



## Meeting the Needs of Children with Foetal Alcohol Spectrum Disorder Through Research Based Interventions

*New Zealand Journal of Teachers' Work, Volume 10, Issue 1, 148-168, 2013*

---

JANE GUNN

*Victoria University of Wellington*

### ABSTRACT

*This systematic review addresses the research question: What interventions are most effective in supporting the Special Educational Needs of primary aged children with Foetal Alcohol Spectrum Disorder (FASD). Four peer reviewed journals were systematically searched, identifying 11 studies that met inclusion criteria. This review summarises and appraises the intervention outcomes of these studies and provides a cross-study analysis of results. While the majority of outcomes were unsubstantiated, several themes have emerged. Firstly, interventions that include parents and children as participants were more likely to meet their intended outcome. Second, a number of interventions led to a reduction in challenging behaviour, even if this was not the primary outcome of the study. Finally, a range of interventions, based on research with children with general learning disabilities, was shown to be effective in addressing specific deficits. Further research into effective interventions is needed to develop a strong evidence base to guide parents, educators and other professionals working with children with FASD.*

### Keywords

*Interventions, Children, Foetal Alcohol Spectrum Disorder (FASD), Parental Involvement*

Foetal Alcohol Spectrum Disorder (FASD) is a term that is used to describe the physical anomalies and wide range of cognitive deficits that can be caused by exposure to moderate to heavy amounts of alcohol in utero. At the severe end of the continuum is Foetal Alcohol Syndrome (FAS), a condition with diagnostic criteria that includes: growth deficiency; physical anomalies; central nervous system dysfunction; and confirmed maternal alcohol consumption (Blackburn, Carpenter, & Egerton, 2010). The umbrella term FASD can also be used to describe the condition of subjects who meet some, but not all, of the above diagnostic criteria. In these cases the terms partial FAS or Alcohol Related Neurodevelopmental Disorder (ARND) are also used.

FASD has been linked to a number of difficulties that affect learning and development, including: deficits in intellectual ability; poor executive functioning (for example: planning, working memory, and integration of processes such as attention, perception, sensation and motor activity); deficits in learning and memory in relation to both verbal and non-verbal skills; speech and language difficulties; deficits in visual-spatial ability; poor fine and gross motor skills and difficulties in maintaining attention and regulating activity levels (Mattson, Crocker, & Nguyen, 2011). In light of these challenges, it is not surprising that children with FASD are more likely to exhibit: poor social skills (Steinhausen & Spohr, 1998); clinically significant conduct problems (Mattson & Riley, 2000); emotional impairment; intellectual delay; and difficulty in accessing the curriculum (Mattson et al., 2011).

The severity of these effects varies depending on the amount of alcohol consumed, the pattern of alcohol exposure (for example, binge drinking), the stage of foetal development, maternal age and health, genetic influences, the use of other drugs, and postnatal factors (Blackburn, Carpenter, & Egerton, 2012; Mattson et al., 2011).

Challenges with recording and identifying FASDs have resulted in a lack of accurate prevalence data internationally. There is currently no prevalence data regarding FASD in New Zealand (Foetal Alcohol Network NZ, 2012). The most quoted prevalence rates in the US, UK and Europe are around one in every hundred children. However, many researchers would argue that these estimates are conservative and that prevalence rates tend to be considerably higher in high-risk populations (Blackburn et al., 2012).

In a systematic review to identify effective interventions for children and youth from birth to eighteen years old, Premji, Benzies, Serrett, and Hayden (2006) searched 40 peer reviewed journals and 23 grey literature databases (which include articles that are not published by commercial publishers) for relevant studies. Of the 665 studies considered potentially relevant, only 10 studies met their criteria for relevance, and only three of these used an experimental design, thus meeting their standard of empirical significance. Not surprisingly, the key conclusion drawn from this review and subsequent similar reviews (for example, Riley, et al., 2003; Peadon, Rhys-Jones, Bower, & Elliott, 2009) is that there is a serious lack of empirically supported interventions for improving developmental outcomes of children with FASD. Premji and colleagues (2006) also lament that the majority of research in this area is “non-specific, unsystematic, and has not been scrutinised in a scientific manner” (p. 33).

This systematic review aimed to answer the research question: What interventions are most effective in supporting the special educational needs of primary aged children with Foetal Alcohol Spectrum Disorder?

The term ‘special educational needs’ refers to learning difficulties or disabilities that make it harder to access the curriculum, including: academic, physical, behavioural, sensory, social and emotional needs. This broad area of inquiry was developed to ensure the review acknowledged several key factors. Firstly, with previous reviews concluding a lack of empirical evidence, it was anticipated that a systematic review targeting more specific needs (for example behavioural needs) would not yield sufficient articles to make a reliable comparison. Secondly, the broad line of enquiry acknowledges the multifaceted nature of the disorder. A systematic review covering a range of difficulties will

be useful as a first point of reference for education professionals and parents seeking to broaden their understanding of interventions. Thirdly, an initial appraisal of the literature revealed that a number of studies measured the effects of a single intervention on a range of developmental outcomes. It was felt that researching 'special educational needs' encapsulates the full range of outcomes relevant to educators and parents alike. Finally, by not specifying a setting, studies could include interventions administered in a school, home or community setting. This recognises the need for an ecological approach to identifying and addressing the special educational needs of children with FASD.

Effectiveness is defined in terms of: the extent to which an intervention ameliorates or accommodates for an identified special educational need; the generalisability or effect of the improvements on other areas of development; and the applicability of the intervention within a home, community or school setting.

The objectives of the review were to: i) identify empirically sound studies that describe interventions that are effective in supporting the special educational needs of children with FASD; ii) synthesise and analyse the findings of these studies in order to inform educators, parents and other professionals about best practice, and to inform policy decision; and iii) identify priority areas for future research.

## **METHOD**

### **Search procedures**

Systematic searches were conducted between 4 September 2012 and 6 September 2012 in four peer reviewed, electronic databases: Education Research Information Center (ERIC), PSYCinfo, Education Research Complete, and A+ Education. The key terms in all four databases included: 'prenatal alcohol exposure' or 'foetal alcohol' or 'fetal alcohol' and 'interventions' or 'strategies' or 'treatment'. The search was restricted to studies published in English since 1998. Initially 681 articles were identified in this electronic database search. It was anticipated that a large number of studies would be identified in this first instance due to the deliberately broad search terms. The abstracts of these articles were then reviewed according to the inclusion criteria (see below), which resulted in 42 studies being identified. The majority of the excluded studies at this stage were concerned with epidemiology or diagnostic criteria, rather than interventions. Several articles were also excluded, as they were duplicate articles about a single study. The reference lists of the articles included were reviewed to identify additional studies. The ensuing 47 studies were thus reviewed against both the inclusion and exclusion criteria, resulting in 11 studies being included in the final review.

### **Inclusion and exclusion criteria**

In order to be included in this review, an article had to meet four criteria. First, the subjects had to include a child or children (or their caregivers) aged 5-13 years with a FASD. Second, the study had to describe an intervention (the independent variable). Third, the study had to be conducted in a school, home and/or community setting. Fourth, the dependent variable had to be in some way related to the amelioration of special educational outcomes, including social, behavioural, academic or other cognitive measures.

Studies were excluded from this review for the following reasons: firstly, if they summarised classroom strategies or teacher perceptions but did not describe or measure the effect of an intervention (for example Ryan, 2006); secondly, if they were set in a residential care or juvenile detention facility; thirdly, if they described interventions that were designed to reduce alcohol consumption during pregnancy (for example, Belcher et al., 2005); fourthly, if they described pharmaceutical treatments, or a combination of pharmaceutical and psycho-educational treatments; and fifthly, if they did not describe primary research. The rationale for these exclusions was primarily related to the educational focus of the study and the desire to present studies that could be applied within the school, home or educational setting.

### **Data extraction**

Once the final list of studies had been identified, included studies were summarised in terms of: a) aims/objectives of study; b) sample and study design; c) intervention and setting; d) outcome measures; and e) outcome.

### **Quality assessment**

The findings of individual studies were considered in light of quality standards outlined by the Centre for Reviews and Dissemination (2008) and in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins, Altman, & Sterne, 2011). Study design considerations included: procedures for selecting and allocating participants to groups; concealment of allocation; balance of known and unknown group factors; blinding of care providers, participants and outcome assessors to the treatment; unexpected imbalances between groups; and attrition rates.

**Table 1 TABLE OF EVIDENCE***Summary of intervention studies involving children with Foetal Alcohol Spectrum Disorder*

<b>AUTHOR</b>	<b>AIMS/OBJECTIVES</b>	<b>SAMPLE AND STUDY DESIGN</b>	<b>INTERVENTION AND SETTING</b>	<b>OUTCOME MEASURES</b>	<b>OUTCOME</b>
Adnams et al. (2001)	To determine the feasibility of applying intervention strategies to children with FAS in an educational environment; to assess the effect of Cognitive Control Therapy (CCT) on the cognitive processing and behaviour of children with FAS.	Pilot study, pretest/post-test controlled intervention. 10 children identified from a group of 64 children diagnosed with FAS in a previous study. Assigned to either: Intervention Group: N=5; M age 8.4 years; female 1. Control Group: N=5; M age 8.6 years, female 2	Intervention group: Attended weekly 1-hour sessions during school term time for 10 months. The CCT therapy consisted of rehabilitation in 5 metacognitive control domains.	Cognitive Control Battery; a comprehensive neuropsychological battery; Personal Behaviour Checklist	A marked improvement in the rated behaviour of the intervention group, compared to control group, at post-test behaviour of intervention group was comparable to non-FAS control children in a previous study. No significant differences in cognitive functions between groups.
Chasnoff, Schmidt, Schwartz, Telford, & Wells (2012).	To develop and evaluate a programme of neurocognitive habilitation for children who had been in foster care or who had been adopted, and who had a diagnosis of FAS or ARND. The programme aimed to enhance family capacity to care for FASD children, and focuses on improving the children's executive functioning.	78 foster and adopted children, aged between 6 and 11 years, 6 months, with a confirmed history of prenatal alcohol exposure recruited, 74 completed. Randomly assigned to groups. Intervention Group: N=40 Control group: N=38	Intervention Group: Participated in a course of 12 weekly 75-minute neurocognitive habilitation group therapy sessions based on the Alert Program. The parents participated in a parent education group. Control group: Referred for community based services, e.g. occupational therapy, physical therapy, or speech and language therapy.	Behavior Rating Scale of Executive Function (BRIEF); Robert Apperception Test for Children (RATC); Personal behavior checklist; Teacher ratings of academic progress	Children who participated in the neurocognitive habilitation programme demonstrated significant improvement in executive functioning skills and adaptive skills.

AUTHOR	AIMS/OBJECTIVES	SAMPLE AND STUDY DESIGN	INTERVENTION AND SETTING	OUTCOME MEASURES	OUTCOME
Kerns, MacSween, Vander Wekken, & Gruppuso (2010)	To evaluate whether attention deficits of children with FASD can be improved by Computerised Progressive Attention Training (CPAT) AND To determine the feasibility of delivering such an intervention in a school setting and as part of the child's school day curriculum.	10 children with FASD. Recruitment: caregivers invited to have children participate throughout a school district. 12 enrolled 2 dropped out, 10 in study: 2 from elementary school, 8 from middle schools. Mix of boys and girls. 8-15 years 6-15 years old	CPAT Based on Petersen's model of attention. 16 hours over 9 weeks, at school. Aided by research assistant.	Working memory (spatial span task, WISC-III/NI); Attention (Attentional Network Test for Children, ANT-C, and Sad and Happy Ghost task on KiTAP); Academic (Maths and Reading Fluency from Woodcock-Johnson, WJ-III); intellectual abilities (Kaufman Brief Intelligence Test-Second ed. KBIT-2).	Pre post-test: significant improvement on several attention measures, including: sustained attention and selective attention. In addition: measures of spatial working memory, math fluency, and reading fluency also significantly increased. Only a few parent/teacher questionnaires returned, parents saw some improvement in attention. Teachers were generally positive about intervention.
Carmichael-Olson, Feldman, Streissguth, Sampson, & Bookstein (1998)	To investigate the effectiveness of the Families Moving Forward (FMF) intervention in improving caregiver self-efficacy, meeting family needs and reducing child problem behaviours.	52 children, aged between 5 and 11 years with FASD. Families were divided into two groups: FMF Standard Care A stratified randomised block design approach was used in group assignment.	FMF At least 16 90-minute sessions, fortnightly. A manualised curriculum, individualised for families was used. Services were provided in family homes. Standard Care Received a range of services, already available, e.g., speech and language therapy.	Parent Sense of Efficacy Scale; Parenting Stress Index, Eyberg Child Behavior Inventory, and parent ratings of: changes in parental self-care; provider skills; the extent to which needs were met.	96% completed Caregivers in FMF group showed improved sense of parenting self-efficacy and an increased engagement of self-care behaviours. No differences were found in child-related parenting stress. The FMF group also reported higher levels of satisfaction and having their needs met more often. Parents reported significantly fewer problem behaviours.

AUTHOR	AIMS/OBJECTIVES	SAMPLE AND STUDY DESIGN	INTERVENTION AND SETTING	OUTCOME MEASURES	OUTCOME
Bertrand, (2009)	To evaluate and compare two group-based interventions (parent and child behaviour therapy; parent only behaviour support) that aim to reduce behaviour problems among children with FASD, and decrease parenting stress.	58 children, aged 3-7 years with FASD & their caregivers recruited, 46 entered treatment and were randomised into either intervention or comparison group.	Both groups received 14 weeks of assigned intervention, each weekly session lasted 90 minutes. Intervention group: Behavioural parent training treatment, Parent-Child Interaction Therapy (PCIT) Comparison group: Parent only Parenting Support and Management (PSM) programme.	Parenting stress index, third edition-short form (PSI); the Eyberg Child Behavior Inventory (ECBI), and the Child Behaviour Checklist (CBCL) Dyadic Parent-Child Interaction Coding System-II (DPICS-II).	Only 46% of families completed either treatment groups (50% for PCIT, 42% for PSM). Problem behaviours reduced (from clinical to below clinical) over the 14 week period in both groups. There were no significant differences in improvement rates between the two groups.
O'Connor et al. (2006)	To examine the impact of parent-assisted child friendship training (CFT) on social skills knowledge and behaviour in children with FASD. To examine the maintenance of social skills gained over a 3 month period.	100 children with FASD. CFT group: n=51, M age 8.32 years; 56.8% white, 11.8% Black, 19.6% Hispanic, 2% Asian, 9.8% mixed; M IQ 95.53. Delayed Treatment Control group: n=49; M age 8.66 years; 51.1% white, 22.4% black; 14.3 Hispanic; 2% Asian; 10.2 mixed.	Weekly 90 minute sessions over 12 weeks. Child group sessions: focus on different social skills. Parent group sessions: taught about issues related to FASD and about the social skills the children were learning about.	Test of Social Skills Knowledge (TSSK); Social Skills Rating System (SSRS).	Compared to the DTC, the CFT group showed significantly improved social skills knowledge and fewer parent reported problem behaviours at post-testing. Gains had further increased at a 3-month follow-up.
Loomes, Rasmussen, Pei, Manji, & Andrew (2008)	To determine whether rehearsal can be effectively used in children with FASD to improve memory for numbers.	33 children with FASD Experimental Group: N=17; M age 7.5 years; female 9. Control Group: n=16; M age 7.6 years; female 5.	Each child was seen individually over two sessions. Session 1: All students had a pre-test, then experimental group received rehearsal instruction. Students then had a post-test. Session 2: Experimental group were reminded about rehearsing, all students completed a second post-test.	Digit span memory task, modelled after the Working Memory Test Battery for Children (WMTB-C)	The experimental group showed improved performance at the first post-test (which was immediately after being given rehearsal instruction) and at the second, time delayed post-test (after being given a reminder about using rehearsal to remember).

AUTHOR	AIMS/OBJECTIVES	SAMPLE AND STUDY DESIGN	INTERVENTION AND SETTING	OUTCOME MEASURES	OUTCOME
Padgett, Strickland, & Coles (2006)	To assess the effectiveness of a virtual reality computer game in teaching fire safety skills to children with FASD.	5 students, multiple baseline, multiple probe, and pre and post-test case series design.	Initial visit: Pretesting and engagement in virtual reality computer game, post-testing Second visit: post-testing	Card sequencing activity to demonstrate safety procedures; Imaginary real world scenario.	Pretest: no children could demonstrate knowledge of correct home fire safety procedures. Post-test: all children were able to complete safety steps; 4/5 could generalise sequence cards; 4/5 could generalise steps in response to imaginary fire. 3/5 could complete safety steps, sequence cards and response to an imaginary fire.
Coles, Strickland, Padgett, & Bellmoff (2007)	To evaluate the effectiveness of computer games as methods for teaching preschool and school-aged, alcohol-affected children safety skills in fire and street safety.	32 children aged 4-10 years, with FASD. Randomly assigned to: Fire Safety group: M age 6.98 years; ability score 83.13, adaptive behaviour 73.13, female 12.5%. Street Safety group: M age 6.8 years; ability score 77.53; adaptive behaviour 73.07; female 56.2%.	Fire safety group: Played a virtual game on the computer which taught fire safety skills. Street safety group: Played a virtual game on the computer which taught street safety skills. Mastery was achieved when children could complete the game activities independently.	Children were tested verbally immediately following the game session.  Generalisation was demonstrated by acting out the safety steps learned in the game.	Children showed significantly better knowledge and application of safety rules immediately following the programme, and one week later.



AUTHOR	AIMS/OBJECTIVES	SAMPLE AND STUDY DESIGN	INTERVENTION AND SETTING	OUTCOME MEASURES	OUTCOME
Kable, Coles, & Taddeo (2007)	To evaluate the effect of a sociocognitive habilitation programme designed to improve the behavioural and mathematical functioning of alcohol-affected children.	61 children with FASD, aged 3-10 years. 56 completed post-testing <b>Math group</b> (intervention): M age 6.5 years; female 48.7%; M cognitive ability 12.4 <sup>th</sup> %ile; <b>Psychoeducational group</b> (control): M age 6.2; female 34.6; M cognitive ability 14.9 <sup>th</sup> %ile; All participants were required to have been with current caregiver for at least 6 months prior to enrolment, projected to stay with caregiver for following 6 months. Excluded: moderate intellectually deficient range or below.	Both groups received psychoeducational treatment, including assistance with placement, and instruction around advocating for their children, FASD, and behavioural regulation. <b>Math intervention group:</b> 6 week individual tutoring (based on the High Scope Series); caregiver instruction in supporting maths at home, & weekly home assignments, & teacher support (FASD & IEP goals). Called Maths interactive learning experience (MILE).	Parent satisfaction scale Parent knowledge scale Child Behavior Checklist, Test of Early Mathematical Ability-2, Key Mat R/NU, Pre math concepts from the Bayley Scales.	Parents from both groups benefited from workshops, reporting very high satisfaction, significant gains in knowledge of FASD, advocacy topics & behavioural regulation. There were fewer reported problem behaviours. The math group showed significant gains in math knowledge, which were maintained at 6 month follow-up.
Adnams et al. (2007) South Africa	To determine the degree to which a classroom language and literacy intervention programme improved academic skills in children exposed to high levels of alcohol.	RCT, parallel groups with random assignment. <b>FASD LLT</b> (intervention group) n=20: M age 9.52 years; female 50%; Verbal ability M %ile 9.62. <b>FASD C</b> (control group) n=20: M age 9.63 years; female 44.4%; verbal ability M %ile 9.62. Non-FASD controls n=25: M age 9.42 years, female 51.2%; verbal ability M %ile 26.09	Language and literacy training (LLT) group received 38 hours of therapy over a 9 month period; language therapy (19 hours) alternating with literacy training (19 hours). Therapy was provided by speech and language therapists, with children in ability groupings of 5. Program focused on phonological awareness and acquisition of other pre and early literacy skills.	University of Cape Town (UCT) Reading Test, UCT Spelling Test, Ballard 1 minute Addition and Subtraction; Phonological Awareness and Early Literacy	The LLT group did not show significant gains over control groups in scholastic achievement, but showed greater improvement in specific language related tasks. There were no follow-up data taken.

h= hours; M= mean. References for outcome measures can be retrieved from associated study.

## **Summary of included studies**

### *Interventions targeting cognitive skills*

Three of the included studies investigated the effectiveness of interventions that targeted specific cognitive skills, such as attention, information processing and self-regulation.

In a pilot study, Adnams et al. (2001) investigated the effectiveness of cognitive control therapy (CCT) on the cognitive processing and behaviour of children with FAS within an educational setting. Cognitive control strategies aim to teach children the processes involved in acquiring, processing and organising new information. Ten students with FAS were assigned to either the intervention (based in one school) or control group (based at a comparison school). The CCT consisted of weekly one-hour sessions over 10 school terms, targeting five metacognitive domains: body position, movements, and self-awareness; focal attention; processing information in the presence of distractions; controlling external information; and categorising information. Pre and post-intervention data indicated that the intervention group showed a greater improvement in behaviour compared to the control group; however, there was no significant difference in the neuropsychological tests between groups.

Given the small sample size, the failure to match socioeconomic factors between groups and the limited statistical significance of the findings, firm conclusions cannot be drawn from this study. However, the improvements in classroom and adaptive behaviour are noteworthy, and would indicate that CCT as an effective intervention for children with FASD is an area of important future research.

In another study targeting cognitive skills, Chasnoff et al. (2012) investigated the effectiveness of a neurocognitive habilitation programme in improving the executive functions for children with FASDs who were in adoptive or foster care. Adapted from the Alert Program (Williams & Shellenberger, 1996, cited in Bertrand, 2009), the neurocognitive habilitation programme was based on the concept that children would be more equipped to improve their executive functioning if they were better able to self-regulate. Seventy-eight foster and adopted children aged 6 to 11 years 11 months, with a confirmed history of prenatal alcohol exposure, were randomly assigned to either a treatment or control group. The intervention group received 75-minute neurocognitive habilitation group therapy sessions over a 12-week period based on the Alert Program and their parents concurrently participated in a parent education group. The children in both groups were also referred to community based, standard care services, such as speech and language therapy. Pre- and post-testing of the parents' ratings of executive function behaviours and the children's adaptive and maladaptive functioning found that the children in the intervention group made statistically significant gains on both measures.

As the intervention group received both group therapy and parent education, it is difficult to ascertain what independent variable led to executive function and behaviour gains. It is also uncertain whether the parent education had an impact on the parents' scoring of their child's executive functioning, as this dependent variable was measured through a parent questionnaire. Further research would be needed to isolate and measure the effects of each independent variable.

Kerns et al. (2010) investigated the effectiveness of a process-specific computer training programme in ameliorating attention deficits in children with FASDs within a school setting. Process-specific approaches aim to strengthen underlying attention skills by engaging participants in repetitive tasks that aim to exercise components of attention, while gradually increasing demands, speed, and cognitive load. The approach is based on the idea that the brain has a high degree of plasticity and that process-specific exercises will re-organise neural pathways, thus improving cognitive function. Twelve students, between 8 and 15 years old with a FASD diagnosis, were recruited by invitation to participate in this pre-test post-test study. Based on Posner and Petersen's model of attention (Posner & Petersen, 1990), CPAT involves a minimum of 16 hours of engagement in repetitive exercises on three tasks that target different attentional systems: the vigilance network, the visual orienting network, and the executive attention network. Students completed on average 30.5 sessions over 9.5 weeks. A comparison of pre and post-intervention assessments showed the greatest gains in reading and maths fluency. Results also indicated decreases on the distractibility test and increased scores on auditory sustained attention. Results of reaction times were variable.

The positive effects recorded in this study suggest that CPAT might be an effective intervention for addressing attention difficulties in children with FASD; however, a lack of a control group makes the results of this study difficult to interpret, as the observed changes could be due to other factors. Further research in this area is needed.

### *Behavioural interventions*

Two of the included studies investigated the effectiveness of parent focused behaviour training programmes in reducing child problem behaviours and parenting stress.

Carmichael-Olson et al. (1998) used a randomised control trial design to investigate the efficacy of the FMF intervention in improving caregiver self-efficacy, meeting family needs and reducing child problem behaviours, for caregivers raising children with FASDs who exhibit significant challenging behaviours. The FMF model aims to modify specific parenting attitudes and responses toward child problem behaviours by assisting caregivers in recognising that their child's behaviour is affected by neurodevelopmental disabilities, rather than wilful disobedience.

Participants (children aged between 5 and 11 years and their caregivers) were randomised into either an intervention or a 'standard community care' comparison group. The FMF group engaged in 16, 90-minute biweekly sessions in their own homes. Both groups had access to regular mental health and community services. All the children and 96% of caregivers completed baseline and follow-up assessments. Compared to the standard community care group, caregivers in the FMF intervention showed a significantly improved sense of parenting self-efficacy, they engaged in more self-care behaviours, and they reported a significant reduction in child problem behaviours. There was no difference between groups in changes in parent stress levels.

This study showed a strong methodology and internal validity, which would suggest that FMF is an effective intervention for supporting behaviour change for children with FASD who exhibit challenging behaviours, and for improving the self-efficacy and self-care behaviours of their caregivers.

However, it appears that the FMF intervention did not lead to a reduction of self-reported caregiver stress. More objective measures of child behaviour, for example observations or teacher questionnaires, would strengthen the validity of the findings relating to the reduction in challenging behaviour.

In another study of parent focused behaviour training (study five, cited in Bertrand, 2009), two group-based interventions for children with FASDs that aimed to reduce behaviour problems among children with FASDs and reduce caregiver stress levels were compared. One treatment used a group adaptation of PCIT (Neary & Eyberg, 2002). It consisted of parent and child group sessions, where participants received coaching in behavioural parenting skills. The other treatment was a parent-only PSM programme, adapted from The Incredible Years Parenting Programme (Webster-Stratton, 2001) and Barkley's (1997, cited in Bertrand, 2009) parent training programme.

Children aged three to seven with FASD and their caregivers were randomised into intervention groups. Participants in both groups attended 14 90-minute weekly sessions. Under half (46%) of the families in the study completed the 14-week treatment programme. Surveys of families who did not complete the intervention suggest that dropout was largely due to life circumstances.

When looking at data of groups who did complete the treatment, both groups showed significant reductions in parent stress and child problem behaviours across the course of the intervention, with child behaviour for both groups progressing from clinical at pre-test to below clinical cut-offs at post-test.

The high attrition rate, lack of control group and lack of raw data presented in the article means it is difficult to draw any firm conclusions from the results of this study. However, the results do suggest that both parent-child, and parent group behavioural training could be effective in reducing behaviour difficulties of children with FASD and in reducing parental stress levels. Further research in this area is needed.

### *Social skills interventions*

O'Connor et al. (2006) investigated the impact of a parent-assisted CFT programme on the social skills of children with a history of prenatal alcohol exposure. Based on social learning theory, CFT aims to improve social skills through: the instruction of rules of social behaviour; modelling, rehearsal and performance feedback during sessions; rehearsal at home; homework assignments; and coaching by parents during play with a peer.

Over a period of two years, 100 children between 6 and 12 years were assigned into a CFT or Waitlist Control (WLC) group. The CFT group attended weekly 90-minute social skills sessions. Their parents attended separate concurrent sessions where they were taught about issues related to FASD and about the social skills the children were learning.

After controlling for a number of variables, post-treatment assessments (as compared to baseline) indicated that the CFT group showed significantly improved knowledge of appropriate social skills, compared to the WLC group. The parent reporting of an improvement in social skills and reduction in problem behaviours was also statistically significant; however, the teacher reporting of social skills and behaviour problems showed no treatment effect.

At a three-month follow-up, the children's knowledge showed further statistically significant gains. Parent reports indicated that social skills gains

continued, and problem behaviours remained low. Teachers saw little change in social skills in the CFT group; however, a positive trend was noted for social skills and a negative trend was noted for problem behaviours.

This study showed a strong methodology and internal validity, which would suggest that CFT is an effective intervention for supporting the social skills and behavioural development of children with FASD. However, it is interesting that the teachers did not report social gains in the school setting. Further analysis by the researchers revealed that the teachers did not perceive significant problems in social competence for children at baseline. They also found a positive association between child IQ and teacher-rated social skills, suggesting teachers rated more intelligent children as making more significant social skills gains regardless of treatment condition. An independent measure of social skills across settings, for example by observing behaviour, would strengthen future studies.

### *Interventions targeting specific skills*

Three of the included studies investigated the effect of teaching a specific skill on the related abilities of children with FASD.

Loomes et al. (2008) investigated whether rehearsal training could be used to increase the memory of number spans for children with FASD. The researchers argue that verbal rehearsal, where someone might repeat ideas verbally or in their head, has been shown to be a viable and applicable strategy to aid memory.

Participants (33 children with a mean age of 7.6 years) were assigned to either an experimental or control group. All children individually attended two sessions lasting approximately 15 minutes. In the first session, all children completed a digit span memory task which provided baseline scores. The experimental group were then given instructions about verbal rehearsal “one way [to help remember things] is to whisper the items over and over in your head.” All children then completed another digit span task with different numbers. After a time period delay of between 6 and 21 days, all of the children completed a second post-test. Prior to the test, the children in the experimental group were reminded about the rehearsal strategy. During all tests, the experimenter recorded behaviour and physical evidence of strategy use.

The results showed that the rehearsal training had a positive effect on the number of digits recalled by the experimental group at post-test 1, and then again at post-test 2, compared to the control group. However, the implication that rehearsal training was effective in improving memory for numbers among children with FASD should be interpreted with caution. There is no evidence that the children had mastered this strategy, as they were tested immediately after instruction, and then again after being given a reminder. Nor is there evidence of generalisation, as the researchers only tested one format of digital sequence. In their investigation into the effects of rehearsal training with children with special needs, Broadley and MacDonald (1993) found that successful long-term effects of rehearsal training required active participation, multiple training sessions, analysis of important task components and performance, systematic instruction of strategies, and regular and extensive practice (to the point of over-learning). Further research is needed to ascertain whether rehearsal training is an effective strategy for overcoming working memory deficits in FASD populations.

In another study targeting specific skills, Padget et al. (2006) investigated the effectiveness of using a virtual reality computer game to teach fire safety procedures to children with FASDs. Five children aged 4-7 years with a FASD who were measured to have no prior knowledge about fire safety procedures were able to complete each of the three safety steps taught in the virtual world after one computer session. Four children demonstrated generalised knowledge immediately after the training by correctly sequencing pictures of safety steps, and three children could complete this task at one-week follow-up.

Coles et al. (2007) went on to investigate the effectiveness of using virtual reality computer games to teach children with FASD fire or road safety skills. Thirty-two children were pre-tested on both sets of safety skills and then randomised into either the fire or road safety training groups. Following the training, all children were then questioned about both skills in a post-test, thus acting as the control group for the game to which they were not exposed.

Results showed that exposure to the computer game led to significantly greater knowledge about safety procedures and the games were effective in helping children learn to generalise these safety skills to role play situations.

#### *Academic interventions*

Two of the included studies investigated the effectiveness of interventions that aim to improve academic skills in children with FASD.

Adnams and colleagues (2007) investigated the effectiveness of a phonological awareness and letter knowledge programme in improving academic skills in children with FASD. The intervention focused on improving various components of phonological awareness, which has been shown to have a causal link with reading achievement (Stahl & Murray, 1994).

Children with FASD were randomised to a LLT and a FASD control group (FASD-C). The study also had a non-exposed control group (NONEXP-C) (i.e., children who were not exposed to alcohol in utero). The intervention was administered for half an hour twice a week by a speech and language therapist, over a nine-month period (term time only).

Results showed that each group showed improvement over baseline assessments in all outcome measures, which was expected due to the longitudinal nature of the study. Children in the intervention group demonstrated statistically significant gains in early literacy and phonological knowledge. This study showed a strong methodology and internal validity, which would suggest that LLT is an effective intervention for improving specific phonological awareness skills. These skills didn't appear to have any impact on general scholastic achievement.

In another academic intervention study, Kable et al. (2007) evaluated the effectiveness of a psycho-educational programme in ameliorating deficits in math and pre-math skills. The maths intervention designed by Kable and colleagues (2007) took into account known deficits in children with general maths difficulties, including difficulties in visual processing (leading to misinterpreting spatial symbols and spatial representation) and deficits in working memory. Based on models of cognitive rehabilitation, the intervention was designed to teach functional mathematics skills rather than an intervention to treat underlying cognitive structures, which, the researchers argue, have been shown to be poorly generalised to other tasks.

Participants (aged 3 to 10) were recruited through a FAS diagnostic clinic. Children received a neurodevelopmental evaluation and to ensure 'readiness to learn,' case management and psychiatric consultation were provided to those who needed it. Parents then engaged in a parent training workshop. Following this workshop, participants were randomly assigned to either the math intervention group or a standard psychoeducational treatment control group. All children received psychoeducational treatment, which consisted of a full neurodevelopmental assessment and individual educational planning support within their school. The maths intervention group also received six weeks of math tutoring services.

Of the 87 participants first recruited, 61 were randomised, and 56 completed post-testing. Pre and post-test comparisons showed that client satisfaction was very high, and caregivers made significant gains in knowledge about FAS and about behavioural regulation. Parents reported significantly fewer problem behaviours at post-testing on internalising, externalising and total problem behaviours. Comparison of intervention groups showed that clinically significant gains in maths knowledge were made in the group receiving the math component.

The study shows that it is likely that the mathematics component of the intervention led to significant gains in maths knowledge. However, it is unclear whether these gains would be sustained over time as there were no follow-up data taken. As both groups received a number of psychoeducational interventions, it is unclear which interventions, if any, led to the behaviour changes noted.

## **DISCUSSION**

Interventions that combined parent education and child directed instruction appeared to be effective in meeting the intended outcome, such as reducing challenging behaviour (Bertrand, 2009; Carmichael-Olson et al., 1998), improving social skills (O'Connor et al., 2006), improving executive functions and adaptive functioning (Chasnoff et al., 2012) and teaching academic skills (Kable et al., 2007). The high attrition rate in 'Study Five' (in Bertrand, 2009) highlights the importance of reducing barriers for families to access interventions that require regular and lengthy engagement. While also time-intensive, the FMF intervention (Carmichael-Olson et al., 1998) was implemented in the family home, thus removing the possible barriers of travel and childcare, which may have contributed to the high completion rate.

Studies that investigated the effectiveness of specific skill instruction (Coles et al., 2006; Loomes et al., 2008; Padget et al., 2006) and academic instruction (Adnams et al., 2007; Kable et al., 2007) demonstrated that children with FASDs can be taught specific knowledge and skills. However, Kable and colleagues (2007) and Adnams and colleagues (2007) both found that these specific skills did not generalise to other areas of scholastic achievement. Neither of these studies performed follow-up assessments. It is possible that the involved students made more long-term academic gains, as the improved foundation phonological or mathematical skills led to their more easily accessing the school curriculum.

Six of the eleven studies included in the review measured the effect of the intervention on child behaviour. Whether the study was targeting cognitive

skills (Adnams et al., 2001; Chasnoff et al., 2012), behaviour (Bertrand, 2009; Carmichael-Olson et al., 1998), social skills (O'Connor et al., 2006) or academic skills (Kable et al., 2007), each intervention led to a reduction in problem behaviours of children with FASD. One common factor across five of the six studies is the inclusion of a parent education component, which would indicate that better parent child relationships, and better behaviour management at home leads to improved behaviour.

### **Limitations**

Of all of the included studies, only Carmichael-Olson and colleagues (1998) focused their intervention on a distinct FASD population, those with significantly challenging behaviour. The broad range of difficulties associated with FASD mean that some interventions would not be relevant for some children. Future intervention research that controls for differences amongst the targeted population would be beneficial.

Several of the studies excluded children with a very low IQ score (for example, Adnams et al., 2007) as it was felt that the children needed a level of cognitive functioning to access the intervention delivered. Thus, caution is needed in interpreting their results as they may not generalise to all children with FASD. Further research into effective interventions for children with different cognitive profiles is needed. Researchers should be explicit about the profile of their targeted population when drawing conclusions from their research.

Several researchers commented on the difficulties associated with identifying and accessing a population of children to include in their research; therefore, children and families were usually recruited by invitation. This could have reduced the internal validity of the study, as caregivers who volunteer for such programmes have already demonstrated a level of commitment to, and motivation for, addressing their child's difficulties. Researchers should ensure that they acknowledge and control for this (where possible) in their analysis of results.

### **Ethical considerations**

Prevalence studies identify the higher rate of FASDs amongst high-risk populations and minority cultures (Blackburn, Carpenter, & Egerton, 2010). This has a range of ethical implications for research, policy and practice. It is likely that there are multiple barriers that people from high-risk populations would face in accessing services, such as a lack of knowledge of available services, ability to travel to attend sessions and the ability to provide childcare if caregivers are expected to engage in interventions. It is important that researchers and care providers consider these barriers when recruiting participants and planning interventions, to ensure that the children most in need are given equal opportunity to access services. Interventions should be culturally responsive and appropriate.

Reviewed studies have largely focused on the collective deficits of their participants. Researchers, educators and parents should consider the individual strengths and challenges of children with FASD when drawing conclusions from this research and applying this research to individual cases.



Many studies provided services to control or comparison groups, recognising the importance of intervening early rather than allowing control groups to wait for potentially beneficial services.

### **Implications for teachers**

Research into effective interventions for children with FASD is still in its infancy, with the majority of the reviewed interventions being beyond the limits of the general classroom teacher. However, there are a number of themes and conclusions that can be drawn to support the inclusion of children with FASD within the classroom:

- Children with FASD do not make up a homogenous group. Rather, they have a range of cognitive strengths and difficulties. Individual Educational Plans should be based on comprehensive assessments of individual strengths and areas for intervention.
- Children made improvement on specific skill deficits with targeted remedial instruction. Planning teams should draw on the vast array of research into special education interventions for specific difficulties when planning interventions.
- Due to the range of difficulties that children with FASD face, it is easy to see why so many exhibit challenging classroom behaviour. As with cognitive interventions, school staff should draw from the vast collection of literature on supporting positive behaviour in the classroom when planning to meet the needs of children with FASD.
- While it is beyond the scope of a classroom teacher to be facilitating parent education into FASD, the current research highlights the importance of including parents and caregivers in effective interventions. Building strong home/school relationships should be prioritised for children with FASD.

### **CONCLUSION**

In this study, a range of interventions has been identified that seek to ameliorate social, behavioural, cognitive, academic or other specific difficulties that children with FASD may experience. A number of interventions have shown they might be effective in supporting the special educational needs of children with FASD. However, due to the limited amount of research in this area and the inadequate design and methodology of some of the studies it is difficult to draw any firm conclusions to date. In saying that, cross-study analysis has revealed some promising themes. Firstly, interventions that engage both caregivers and children appear to be more effective in meeting the needs of the participants. Secondly, a range of interventions, based on research into general learning difficulties, were effective in teaching specific skills to children with FASD. Thirdly, a range of different interventions led to positive effects on child behaviour. While there is a growing body of research into FASD and related difficulties, there is a lack of research into effective evidence-based interventions. Further research is vital in ensuring a strong evidence base is available to support the special educational needs of children with FASD.

## REFERENCES

- Adnams, C. M., Kodituwakku, P. W., Hay, A., Molteno, C. D., Viljoen, D., & May, P. A. (2001). Patterns of cognitive-motor development in children with Fetal Alcohol Syndrome from a community in South Africa. *Alcoholism: Clinical and Experimental Research*, 25(4), 557–562. doi:10.1111/j.1530-0277.2001.tb02250.x
- Adnams, C. M., Sorour, P., Kalberg, W. O., Kodituwakku, P., Perold, M. D., Kotze, A., & May, P. A. (2007). Language and literacy outcomes from a pilot intervention study for children with fetal alcohol spectrum disorders in South Africa. *Alcohol*, 41(6), 403–414.
- Belcher, H. M. E., Butz, A. M., Wallace, P., Hoon, A., Reinhardt, E., & Reeves, S. (2005). Spectrum of early intervention services for children with intrauterine drug exposure. *Infants and Young Children*, 18, 2–15.
- Bertrand, J. (2009). Interventions for children with fetal alcohol spectrum disorders (FASDs): Overview of findings for five innovative research projects. *Research in Developmental Disabilities: A Multidisciplinary Journal*, 30(5), 986–1006.
- Blackburn, C., Carpenter, B., & Egerton, J. (2010). Shaping the future for children with foetal alcohol spectrum disorder. *British Journal of Learning Support*, 25(3), 139–145.
- Blackburn, C., Carpenter, B., & Egerton, J. (2012). *Educating children and young people with Fetal Alcohol Spectrum Disorders: Constructing personalised pathways to learning*. New York, N.Y: Routledge.
- Broadley, I., & MacDonald, J. (1993). Teaching short-term memory skills to children with Down's syndrome. *Down's Syndrome: Research and Practice*, 1, 446–453.
- Carmichael-Olson, H., Feldman, A. P., Streissguth, A. P., Sampson, P. D., & Bookstein, F. L. (1998). Neuropsychological deficits in adolescents with fetal alcohol syndrome: Clinical findings. *Alcoholism: Clinical and Experimental Research*, 22(9), 1998–2012.
- Centre for Reviews and Dissemination. (2008). *Systematic reviews: CRD's guidance for undertaking reviews in health care*. York, UK: University of York. Retrieved from: [http://www.york.ac.uk/inst/crd/index\\_guidance.htm](http://www.york.ac.uk/inst/crd/index_guidance.htm)
- Chasnoff, I. J., Schmidt, C. A., Schwartz, L. D., Telford, E., & Wells, A. M. (2012). Neurocognitive habilitation therapy for children with fetal alcohol spectrum disorders: An adaptation of the Alert Program. *AJOT: American Journal of Occupational Therapy*, 66(1), 24–34.
- Coles, C. D., Strickland, D. C., Padgett, L., & Bellmoff, L. (2007). Games that “work”: Using computer games to teach alcohol-affected children about fire and street safety. *Research in Developmental Disabilities*, 28, 518–530.

- Fetal Alcohol Network NZ. (2012). *Fetal Alcohol Spectrum Disorder*. Retrieved from: <http://www.fan.org.nz/>
- Higgins, J., Altman, D., & Sterne, J. (2011). Assessing risk of bias in included studies. In J. Higgins & S. Green (Eds.), *Cochrane handbook for systematic reviews of interventions*. Version 5.1.0. The Cochrane Collaboration. Retrieved from <http://www.cochrane-handbook.org>.
- Kable, J. A., Coles, C. D., & Taddeo, E. (2007). Socio-cognitive habilitation using the math interactive learning experience program for alcohol-affected children. *Alcoholism: Clinical & Experimental Research*, 31(8), 1425–1434.
- Kerns, K. A., MacSween, J., Vander Wekken, S., & Gruppuso, V. (2010). Investigating the efficacy of an attention training programme in children with foetal alcohol spectrum disorder. *Developmental Neurorehabilitation*, 13(6), 413–422.
- Loomes, C., Rasmussen, C., Pei, J., Manji, S., & Andrew, G. (2008). The effect of rehearsal training on working memory span of children with fetal alcohol spectrum disorder. *Research in Developmental Disabilities*, 29, 113–124.
- Mattson, S. N., Crocker, N., & Nguyen, T. T. (2011). Fetal Alcohol Spectrum Disorders: Neuropsychological and behavioral features. *Neuropsychological Review*, 21, 81–101.
- Mattson S. N., & Riley E. P. (2000). Parent ratings of behavior in children with heavy prenatal alcohol exposure and IQ matched controls. *Alcoholism: Clinical and Experimental Research*, 24(2), 226–231.
- Neary, E. M., & Eyberg, S. M. (2002). Management of disruptive behavior in young children. *Infants and Young Children*, 14(4), 53–67
- O'Connor, M. J., Frankel, F., Paley, B., Schonfeld, A. M., Carpenter, E., Laugeson, E. A., & Marquardt, R. (2006). A controlled social skills training for children with fetal alcohol spectrum disorders. *Journal of Consulting & Clinical Psychology*, 74(4), 639–648.
- Padgett, L. S., Strickland, D., & Coles, C. D. (2006). Case study: Using a virtual reality computer game to teach fire safety skills to children diagnosed with fetal alcohol syndrome. *Journal of Pediatric Psychology*, 31(1), 65–70.
- Peadon, E., Rhys-Jones, B., Bower, C., & Elliott, E. J. (2009). Systematic review of interventions for children with Fetal Alcohol Spectrum Disorders, *BMC Pediatrics*, 9(35). doi:10.1186/1471-2431-9-35
- Posner M. I., & Petersen S. E. (1990). The attention system of the human brain. *Annual Review of Neuroscience*, 13(1), 25–42.
- Premji, S., Benzie, K., Serrett, K., & Hayden, K. A. (2006). Research-based interventions for children and youth with a Fetal Alcohol Spectrum Disorder: Revealing the gap. *Child: Care, Health and Development*, 33(4), 389–397.

- Riley, E. P., Mattson, S. N., Li, T. K., Jacobson, S. W., Coles, C. D., Kodituwakku, P.W., ... Korkman M. I. (2003). Neurobehavioral consequences of prenatal alcohol exposure: An international perspective. *Alcoholism, Clinical and Experimental Research*, 27(2), 362–373.
- Ryan, S. M. (2006). Instructional tips: Supporting the educational needs of students with fetal alcohol spectrum disorders. *TEACHING Exceptional Children Plus*, 3(2), 12.
- Stahl, S. A., & Murray, B. A. (1994). Defining phonological awareness and its relationship to early reading. *Journal of Educational Psychology*, 86(2), 221–234.
- Steinhausen, H. C., & Spohr H. L. (1998). Long-term outcome of children with foetal alcohol syndrome: Psychopathology, behavior and intelligence. *Alcoholism: Clinical and Experimental Research*, 22(2), 334–338.
- Webster-Stratton, C. (2001). *The incredible years training series*. Retrieved from: <http://babel.hathitrust.org>

Manuscript Submitted: December 17, 2012 Manuscript Accepted: June 6, 2013
--

## ABOUT THE AUTHOR

JANE GUNN

*Victoria University of Wellington*



Jane Gunn is currently working at the Ministry of Education as a Special Needs Advisor to primary and secondary schools, supporting children and young people with challenging behaviour.

She is working towards her Masters in Educational Psychology at Victoria University

Email: [janeshrimpton@gmail.com](mailto:janeshrimpton@gmail.com)