly working-class population (Pilarz, 2009). This casts doubt on the generalizability of findings to populations with lower levels of parental educational or lower social economic status.

Selection bias

Families were recruited to participate in the research either through paper advertising or through contact with a professional. The element of self-referral in the research process highlights the potential for selection bias.

Power Analysis

Sample sizes ranged from sixty-eight to eleven participants. In two studies the sample size was sufficient to detect a large effect size (Pajareya & Nopmaneejumruslers 2012; Solomon et al., 2007). However, in the other three studies, the sample size was too small. Consequently, these studies were considered under-powered (Liao et al., 2014; Pajareya & Nopmaneejumruslers, 2011; Pilarz, 2009).

Research design

Experimental design

Two studies used an experimental design. Only one demonstrated random allocation (Pajareya & Nopmaneejumruslers, 2011). Consequently this was the only study to be given a 'high' weighting for methodological relevance. Group equivalence was established by using stratified random assignment based on age and symptom severity, the latter of which was assessed using a clinical tool, The Childhood Autism Rating Scale or CARS (Schopler at al., 1980). The participants in the control group were put on a waiting-list to receive the intervention. In contrast, Pilarz's (2009) experimental design used a convenience method to assign groups, with children assigned to groups based on whether their parents had agreed to undertake DIR/Floortime training. Since group equivalence could not be established this study was given a 'medium' weighting for methodological relevance.

Quasi-experimental design

The remaining three studies employed a quasi-experimental design (Liao et. al, 2014; Pajareya & Nopmaneejumruslers, 2012; Solomon et al., 2007). With the absence of a control group, the effect of confounding variables (such as developmental maturation) could not be accounted for and, for this reason, these three studies were awarded a 'low' weighting for methodological relevance.

Intervention

Implementation

All studies employed DIR/Floortime as the sole parental training intervention. Since close adherence to Wieder and Greenspan's model was demonstrated by all studies, each was awarded a 'high' rating for implementation fidelity (refer to the coding protocols in Appendix G). For example, parental training workshops were delivered by either the project director or an educational psychologist and on-going supervision took place throughout the intervention period. However, whilst parental training procedures were robust, the intensity of the intervention differed between studies. Naturally, parents could not be compelled to deliver a set number of sessions and therefore the amount of DIR/Floortime each participant received differed, from less than seven hours per week to in excess of fourteen hours (Pajareya & Nopmaneejumruslers, 2012). However, this reflects the real-life context in which home-based interventions occur, as the amount of time spent delivering an intervention will differ by family and may be dependent on a range of factors, such as, number of siblings at home and parental employment status. Furthermore, the duration of the intervention differed considerably between studies, with some programmes lasting only a few months (Liao et al., 2014; Pajareya & Nopmaneejumruslers, 2011; Pilarz, 2009) and others lasting up to a year (Pajareya & Nopmaneejumruslers, 2012; Solomon et al., 2007) . These differences may have

affected findings. For instance, longer-running programmes may have been more susceptible to the effect of developmental maturation.

Concurrent Exposure

All the studies reported that some, or all, of the participants were accessing other forms of ongoing support, either as part of a specialised school or pre-school curriculum or in a clinical setting, such as speech therapy or occupational therapy. Therefore none of the studies could be awarded a 'high' rating for topic relevance. Without controlling for the effects of these other interventions, the extent to which DIR/Floortime may be associated with improved social-emotional functioning is lessened. However, from an ethical perspective, forcing participants to withdraw from specialised school programmes or therapies for the duration of the study could be deemed unethical. Thus, whilst validity may have been weakened by concurrent exposure to other programmes, ethical integrity remained upheld.

Cost

Only one study provided cost-analysis information. According to Solomon et al . (2007), the cost of implementation was approximately $2500 - $3000 (roughly £1600 - £1950) per family, per year, which may be reasonably high. High costs could undermine the feasibility of the intervention.

Measures

FEAS

All studies used the Functional Emotional Assessment Scale (FEAS) to assess participants' social-emotional functioning (Greenspan & DeGangi, 2001). Other instruments included in the studies (such as parental levels of stress or participants' symptom severity) were not considered relevant to the review question and were therefore excluded from critical

appraisal. The FEAS is considered to be a valid and reliable clinical rating scale for measuring social-emotional development (Ringwalt, 2008). Inter-observer reliability co-efficients range between 0.91 and 0.98 (Greenspan & DeGangi, 2001). The FEAS consists of six-subtests which collectively give an overall rating for social-emotional functioning. For the purposes of this review, only the overall scores were considered.

Four studies gave evidence of high inter-rater reliability. Solomon et al. (2007) found no significant difference on a two-tailed t-test. Pajareya and Nopmaneejumruslers (2011) (2012) and Liao. et al. (2014) reported correlation co-efficients of between 0.85 and 0.96.

On account of high reliability, FEAS was given a 'high' rating in the measurement section of the coding protocols. FEAS was also considered highly relevant to the review topic, which informed ratings for Weight of Evidence C.

Findings

All the studies reported statistically significant findings. Effect sizes were calculated using the means of pre- and post-test data and the population standard deviation, the latter of which was obtained from Liao's et al. (2014) data. Effect sizes were interpreted according to Cohen's criteria, where '0.2' is considered a 'small' effect, '0.5' is regarded as a 'medium' effect and '0.8' is deemed be a 'large' effect (Cohen, 1988).

For all studies it was possible to compute an effect size for the intervention group, by subtracting the pre-test mean FEAS score from the post-test mean FEAS score, and then dividing this figure by the population standard deviation. For the two studies with an experimental design, an additional effect size was obtained in order to examine differences between the control and intervention group. For Pajareya & Nopmaneejumruslers' (2011) study, this effect size was calculated by finding the post-test mean difference between the groups and then dividing this figure by the population standard deviation. For Pilarz's (2009)

study, this effect size was reported as a partial eta squared value. Referring to research by Fritz, Morris and Richler (2012), the partial eta squared value was interpreted according to Cohen's criteria.

As seen from Table 4, effect sizes ranged from small to large, with the majority being 'medium', lending support to the efficacy of this intervention in promoting social-emotional development.

However, caution should be used when interpreting the findings from the three under-powered studies (Liao et al, 2014; Pilarz, 2009;Pajareya & Nopmaneejumruslers, 2011). The reliability of Pilarz's findings (2009) is particularly under scrutiny, as she reported a small decline in the social-emotional functioning of participants in the control group (with a pre-test post-test mean difference of -0.19). This is surprising, given the expectation that social-emotional functioning would increase somewhat over a period of three months due to developmental maturation.

Table 4

Summary of study findings: Effect sizes and overall weight of evidence

Study ID number	Authors (date)	Effect sizes (Cohen's *d*)		Overall weight of evidence
		Pre-test, post-test mean difference (intervention group only)	**Post-test mean difference (intervention versus control group)**	
1	Solomon et. al. (2007)	0.51 ** medium	N/A	medium
2	Pilarz (2009)	0.54 *** medium	partial η2 = 0.71 *** large ^	medium
3	Pajareya & Nopmaneejumruslers (2011)	0.51 * medium	0.38* small	medium
4	Pajareya & Nopmaneejumruslers (2012)	0.57** medium	N/A	medium
5	Liao et al. (2014)	0.68* medium	N/A	medium

*$p \leq 0.05$ **$p \leq 0.001$ *** $p \leq 0.0001$ *Population SD = 13.6 (Liao et al. , 2014)*

Note. According to Fritz, Morris and Richler (2012), partial η2 = 0.71 is a large effect size using Cohen's criteria.

Conclusion

Overall, the five studies in this review present positive evidence for the efficacy of DIR/Floortime in promoting the social-emotional development of infants and children with an ASD. Individuals who received the intervention appeared to have benefitted from it and

parental responses to the programme were mostly positive. Findings suggest that, after a period of intervention, infants and children show significant gains in levels of social-emotional functioning.

However, generalizing these results must be carried out with care because the overall weight of evidence presented by the five studies is considered to be only 'medium'. This review revealed some weaknesses in the design of studies and the rigour in which they were conducted. In the absence of a control group, three studies were unable to account for the effect of confounding variables, most notably the effect of developmental maturation (Liao et al., 2014; Solomon et al., 2007; Pajareya & Nopmaneejumruslers, 2012). Non-randomization in four studies meant that samples were susceptible to selection bias (Liao et al., 2014; Pajareya & Nopmaneejumruslers, 2012; Pilarz, 2009;Solomon et al., 2007). Since most of the participants came socially advantaged backgrounds, where levels of parental education were high, it is difficult to know how effective this intervention might be for infants and children from lower-income families, or homes where parents have a lower level of education (Liao et al., 2014; Pajareya & Nopmaneejumruslers, 2011; Pajareya & Nopmaneejumruslers, 2012;Solomon et al., 2007). Insufficient sample sizes in three of the studies mean that it is difficult to ascertain the effect size of the intervention (Liao et al., 2014; Pajareya & Nopmaneejumruslers, 2012; Pilarz, 2009). Discerning the true effect of the intervention is made harder still by the fact that many of the participants were receiving other forms of on-going support, which may have contributed to their improved scores on social-emotional functioning. Moreover, the longer term impact of DIR/Floortime is unknown, as follow-up research was not conducted.

Recommendations

There is moderate evidence to suggest that DIR/Floortime may be an effective parent-mediated intervention for improving the social-emotional functioning of infants and children who have an ASD. Consequently, educational psychologists may wish to recommend this programme to families and educational professionals who are seeking a home-based early intervention. However, cost considerations may also need to be taken into account. With an estimated cost of between $2500 and $3000 per family, per year (roughly £1600 - £1950), a more affordable alternative may be preferable for those who are funding programmes (Solomon et al., 2007).

To help justify the cost of this intervention, more rigorous research is needed. Randomized controlled trials, with sufficiently large sample sizes, are required. The suitability of the intervention for a home population also needs to be considered. Future studies should use samples which reflect the socio-economic and ethnic backgrounds of infants and children in the United Kingdom. Research into the potential longer term benefits of DIR/Floortime could also help to strengthen the evidence-base for this intervention.

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Appendices

Appendix A: Inclusion and exclusion criteria for the literature search

Table A1

Inclusion and exclusion criteria

	Inclusion criteria	**Exclusion criteria**	**Rationale**
1 Type of publication	The study appears in either a peer reviewed journal or is a doctoral thesis which has been accepted at an accredited institution.	The study has not been through a rigorous evaluation process. For example, it does not appear in a peer reviewed journal or it has not been scrutinised at doctoral level by an accredited university. Such examples may include conference papers, reports or books.	This is to ensure that the research has been rigorously evaluated by other experts in the field and, as a result, is of a high quality.
2 Language	The study must be published in English..	The study is not available in English.	This is to ensure that the study can be understood (translation services are not available to the reviewer).
3 Research design	The study must include primary empirical data. It must feature a casual	The study does not include primary empirical data, for example, it is a review or a meta-analysis. A control group or data relating to pre and post	Primary empirical data is required in order to compare the effectiveness of each study. Pre- and post-data or data from a

	research design, for example, a randomised controlled trial or a comparison study with pre- and post-data. Data must be quantitative.	intervention are missing. Data is exclusively qualitative.	randomised controlled trial is needed in order to calculate effect sizes.
4 Intervention	The intervention is implemented exclusively by parents or carers.	The intervention does not require parents or carers to implement the intervention, for example, it may be school-based or community-based.	The purpose of this review is to evaluate a parental training programme. Therefore parents must be responsible for implementing the intervention.
	The intervention is based on the DIR/Floortime approach.	The intervention is not based on the DIR/Floortime method.	This review is concerned only with DIR/Floortime and not variations of it, nor other types of interventions.
5 Measures	Instruments measure participants' socio-emotional functioning in a quantitative manner.	Participants' socio-emotional functioning is not measured in a quantitative way. The study may look at other variables, for example, parental	This review is concerned only with participants' socio-emotional functioning. Quantitative measures are needed to

		stress or autism severity.	obtain empirical data.
6 Population	The participants must be aged 0 to 12 and meet the criteria for an autistic spectrum disorder.	The participants are older than 12. They do not meet the criteria for an autistic spectrum disorder. For example, they may be diagnosed with another developmental disorder that is not an ASD.	This is to ensure that all participants are children, who have a recognised diagnosis of ASD.
7. Sample	This study has a sample size greater than one.	This paper is a single case study.	Multiple participants improve the reliability of findings.

Appendix B: Excluded studies with rationale

Table B1

Excluded studies with rationale

Study	**Reason for exclusion**
Hess, E. B. (2013). DIR / Floortime: Evidence-based practice towards the treatment of autism and sensory processing disorder in children and adolescents. *International Journal of Child Health and Human Development, 6*(3), 267–274.	This study does not assess the effectiveness of the DIR Model with primary empirical data (exclusion criterion 3). It is a descriptive overview of the intervention.
DeWaay, R. J. (2012). *Parents' perceptions of treatment effectiveness in a DIR/Floortime home intervention.* Unpublished doctoral dissertation, Fuller Theological Seminary, CA.	The participants in this study are not exclusively children (exclusion criterion 6). Adolescents are included in the sample.
Ryan B. et al. (2011). Research-based educational practices for students with autism spectrum disorders. *Teaching Exceptional Children, 43* (3), 56-64.	This study does not assess the effectiveness of the DIR Model with primary empirical data (exclusion criteria 3 and 4). It is a review of various interventions.

Appendix C: Summary of the included studies

Table C1

Summary of included studies

Study	**Participant sample**	**Country**	**Intervention**	**Design**	**Primary outcome measures**	**Primary outcomes**
Solomon, R. et al. (2007)	68 children (51 boys and 17 girls) aged 2-6 years, all with a clinical diagnosis of an ASD.	United States	8-12 month programme, with families encouraged to deliver 15 hours per week of DIR/Floortime. Initial training workshop for families, delivered by the project's director.	Quasi-experimental. Pre/post design. No control group.	Functional Emotional Assessment Scale (FEAS)	Participants' total FEAS scores were significantly higher after 12 months ($p \leq 0.0001$). 45.5 % of participants made good to very good developmental progress over the 8-12 month period.
Pilarz, K. (2009)	26 children (21 boys and 5 girls), aged 3-12 years, all with a clinical diagnosis of an ASD.	United States	Seven week programme. Parents encouraged to deliver DIR/Floortime 8 to 10 times daily. Initial training sessions for families, delivered by an educational psychologist.	Non-randomized group design with a control group. The control group received no input.	FEAS	Participants in the intervention group had significantly higher total FEAS scores than participants in the control group (F (1, 23) =59.95, p = 0.000, partial $\eta 2 = 0.71$).

Pajareya, K. & Nopmaneejumruslers, K. (2011)	32 children (28 boys and 4 girls), aged 2 - 6 years, all with a clinical diagnosis of an ASD.	Thailand	3 month programme, with each child in the intervention group receiving an average of 15.2 hours per week of DIR/Floortime. Initial training sessions for families, delivered by a home consultant.	Randomised group design with waitlist control group. The control group received no input.	FEAS	Participants in the intervention group made significantly greater gains in total FEAS scores than participants in the control group ($F=5.1$, $p = 0.31$).
Pajareya, K. & Nopmaneejumruslers, K. (2012)	34 children (30 males and 4 females), aged 2 - 6 years, all with a clinical diagnosis of an ASD.	Thailand	One-year programme, with each child receiving an average of 14.2 hours per week of DIR/Floortime. Initial training sessions for families, delivered by a home consultant.	Quasi-experimental. Pre/post design. No control group.	FEAS	Participants' total FEAS scores were significantly higher after 12 months ($p \leq 0.001$). 70% of participants achieved a gain of one or more developmental levels within 12 months.
Liao, S.T. et al. (2014)	11 boys, aged 45-69 months, all with a clinical diagnosis of an ASD.	Taiwan	10 week programme, with each child receiving an average of 10 hours per week of DIR/Floortime.	Quasi-experimental Pre/post design. No control group.	FEAS	Participants showed significant gains in socio-emotional development. Mean scores for total FEAS increased significantly ($Z= -2.31$, $p < 0.05$).

	Initial training sessions for mothers, delivered by project director.	

Appendix D: Changes to the coding protocol and summary of coding protocol evidence

Table D1

Changes to the coding protocol

Section removed from coding protocol	**Rationale for removal**
B7 Coding	Qualitative research measures are not included in this review.
B3 Counter-balancing of change agents	The change-agents are the parents of the participants. They cannot be counter-balanced. (It is not possible for a participant to change his or her parents.)
C2-C5 Primary and secondary outcomes	Only outcomes relating to socio-emotional functioning are relevant to this review.
Effect size table	Effect sizes are reported elsewhere in this review.
D Educational/clinical significance	Educational significance is discussed elsewhere in this review. Clinical significance is not relevant as this review is not concerned with changes in participants' diagnoses.
I Follow up assessment	This was not conducted by any study.
A2-A3. Participant Characteristics	This is discussed in detail elsewhere in the review.

Table D2

Summary of coding protocol evidence

Study	Measurement	Comparison Group	Primary Outcomes are statistically significant	Fidelity	Site	Overall score and rating
Solomon et. al. (2007)	3	0	3	3	1	2 medium
Pilarz (2009)	3	1	3	3	1	2.2 medium
Pajareya & Nopmaneejumruslers (2011)	3	2	3	3	1	2.4 medium
Pajareya & Nopmaneejumruslers (2012)	3	0	3	3	1	2 medium
Liao et al. (2014)	3	0	1	3	1	1.6 medium

Overall scores were obtained by averaging the scores for measurement, comparison group, primary outcomes, fidelity and site. Overall scores in the range '2.6' to '3' were awarded a 'high' weighting, those in the range '1.5' to '2.5' achieved a 'medium' weighting and scores falling at '1.4' or below were given a 'low' weighting.

Appendix E: Criteria for methodological relevance weightings (Weight of Evidence B)

Table E1

Criteria for Weight of Evidence B

Weighting		
High	**Medium**	**Low**
Control group and intervention group. Random assignment.	Control group and intervention group. Non-random assignment.	Intervention group only.

Appendix F: Criteria for topic relevance weightings (Weight of Evidence C)

Table F1

Criteria for Weight of Evidence C

Weighting		
High	**Medium**	**Low**
Participants are infants or children (aged 0 – 12).	Participants are infants, children or adolescents (aged 0 – 18).	Participants are adults (aged 18 or older).
Participants are selected on the basis of a clinical diagnosis of an ASD, as recognised by American Psychiatric Association.	Participants are selected on the basis of other criteria for an ASD, e.g. researcher's own diagnostic measures.	Participants' diagnosis of an ASD is assumed, but no effort has been made to measure this (e.g. evidence for an ASD may be anecdotal, such as, comments from teachers or parents).
Intervention is implemented by parents only.	Parents and others (e.g. teachers or therapists) implement the intervention.	Parents play a minor role in delivering the intervention.
DIR/Floortime is used exclusive of other interventions.	DIR/Floortime is used as well as other interventions/therapies.	Elements of the DIR/Floortime model are used.
Pre and post measures of social-emotional functioning are taken.	Pre and post social-emotional functioning is described, but not quantified.	Participants' social-emotional functioning is not described

Appendix G: Coding protocols

Coding Protocol: Group Based Design

Domain:

School-and community-based intervention programs for social and behavioural problems	
Academic intervention programmes	
Family and parent intervention programmes	■
School-wide and classroom-based programmes	
Comprehensive and coordinated school health services	

Name of Coder: **Date:** January 16th, 2015

Full name of Study in APA format: Solomon, R., Necheles, J., Ferch, C., & Bruckman, D. (2007). Pilot study of a parent training program for young children with autism: the PLAY Project Home Consultation program. *Autism : The International Journal of Research and Practice*, *11*(3), 205–24.

Intervention Name (description from study):DIR/Floortime

Study ID Number (Unique Identifier): 1

Type of Publication: (Check one)

Book/Monograph	
Journal article	■
Book Chapter	
Other (specify):	

1. **General Characteristics**

Quasi-Experimental Designs Without Control Groups

The One-Group Posttest-Only Design	
The One-Group Posttest-Only Design with Multiple Substantive Posttests	
The One-Group Pretest-Posttest Design	■
The One-Group Pretest-Posttest Design Using a Double Pretest	
The One-Group Pretest-Posttest Design Using a Non-equivalent Dependent Variable	
The Removed-Treatment Design	
The Repeated-Treatment Design	

A. Statistical Treatment/ Data Analysis

	Yes	No	N/A
B1. Appropriate unit of analysis	■		
B2. Familywise error rate controlled			■
B3. Sufficiently large *N*	■		

B.3.1 Statistical Test: 2 tailed paired t-test

B3. 2 Level: 0.05

ES: Large

N required: 26

B4. Total size of sample (start of the study): 68

B5. Intervention group sample size: N/A

B6. Control group sample size: N/A

B. Type of Programme

C.1 Universal prevention programme	
C.2 Selective prevention programme	
C.3 Targeted prevention programme	
C.4 Intervention/Treatment	■
C.5 Unknown	

C. Stage of the Programme

D.1 Model/demonstration programmes	■
D.2 Early stage programmes	
D.3 Established/institutionalised programmes	
D.4 Unknown	

D. Concurrent or Historical Intervention Exposure

E.1 Current exposure	■
E.2 Prior Exposure	
E.3 Unknown	

II. Key Features for Coding Studies and Rating Levels of Evidence/Support

(3 = Strong Evidence; 2 = Promising Evidence; 1 = Weak Evidence; 0 = No Evidence)

A. Measurement

A1. Use of outcome measure produces reliable sources for the majority of primary outcomes.

A1.1Yes	■
A1.2 No	
A1.3 Unknown/Unable to code	

A2. Multi-method

A2.1 Yes	
A2.2 No	
A2.3 N/A	■
A2.4 Unknown/Unable to code	

A3. Multi-source

A3.1 Yes	

A3.2 No	
A3.3 N/A	■
A3.4 Unknown/Unable to code	

A4. Validity of measures reported

A4.1 Yes validated with specific target group	
A4.2 In part, validated for general population only	
A4.3 No	■
A4.4 Unknown/Unable to code	

Rating for Measurement

3	■
2	
1	
0	

B. Comparison Group

B1. Type of Comparison Group

B1.1 Typical contact	
B1.2 Typical contact (other) specify:	
B1.3 Attention placebo	
B1.4 Intervention elements placebo	
B1.5 Alternative intervention	
B1.6 Pharmacotherapy	
B1.7 No intervention	
B1.8 Wait list/ delayed intervention	
B1.9 Minimal contact	
B1.10 Unable to identify comparison group	■

Rating for Comparison Group

3	
2	
1	
0	■

B2. Overall confidence rating in judgement of type of comparison group

B2.1 Very low (little basis)	
B2.2 Low (guess)	
B2.3 Moderate (weak inference)	
B2.4 High (strong inference)	
B2.5 Very high (explicitly stated)	
B2.6 N/A	
B2.7 Unknown/unable to code	■

B4. Group Equivalence Established – not applicable

B4.1 Random assignment	
B4.2 Post hoc matched set	
B4.3 Statistical matching	
B4.4 Post hoc test for group equivalence	

B5. Equivalent Mortality – not applicable

B5.1 Low attrition (less than 20% for Post)	
B5.2 Low attrition (less than 30% for follow-up)	
B5.3 Intent to intervene analysis carried out	

C. Primary/Secondary Outcomes Are Statistically Significant

C.1 Evidence of appropriate statistical analysis for primary outcomes

C1.1 Appropriate unit of analysis	
C1.2 Familywise/experimenterwise error rate controlled when applicable	
C1.3 Sufficiently large *N*	

Rating for Primary Outcomes Statistically Significant

3	
2	
1	
0	

F.Implementation Fidelity

F1. Evidence of Acceptable Adherence

F1.1 Ongoing supervision/consultation	■
F1.2 Coding intervention sessions/lessons or procedures	
F1.3 Audio/video tape implementation	

F1.3.1 Entire intervention	■
F1.3.2 Part of intervention	

F2. Manualization

F2.1 Written material involving a detailed account of the exact procedures and the sequence in which they are to be used	
F2.2 Formal training session that includes a detailed account of the exact procedures and the sequence in which they are to be used	■
F2.3 Written material involving an overview of broad principles and a description of the intervention phases	
F2.4 Formal or informal training session involving an overview of broad principles and a description of the intervention phases	■

	Yes	No	Unknown
F3. Adaptation procedures are specified		■	

Rating for Implementation Fidelity

3	■
2	
1	
0	

H Site of implementation

Non School Site

Home	■
University clinic	
Summer program	
Outpatient hospital	
Partial inpatient/day program	
Inpatient hospital	
Private practice	
Mental health centre	
Other	

[adapted from Task Force on Evidence-Based Interventions in School Psychology, American Psychology Association, Kratochwill, T.R. (2003)]

Rating for Site Implementation

3	
2	
1	■
0	

III. Other Descriptive or Supplemental Criteria to Consider

A. External Validity Indicators

	Yes	No
A1. Sampling procedures described in detail	■	

	Yes	No
A1.1 Inclusion/exclusion criteria specified	■	
A1.2 Inclusion/exclusion criteria similar to school practice		■
A1.3 Specified criteria related to concern	■	

A4. Receptivity/acceptance by target participant population

Participants from Treatment Group	**Results (What person reported to have gained from participation in programme)**	**General Rating**
☐Child/Student Parent/caregiver ☐Teacher ☐School ☐Other		Participants reported benefiting overall from the intervention (parents) ☐ Participants reported not benefiting overall from the intervention

A5. Generalisation of Effects:

A5.1 Generalisation over time

	Yes	No
A5.1.1 Evidence is provided regarding the sustainability of outcomes after intervention is terminated.		■
A5.1.2 Procedures for maintaining outcomes are specified		■

A5.2 Generalisation across settings

	Yes	No
A5.2.1 Evidence is provided regarding the extent to which outcomes are maintained in contexts that are different from the intervention context.		■

[adapted from Task Force on Evidence-Based Interventions in School Psychology, American Psychology Association, Kratochwill, T.R. (2003)]

A5.2.2 Documentation of the efforts to ensure application of intervention to other settings.		
A5.2.3 Impact on implementers or context is sustained.		

.

A5.3 Generalisation across persons

	Yes	No
A5.3.1 Evidence is provided regarding the degree to which outcomes are manifested with participants who are different than the original group of participants for with the intervention was evaluated		

B. Length of Intervention

B1. Unknown/insufficient information provided	
B2. Information provided (if information provided, specify one of the following):	

B2.1. Weeks:

B2.2 Months: 8 - 12

B2.3 Years: __

B2.4 Other: __

C. Intensity/dosage of Intervention

C1. Unknown/insufficient information provided	
C2. Information provided (if information provided, specify one of the following):	

C2.1. Length of intervention session:

C2.2 Frequency of intervention sessions:

E.Programme Implementer

E1. Research Staff	
E2. School Speciality Staff	
E3. Teachers	
E4. Educational Assistants	
E5. Parents	
E6. College Students	
E7. Peers	
E8. Others	
E9. Unknown/insufficient information provided	

F.Characteristics of the Intervener

F1. Highly similar to target population on key variables (e.g., race, gender, SES)	

[adapted from Task Force on Evidence-Based Interventions in School Psychology, American Psychology Association, Kratochwill, T.R. (2003)]

F2. Somewhat similar to target participants on key variables	
F3. Different from target participants on key variables	

G.Intervention Style or Orientation

G1. Behavioural	
G2. Cognitive-behavioural	
G3. Experimental	
G4. Humanistic/Interpersonal	
G5. Psychodynamic/insight oriented	
G6. Other, *specify: developmental social-pragmatic*	
G7. Unknown/insufficient information provided	

H.Cost Analysis Data

H1. Unknown/insufficient information provided	
H2. Information provided (if information provided, answer H2.1):	

H2.1 Estimated Cost of Implementation:$2500 - $ 3000 per family per year

I Training and Support Resources

I1. Simple orientation given to change agents	
I2. Training workshops conducted	

# of workshops provided: _1___

Average length of training: workshop was for full day

Who conducted training:

I2.1 Project Director	
I2.2 Graduate/project assistants	
12.3 Other, *specify:*	
12.4 Unknown	

I3. Ongoing technical support	
I4. Programme materials obtained	
I5. Special facilities	
I6. Other, *specify: monthly home visits*	

.

D. Feasibility

J1. Level of difficulty in training intervention agents

J1.1 High	
J1.2 Moderate	
J1.3 Low	
J1.4 Unknown	

J2. Cost to train intervention agents (specify if known):__unknown_____

[adapted from Task Force on Evidence-Based Interventions in School Psychology, American Psychology Association, Kratochwill, T.R. (2003)]

J3. Rating cost to train intervention agents:

J3.1 High	
J3.2 Moderate	
J3.3 Low	
J3.4 Unknown	■

Summary of Evidence for Group-Based Design Studies

Indicator	Overall Evidence Rating NNR = No numerical rating or 0-3	Description of Evidence (Strong, Promising, Weak, No/limited evidence, or Descriptive Ratings
General Characteristics		
General Design Characteristics	NNR	Quasi experimental
Statistical Treatment	NNR	2 tailed t-test
Type of Programme	NNR	Intervention/Treatment
Stage of Programme	NNR	Model/Demonstration
Concurrent/Historical Intervention Exposure	NNR	Concurrent
Key Features		
Measurement	3	Strong evidence
Comparison Group	0	No evidence
Primary Outcomes are Statistically Significant	3	Strong
Implementation Fidelity	3	Strong
Site of implementation	1	Weak
Descriptive /Supplemental Criteria		
External Validity Indicators	NNR	Sampling procedure described in detail
Length of Intervention	NNR	8-12 months
Intensity/Dosage	NNR	Not controlled
Programme Implementer	NNR	Parents
Characteristics of the Intervener	NNR	Highly similar to participants
Intervention Style/Orientation	NNR	Developmental
Cost Analysis Data Provided	NNR	Expensive
Training and Support Resources	NNR	Initial training workshop plus monthly home visits
Feasibility	NNR	Unknown

[adapted from Task Force on Evidence-Based Interventions in School Psychology, American Psychology Association, Kratochwill, T.R. (2003)]

References

DeWaay, R. J. (2012). *Parents' perceptions of treatment effectiveness in a DIR/Floortime home intervention.* Unpublished doctoral dissertation, Fuller Theological Seminary, CA.

Hess, E. B.(2013). DIR / Floortime: Evidence-based practice towards the treatment of autism and sensory processing disorder in children and adolescents. *International Journal of Child Health and Human Development, 6*(3), 267–274.

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