Educational interventions for children with ASD: A systematic literature review 2008–2013

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Abstract
Systematic literature reviews can play a key role in underpinning evidence-based practice. To date, large-scale reviews of interventions for individuals with Autism Spectrum Disorder (ASD) have focused primarily on research quality. To assist practitioners, the current review adopted a broader framework which allowed for greater consideration of educational utility. Between July and August 2013, 20 databases were searched, alongside web searches and hand searches, to identify ASD intervention studies published between 2008 and 2013. This search yielded 6,232 articles and the subsequent screening and evaluation process identified 85 best evidence studies. Studies were grouped into categories and individual interventions were assessed and classified as providing most; moderate; some; or a small amount of evidence. Interventions with most evidence tended to focus on younger children and core difficulties associated

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with ASD. Emerging trends, such as increasing evidence for technology-based interventions and peer-mediated interventions, were identified. An encouraging finding for practitioners is that in 59% of the studies, interventions were undertaken with or by school staff. Implications for school psychology practice as well as factors to consider when selecting educational interventions are discussed.

Keywords

Autism Spectrum Disorder, children and youth, education, evidence-based practice, intervention

Since the mid-2000s there has been a substantial growth in systematic reviews of educational interventions, reflecting a wider trend towards evidence-based practice generally (Wong et al. 2015). Within school psychology, the implementation of evidence-based practice has been extensively discussed (Kratochwill, 2007). The Procedural and Coding Framework (Kratochwill & Stobier, 2002) was designed to support school psychologists bridge the research practice gap. In common with many other review frameworks, it includes assessment of research quality, but also gives a stronger weighting to evidence developed in school contexts, and takes into consideration contextual factors. Despite the substantial effort invested in developing evidence-based practice—often through a focus on interventions evaluated as high quality evidence—there is concern that outcomes have been variable (Dingfelder & Mandell, 2011). Consequently, there has been renewed emphasis on the importance of implementation factors in recent years (Forman et al., 2013). Barriers to implementation of evidence-based educational interventions reflect those identified in the wider implementation literature, such as the external environment (Hicks, Shahidullah, Carlson, & Palejwala, 2014), organizational factors (Forman et al., 2013), and personal implementer factors (Forman, Fagley, Chu, & Walkup, 2012).

Within the area of Autism Spectrum Disorder (ASD), a number of systematic reviews have been undertaken with the aim of identifying which interventions are most effective. Some of these have focused on interventions designed to address specific aspects of ASD, for instance to increase social interaction (Hughes et al., 2012) or increase adaptive behaviour (Palmer, Didden, & Lang, 2012); whilst other reviews have focused on interventions such as technology which may be used to address more than one aspect of ASD (such as organizational skills or social understanding). In addition to these, several reviews have evaluated the quality of the ASD evidence base as a whole (National Autism Center, 2009; Odom, Collet-Klinberg, Rogers, & Hatton, 2010; Wong et al., 2013). Furthermore, a recent review by Wong et al. (2013) evaluated the quality of evidence for autism interventions with children and young people from 1990–2011. They included 456 studies and identified 27 evidence-based practices. These interventions mainly addressed behavioural, communication, and social outcomes but also included

interventions with a smaller evidence base in categories such as exercise, cognitive skills, and self-management. A growth in technological interventions was also evident.

Although such reviews can be helpful for school psychologists to draw upon when recommending interventions, evidence suggests that they may not consistently consult these reviews when recommending interventions (Sansosti & Sansosti, 2013). McKenney, Dorencz, Bristol, and Hall (2015) also identified that many larger reviews (e.g. National Autism Centre, 2009; Odom, Collet-Klinberg, Rogers, & Hatton, 2010) tend not to address issues specific to school settings. Furthermore, reviews of ASD evidence-based practice have not been conducted from a school psychology perspective. The ASD evidence-practice gap can therefore create challenges for school psychologists when deciding whether it is possible or appropriate to implement a particular intervention in a particular context (Costley, Clark, & Bruck, 2014; Kasari & Smith, 2013; Simpson, Mundschenk, & Heflin, 2011).

There is considerable variability in the focus and aspects reported in ASD systematic reviews. The interventions vary with some focusing on Comprehensive Treatment Models (CTMs) and others on focused intervention practices (Wong et al., 2013). CTMs adopt a more holistic approach and address a range of learning or developmental skills through an overarching framework, such as applied behaviour analysis (ABA) based programmes (Reed & Osborne, 2012), while focused interventions are more time limited, discrete interventions which address a single goal. The setting in which interventions have been evaluated is also important, as the majority of ASD interventions have been developed using single-subject experimental designs with small samples (Costley et al., 2014). Therefore, the extent to which these outcomes generalize to regular education settings is important to consider. Including rigorous evaluations undertaken in real life settings in evaluations is therefore important (Parsons et al., 2013). Kasari and Smith (2013) argue that outcomes also need to be relevant and important to participants, making social validation of research another key aspect to include in evaluations. Documenting broader factors beyond effectiveness such as training and resourcing for interventions can also be informative for practitioners, as resource intensive or costly interventions are less likely to be adopted (Dingfelder & Mandell, 2011).

The current review was commissioned by the National Council for Special Education, Ireland as part of a broader project to evaluate the evidence from research and best practice in educational provision for children and young people with ASD. Other strands included five county case studies and a review of educational guidelines relating to children and young people with ASD. The systematic literature review strand evaluated educational interventions for persons with ASD published between 2008–2013, in order to update a previous review conducted by Parsons et al. (2009). This previous review investigated educational interventions for people with autism to identify those that demonstrated best outcomes and make policy recommendations for Ireland. One hundred articles published 2002–2008 were included, of which only 12 were identified as being of

high-weight of evidence. The majority of studies in their sample focused on early intervention and behaviourally-based teaching. The lack of research focusing on young people aged 12 years and older was highlighted. The review team found insufficient evidence to recommend any one intervention and recommended an eclectic approach to provision, enabling interventions to be tailored to individual needs and preferences. Given the substantial increase in autism research since 2008, the current review was commissioned in order to provide an up-to-date picture of the range of autism interventions available across all ages and assess the strength of this more recent evidence.

Scope and methodology

The focus of the review was 'what works best in the provision of education for persons with autism'. Although the review was limited to a five-year timeframe it was agreed with the NCSE advisory group (which included government officers, educational psychology, and academic representatives) that the review would address gaps in previous reviews by including both qualitative and quantitative research, giving stronger weight to educational utility in order to increase relevance for practitioners (Kasari & Smith, 2013; Kratochwill & Stobier, 2002), and include both CTMs and focused intervention practices (Parsons et al., 2013). The inclusion of qualitative studies was considered important for the inclusion criteria as a potential means of identifying emerging interventions and potential facilitators in educational settings. Implications for implementation, such as specialist training and resourcing, were also included in study descriptions if provided.

Review focus and process

The review report adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Literati, Tetzlaff, & Altman, 2009). It was undertaken using a rigorous, systematic six-stage process, informed by relevant frameworks (Bond, Woods, Humphrey & Symes, 2013; Gough, 2007). Articles included in the review were required to: Be published in English between 2008–2013; include more than one child or young person with ASD aged 0- to 18-years-old; involve a researcher-manipulated intervention; take place in a community, school or home setting; be empirical studies which reported at least one outcome measure about the children/young people; and have educational utility. Educational utility was operationalized by evidence of either utility or effectiveness in the educational context. Evidence of utility included data collected from staff regarding the feasibility or usefulness of the intervention (e.g. social utility ratings) or direct involvement of school staff or peers from the child's primary education setting in the intervention itself. Effectiveness in the educational context was assessed through outcome measures focusing on the child in his/her primary education context (e.g. classroom observations or questionnaires completed by school staff).

Search terms developed with the NCSE advisory group built upon those used by Parsons et al. (2009) and focused on six areas and associated terms: ASD; children, young people and families; outcomes and assessment; educational provision; age/stage of schooling; type of study. Terms were trialled to ensure they were fit for purpose. Studies that were a review or meta-analysis were not included in the review but used for reference harvesting. Between 25 July 2013 and 26 August 2013, 20 databases were searched including PsychInfo, ISI Web of Knowledge, and Applied Social Sciences Index and Abstracts. Web searches using Google Scholar were undertaken, as well as database searches (such as the NCSE's research database) and hand searches of the journal *Good Autism Practice*. Stakeholders interested in the review were also invited to contribute articles throughout the review process. In total 6,232 articles were identified across all databases and through reference harvesting. This was reduced to 1,021 once duplicates and articles which could not be sourced were removed. Following a pilot to ensure consistency, the 1,021 studies were screened in relation to the inclusion criteria by three members of the research team resulting in 176 studies being retained for inclusion in the review.

The 176 studies selected for inclusion in the review were subsequently coded using a purpose-made and fully trialled framework thereby enabling more robust weight of evidence criteria to be adopted. The coding framework was devised by the research team with the aim of accurately describing the approach, sample, intervention, and findings of each study in a systematic way. Evaluative information came from the coders' assessment across three domains: Quality of evidence; methodological appropriateness of the evidence to the review; and aims and effectiveness of the intervention. Criteria on which the quality of a quantitative study was judged were drawn from the American Psychological Association (APA, 2006) and criteria developed by Reichow, Volkmar, and Cicchetti (2008) for evaluating evidence-based practices in ASD. The framework gave one point for: Use of a randomized group design; use of manuals and procedures for monitoring; sample large enough to detect an effect size; details of participant characteristics; attrition rates of not more than 25% and evidence of social validity and up to 2 points for: Focus on a specific, well-defined disorder or problem; comparison with treatment as usual, placebo or—less preferably—standard control and use of outcome measure(s) that have demonstrable reliability and validity. If a study scored between 0–3 points it was categorized as 'low quality', if it scored between 4–7 points it was categorized as 'medium quality' and studies scoring 8–11 points were categorized as 'high quality'. Criteria were also developed for qualitative studies; however, as no qualitative studies were included in the final review these criteria are not described in detail here (see Bond, Symes, Hebron, Humphrey & Morewood, 2015 for a full description). Assessment of methodological appropriateness gave credit for: A clearly defined sample; a sound intervention approach (up to 2 points), and use of objective measures (up to 2 points). Studies were evaluated as 'low appropriateness' if they scored 0–3 points across two criteria; 'medium appropriateness' if they scored 3 points across all three criteria or 4 points

on two criteria and 'high appropriateness if they scored 4–5 points across all criteria. In relation to the effectiveness of the intervention, studies were scored 'low effectiveness' if they had a negative effect or did worse than control/placebo; 'medium effectiveness' if they had a positive effect and no control (or where one intervention was predicted to perform better than another but both performed equally well); and 'high effectiveness' if the intervention performed better than control or comparison, if this was predicted.

The trialling of the coding framework included training, moderation, and framework modification and inter-coder reliability checking. The fifth and final version of the framework was trialled by three members of the research team with eight papers. Across the papers a Cohen's kappa inter-coder reliability co-efficient of 0.87 was calculated (lowest value 0.70). All 176 studies were coded between October 2013 and January 2014 by a member of the research team with the lead research assistant undertaking weekly checks on a sample of coded studies.

Summarizing and grouping of studies

In this review a study was included if it was reported as being at least medium across all three domains (quality of evidence; appropriateness to the review, and effectiveness). Eighty-five studies were assessed as fulfilling this criterion and constituted the best evidence studies. A total of nine studies scored high in all three assessment domains. Studies scoring low on one or more domains were not included as best evidence.

In order to summarize the 85 studies further, they were grouped according to the categories identified by Wong et al. (2013). These categories were selected in discussion with the NCSE advisory group to ensure consistency with previous reviews. In addition to the focused intervention outcome categories from Wong et al. (2013), CTM studies were also included and presented by age categories rather than by outcome due to their comprehensive foci. Within these categories, groups of studies focusing on specific interventions were then evaluated in relation to the evidence they provided for the review using criteria aligned with those used in previous evaluations of ASD research (e.g. Wong et al., 2015) and adjusted to take into consideration what might be a reasonable amount of evidence within the review timeframe:

4—most evidence—at least four studies including a randomized control trial (RCT) or quasi experimental study (QES) or six or more single case experimental studies (SCEs)

3—moderate evidence—at least three studies including an RCT or QES or four or more SCEs

2—some evidence—two or more studies including an RCT or QES or three or more SCEs

1—a small amount of evidence—one RCT or QES or two SCEs

Table 1. Included studies by country of origin.

Country	Number of studies	Country	Number of studies
USA	65	Taiwan	1
UK	7	Canada	1
Australia	2	Netherlands	1
Norway	3	South Africa	1
Ireland	2	Israel	1
Italy	1		

Best evidence studies

Overview

Of the 85 studies included in the review, no qualitative studies and one mixed method study were included. Of the remaining 84 studies, 54 were single case experimental designs and 30 were RCTs or quasi-experimental studies. Few studies conducted follow-up post intervention. The number of participants involved ranged from 2–177 and in 55 studies there were four or fewer participants. The countries where the research took place are displayed in Table 1.

In the majority of studies, authors described participants as having a diagnosis of autism or ASD which in 36 studies was validated through further assessment using standardized instruments such as the Childhood Autism Rating Scale (Schopler, Reichler, & Renner, 1988) or Autism Diagnostic Observation Schedule (Lord et al., 1989). Sixty-one percent of participants in the studies were aged 3- to 8-years-old with only 2% focusing on young people aged 16- to 18-years-old.

In the majority of studies, outcomes focused on the core features of ASD. Social outcomes and reducing challenging behaviour were focused on most frequently followed by communication. CTMs were used most often for pre-school children, with some recent studies using CTMs with school age children and young people. In Table 1 studies are arranged broadly by outcome category and then grouped into individual intervention types. Six interventions which did not reach the threshold to score 1 for evidence are not included. CTMs are presented as a separate category. It is promising that 59% of included studies were implemented by or with school staff, while 35% were implemented by researchers and 6% were unspecified.

The interventions included in each group of studies varied considerably in the resources required to deliver them such as training, delivery time, their core components and target age ranges. Where possible further information relating to these factors is provided, although the reader is also referred to the main research report for detailed outlines of each intervention (Bond et al., 2015).

Table 2. Summary of review evidence (2008–2013).

Intervention	Number of studies	Amount of evidence within the review				Age group(s) where data gathered					Setting type
		4	3	2	1	Pre school	5–8 years	9–12 years	13–16 years	16+ years	
Joint attention interventions	4	√				√					Mixed
Social interventions											
Social initiation training	4		√			√	√	√	√	√	Mixed
Computer-assisted emotion recognition	3		√				√	√			Mixed
Peer-mediated	9	√					√	√	√	√	Mainstream
Multi components social	6	√					√	√	√		Mixed
Play-based interventions											
Lego therapy®	2			√			√	√			Mixed
Play based	3		√			√	√				Mixed
Communication interventions											
Video modelling	4		√			√					Mixed
Picture Exchange Communication System	3		√			√	√	√			Special
Behavioural	2				√		√	√	√		Unknown
Challenging/interfering behaviour interventions											
Behavioural interventions	7	√				√	√	√			Mixed
Narrative	5		√				√	√			Mixed
Self-monitoring	2				√						Unknown
Computer-assisted	2				√						Unknown
Yoga	1				√						Unknown
Pre-academic/academic skills interventions											
Discrete skills teaching informed by behavioural principles	4		√			√	√				Mixed
Computer-aided instruction	2				√						Unknown
Multi-sensory	2				√						Unknown
Motor skills interventions											
Aquatic	1				√						Unknown

(continued)

Table 2. Continued

Intervention	Number of studies	Amount of evidence within the review				Age group(s) where data gathered					Setting type
		4	3	2	1	Pre school	5–8 years	9–12 years	13–16 years	16+ years	
Comprehensive intervention programmes											
Pre-school comprehensive intervention programmes	10	√				√					Mixed
School age comprehensive intervention programmes	3			√			√	√			Mixed

Note: 'Unknown' under 'setting type' means that there was insufficient evidence to determine setting type.

Interventions with most evidence

For pre-school children two interventions were identified as having most evidence: Joint attention and comprehensive pre-school interventions. Joint attention interventions were illustrated by four studies. These interventions usually involved 1:1 delivery of a play-based intervention focusing on turn-taking. These were often delivered by a teacher or parent for short daily sessions over 8–12 weeks with external supervision. Children in the intervention groups were more likely to demonstrate significant change in joint attention and joint engagement compared to controls. The second category, comprehensive pre-school interventions, formed one of the larger evidence groups, with ten studies. All of the studies in this group were experimental or quasi-experimental with samples of 11–177 children. Most of the studies in this group compared autism-specific interventions adopting behavioural principles (e.g. PRT, PECS), structured environments or a combination of these with generic early years interventions such as Portage or general special education. Interventions were delivered in specialist nursery classes or at home and most ran for six months to one year. They were either delivered by trained professionals or regular supervision was provided. On standardized outcome measures children receiving ASD-specific interventions for ten hours or more demonstrated greater progress, particularly in adaptive behaviour and language development, when compared to comparison group children receiving other interventions. In some studies children receiving interventions delivered in an education setting made more progress than those receiving a home-based intervention.

Three interventions were identified as having most evidence for school-aged children: Peer-mediated interventions and multi-component social skills interventions to develop social skills; and behavioural interventions to decrease challenging/interfering behaviour. The behavioural interventions category also includes several studies involving pre-school children, indicating that these interventions are

likely to be effective for pre-school children, although for pre-school children these interventions are often likely to be part of a comprehensive package as discussed above.

Nine peer-mediated interventions were included in the review, making this one of the larger categories. All the studies in this group focus on children aged 5- to 14-years-old attending mainstream schools. These included naturalistic proximity based lunchtime clubs where peers and pupils with ASD interacted around shared interests, or discrete group interventions which involved meeting for one to two short sessions for about six weeks with some direct teaching to enable peers to interact more successfully with children with ASD. Outcomes for children receiving these interventions included: Increased peer interaction; improvements in social skills; and the potential for increased social inclusion. Most interventions in this group were delivered by researchers, and so further work is needed to trial delivery by school staff.

Six studies in the review provided evidence for multi-component social skills interventions with 5- to 17-year-olds. The studies included several elements, such as social skills training or peer support, or they involved parents in addition to a child-focused programme. Studies in this group included manualized researcher delivered after-school social skills groups for pupils with concurrent parent groups. These were often delivered weekly in clinics for about three months and tended to measure a wide range of social outcomes. Other studies involved training teaching staff to deliver manualized social skills groups, parent training and emotional recognition intervention over ten months. They provide positive evidence, but changes reported were not consistent across all measures/respondents, perhaps reflecting the wide range of skills measured and respondents sampled. Further independent replication in school contexts is also needed.

Seven studies in the review provide evidence for behavioural interventions to reduce challenging/interfering behaviours. Many of these interventions were undertaken with 4- to 11-year-olds attending a range of education settings. The interventions were usually based upon an initial functional assessment and illustrate a number of different methods based upon behavioural principles, for instance, multi-element behaviour plans, environmental modification or covert prompting. Approximately half of the studies involved teachers or parents in delivery. They received some initial training and on-going support to deliver the interventions which, for schools were integrated into specialist or regular classes throughout the day. The studies in this group demonstrated decreases in challenging behaviour following intervention, and social validity measures indicated that these behavioural interventions could be adapted to a range of education settings and effectively delivered by school staff.

Interventions with moderate evidence

Two interventions were identified in the current review as having moderate evidence for pre-school children; these were play-based interventions and video

modelling to develop communication. Three studies in the review provide evidence for play-based interventions with children aged 4- to 8-years-old. These researcher delivered interventions usually consisted of 5 minutes 1:1 work and 15–30 minutes group work each day. This focused on teaching key skills such as turn-taking and pretend play with opportunities to generalize to group situations. Two out of the three studies showed positive changes in play skills. Three video modelling studies to develop communication skills focused on pre-school children. These individualized interventions focused on skills such as requesting and were delivered by teachers, often with researcher support. Interventions integrated video modelling approaches into the school day and included the use of video modelling to increase use of PECS or to prompt other target behaviours. All studies showed an increase in target behaviours. There was also evidence within the review to indicate that social initiation training, discrete skills training, and PECS might be effective with pre-school children as well as with school-aged children. These interventions were also identified as beneficial for school-age children and are discussed below.

Five interventions were identified in the current review as having a moderate level of evidence for school-aged children. These included: Social initiation training; computer-assisted emotion recognition interventions to develop social understanding; PECS to develop the communication skills of children in special schools; narrative approaches to reduce challenging/interfering behaviour; and discrete skills teaching informed by behavioural principles. Four studies focused on social initiation training with participants aged 4- to 17-years-old attending a range of school settings. These 1:1 and group interventions were delivered by specialist teachers and/or researchers for short periods during the school day and included Pivotal Response Training, social scripts and prompts to teach social initiation. Outcomes included increased social initiation and engagement, although gains were not maintained for some children post intervention.

Three studies used computer programmes to develop emotion recognition with 5- to 10-year-olds. These interventions consisted of discrete computer programmes for an hour per week for six to ten weeks or video modelling with the researcher. Outcome measures showed improvement in the ability to identify emotions and the programmes were rated positively by school staff. Three studies evaluated the effectiveness of PECS for children in special education settings. Two of these studies involved researcher/teacher collaboration and integration of PECS into the regular running of the classroom. These interventions used pictures and symbols to increase children's communication. Outcomes included increase in spontaneous requesting for objects and there was evidence that the intervention could be delivered by teachers. Five studies focused on the use of narrative interventions with children aged 7- to 13-years-old attending a range of provisions. In most of these studies staff were trained to deliver interventions such as power cards and social stories to prompt particular behaviours. These interventions were flexibly integrated into the school day. Outcome measures showed an increase in both target behaviours and ease of implementation across a range of settings by school staff.

The final four studies with moderate evidence focused on the use of discrete skills teaching informed by behavioural principles with children aged 4- to 7-years-old. These 1:1 interventions were delivered by researchers or as part of a home-based programme and used short, regular intervention to teach discrete skills such as reading single words and recognizing letters or numbers. Parents and teachers reported positive social validity, although generalization of skills was limited in some studies.

Interventions with some support

Due to the relatively small number of studies required to achieve this rating there was insufficient evidence to enable discussion of these interventions by age range. Two types of intervention were identified as having some evidence in the current review: Lego Therapy®; and school age comprehensive interventions. Two studies in the review focused on weekly Lego Therapy® group sessions with children aged 7- to 11-years-old. This intervention uses a structured approach to constructing models in order to develop social skills. Both studies reported improvements in social interaction. Three studies in the review evaluated school age comprehensive interventions with 3- to 11-year-olds attending special classes or special schools. These interventions focused on training staff in evidence-based practices or parent consultation supported by researcher coaching for at least two academic terms. Evaluations showed positive pupil outcomes related to collaboration with parents and staff coaching. However, further research is needed to evaluate pupil progress using standardized measures.

Interventions with a small amount of evidence or insufficient evidence

Seven interventions were identified as having a small amount of evidence, these included: Self-monitoring/computer-assisted and yoga interventions to reduce challenging behaviour; behavioural interventions to improve communication; computer-assisted instruction and multi-sensory intervention to develop academic skills; and aquatic intervention to develop motor skills.

A further six interventions did not have sufficient evidence to meet criteria for a rating of small amount of evidence. These were: Consultation to develop social skills; peer mediated communication interventions; school-readiness interventions; cognitive interventions and computer-assisted and visual cueing interventions to develop adaptive/life skills. Although there was insufficient evidence to support these interventions, this may be due to the intervention being relatively new or the limited time period covered by the review.

Discussion

The current review provides an up-to-date summary of some of the most recent developments in educational interventions for children and young people

with ASD. It provides an update to the previous review by Parsons et al. (2009) but also offers more explicit consideration of strength of evidence. Although the current review was smaller-scale than that by Wong et al. (2013) and had a more specific focus on educational interventions, there were many similarities. For example, both reviews identified that the majority of interventions focus on the core difficulties associated with ASD, and the evidence base for focused intervention studies continues to be strongest for younger school aged children with research steadily declining from 12-years-old onwards. Both reviews also found evidence for: Peer mediated and social initiation training as effective social interventions; behavioural interventions to reduce challenging behaviour; play interventions; PECS and video modelling to support communication; and a growth in technology assisted interventions in a number of areas. Although reviews such as Wong et al. (2013) and Eikeseth & Klintwall (2014) for CTMs can provide a long-term view of strength of evidence for interventions the current review attempts to bridge (McKenny et al., 2015) the research-practice gap by offering a review more tailored to the needs of education practitioners.

Assessment of educational utility has not been a primary focus in previous reviews but for practitioners this is a key consideration when recommending interventions (Kasari & Smith, 2013; Kratochwill, 2007). Focusing on educational utility ensured that evidence-based research was reviewed which could be implemented in school settings or had promising evidence to support its use in school settings. This focus on linking research to the school context is particularly important for school psychologists (Kratochwill & Stobier, 2002). Information about components, age range, and training requirements illustrates that although some interventions are more complex and require significant investment and planning, such as early years CTMS delivered by ABA certified teachers, many are discrete or environmentally-focused interventions which do not require accredited or extensive training and can be integrated into the mainstream school day. However, as the majority of the research described in the current view is from the US, the extent to which findings from these studies can be generalized to other countries with potentially very different educational contexts needs to be acknowledged.

In terms of the key findings and implications of the current review, it is interesting to note the differences between studies in the current review focusing on early years and school-aged children. Many of the early years studies, both comprehensive and discrete interventions focused on early developmental skills such as attention, engagement, and communication, while for school-aged children the focus tended to shift to more socially-focused and discrete interventions. There are overlaps between these age groups, particularly in relation to studies focusing on behavioural outcomes. The developmental appropriateness of interventions may warrant further research and consideration by intervention developers.

In addition to the timeframe of the current review, several other limitations should also be taken into consideration. As there are examples of qualitative research in the autism literature (Bolte, 2014), the authors developed and trialled frameworks to integrate qualitative and quantitative evaluation research within

the review. However, a surprising lack of qualitative studies evaluating interventions was found. Given that almost all of the studies included in the review were quantitative, separate frameworks for assessing the quality of SCEs and group designs, as done in previous reviews (Wong et al., 2015) may have been beneficial. Nevertheless, the framework adopted did enable a large number of SCEs as well as RCTs to be included. In common with other reviews of the ASD intervention literature, it was also not possible to integrate findings further using a meta-analysis as there is currently no agreement on how best to calculate effect sizes for SCEs (Wong et al., 2015). A further limitation of the current review relates to the evaluation of educational utility. This criterion has not been included in previous reviews of ASD interventions and reflects some subjectivity on the part of the research team in relation to what was included in the definition and how this was operationalized. Although this criterion was the one which resulted in most queries and further checking between reviewers, in the authors' opinion this resulted in a more robust operational definition and represents a useful first step in considering educational utility in future evaluations of ASD interventions.

Implications for research and practice

The current review suggests that the measurement of educational utility has the potential to form an important bridge between research and practice. However, the threshold for meeting this criterion was relatively low indicating the need for greater consideration of this in research studies. Although full consideration of implementation factors for each intervention is not possible within the scope of this article, it is encouraging that many of the included interventions were ones which could be integrated into the school day by school staff with some additional training (e.g. behavioural, narrative, and technology assisted interventions), while others might require more extensive or accredited training (e.g. CTMs and multi-component interventions). Some interventions were also at a relatively early stage of development with models for school delivery yet to be developed (e.g. peer-mediated approaches). Knowledge of these logistical aspects and core components are important for school psychologists who can assist schools in identifying which interventions they should implement and in providing training and supervision to ensure effective delivery. Although it is promising that 59% of included studies involved school staff in the delivery or evaluation of the intervention, further work is needed to strengthen school-researcher partnerships to ensure that research is relevant to the settings in which it is most likely to be used (Costley et al., 2014) and has greater focus on participants' priorities (Kasari & Smith, 2013). Research in schools also has the potential to address under-researched areas such as maintenance and generalization. Although conducting research in educational settings presents challenges, relevance is important to address in continuing to develop robust evidence-based practice (Dingfelder & Mandell, 2011).

The findings from this review can assist school psychologists bridge the research-practice gap, by using quality and educational utility criteria to help

schools select the most appropriate targeted interventions to adopt as part of a comprehensive tiered response to meeting the needs of pupils with ASD (Magyar & Pandolfi, 2012). Given school psychologists' knowledge of individual schools and their role as scientist-practitioners, they are ideally placed to support schools with the complex task of identifying which interventions to adopt based upon consideration of a range of factors. These include evidence-base but also, broader factors such as relevance to participant priorities; feasibility in real life (educational) contexts; flexibility to be adapted to individual needs; and the extent to which the intervention enables the views of children and young people with ASD and their families to be considered (Fleming, Hurley, & Goth, 2015). It is hoped that the current review will provide a useful starting point for school psychologists in developing ASD interventions with schools.

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