Paper 1

What are effective Educational Interventions for Autistic Children and Young People?



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Context for the task

In order to support the development of the Autism toolbox it was agreed to:

a) review the evidence for effective educational interventions for autistic learners (current paper)

b) audit approaches to professional learning and implementation currently being used in Scottish local authorities (See Paper 2)

Rationale for method of reviewing effective educational interventions

- it was **not** within the capacity of the team to conduct a new systematic review-these are carried out by teams of researchers requiring a significant period of time;
- it was feasible to examine reviews/ best practice guidelines and summarise the evidence into an accessible format; and,
- Emphasis would be given to recent reviews that emphasised educational utility.

Method

- a request was made to the IDOX information centre. This is an information Service, utilised by Education Scotland, which specialises in
 resources in public and social policy and practice. It is staffed by a team of researchers who provide free tailored support to all
 members.
- The IDOX information centre searched their database using search terms including: "autism AND (education OR school OR teaching)". An additional search was conducted online. A summary list of articles was created.
- Two key reviews were identified to include in the summary paper. In combination these studies span 2008-2017. Both of these reviews are aimed specifically at evaluating interventions for educational settings.

Welsh Government (2019) 'Support for Children and Young People with Autistic Spectrum Disorder (ASD) in educational settings'
 Bond, C., Symes, W., Hebron, J. Humphrey N., and Morewood, G. (2016) 'Educating Persons with Autistic Spectrum Disorder – A Systematic Literature Review' University of Manchester National Council for Special Education Research Reports No. 20

Autism Toolbox The composition of the two reviews used to create the summary of interventions are detailed in Table 1 below.

Name of review	Type of Review	Span	Number of best evidence studies included in review	Countries where research has taken place	Definition of autism being used in the study
Welsh Government (2019) 'Support for Children and Young People with Autistic Spectrum Disorder (ASD) in educational settings'	This report is based on a rapid evidence assessment (REA) of research studies, which involved reviewing and appraising existing research and considering the effectiveness of approaches to support children and young people aged up to 25 years with ASD.	2013-17	35 (from an original 2,469 possible articles for inclusion)	The majority of the evidence came from the US, Canada, UK and Europe.	ASD 'a developmental disorder which affects the way a person communicates with and relates to other people and the world around them. The way in which people are affected varies from one individual to another and by age and intellectual functioning'
Caroline Bond, C., Symes, W., Hebron, J. Humphrey N., and Morewood, G. (2016) 'Educating Persons with Autistic Spectrum Disorder – A Systematic Literature Review' University of Manchester National Council for Special Education Research (NCSER) Reports No.20	This is a systematic review of the literature for those aged 0-18 years. This was complemented by two supplementary strands, which explored how educational provision for children and young people is articulated in policy and practice.	2008-13	85 (from an original 1,021 possible articles for inclusion)	Mainly US and UK but also studies from 9 other countries.	ASD is used throughout this report as a global term. (Sub-terms include autistic disorder, high functioning autism, Asperger's syndrome, and pervasive developmental disorder – not otherwise specified).

Table 1 Composition of the two reviews used to create the summar

- The education endowment fund was checked for relevant entries (nil returns)
- The relevant SIGN guidelines were identified. These are health guidelines for Scotland which include recommendations on interventions for children and young people.
- The National Autistic Society points their website viewers to Research Autism, a site which aims to provide impartial evaluations of autism interventions. The grades given by this review site have been included in the summary table. The Welsh (2019) review was used as the basis for the summary of interventions table as it was the most recent review and offered clear explanations of the interventions

and their effectiveness. Both reviews used the categories established by Bond et al (2016) to organise the interventions. The categories are:

Joint attention	Social interventions	Play-based interventions	Challenging/interfering behaviour interventions
Adaptive/Self-help	Communication Interventions	Pre-academic/ academic skills interventions	Cognitive interventions

Table 2 Categories of interventions

• The methods used by the review papers/sites are available in the appendices.

Points to consider when viewing the summary of interventions

- The reviews do not summarise all interventions available to autistic learners. Instead they represent the interventions with stronger evidence within the stated time period.
- Many autistic learners have co-occurring conditions. Interventions for these conditions have not been included.
- Autistic learners have a wide range of abilities and interests. Not all approaches will be suitable or effective for all autistic learners. Approaches need to be tailored to each learner based on their needs and to the specific educational setting.
- Some experts have noted caution about the push to evidence-based practice; there can be a danger that the interventions trialled are those where goals are easier to measure rather than the most vital; the interventions identified can sometimes be hard to replicate in educational settings. Humphrey et al conclude that,

'Ultimately, a balance in focus must be struck between 'evidence-based practice' and 'practice-based evidence' to develop effective interventions that schools can and will use.'

Humphrey et al. p. ix, 2015

Key for Research Autism and SIGN Gradings

Research autism		
🛩 🛩 Very strong, positive evidence	🛩 🛩 Strong, positive evidence	Limited, positive evidence
Insufficient/Mixed evidence	0 No evidence found in peer-reviewed journals	Some negative evidence
🔀 🔀 Strong negative evidence	¥ ¥ ¥ Very strong negative evidence	N/A It is not possible to provide a rank for this intervention. This is usually because the intervention described, such as speech and language therapy, incorporates a wide range of other interventions, methods and techniques.
SIGN	·	
1++	1+	1 -
High-quality meta-analyses, systematic reviews ofrandomised control trials, or randomised control trials with a very low risk of bias	Well-conducted meta-analyses, systematic reviews, or randomised control trials with a low risk of bias	Meta-analyses, systematic reviews, or randomised control trials with a high risk of bias
2++	2+	2 -
High-quality systematic reviews of case-control or cohort studies High-quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal	Well-conducted case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal	Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
3 Non-analytic studies, e.g. case reports, case series	4 Expert opinion	

Part 1 Summary of Effective Interventions in Educational Settings

What is the Intervention?	Intervention Focus	Age range	Mainstrea	Special	Home	Support for Children and Young People with Autistic Spectrum Disorder (ASD) in educational settings (Welsh Government 2019).	Educating Persons with Autistic Spectrum Disorder (Bond et al, 2016)	Research Autism and SIGN gradings (key in appendix x)
Play-based/turn-taking interventions Joint attention interventions aim to develop children and young people's joint attention and/or joint engagement. Joint attention is the process in which a child learns to recognise the direction of an adult's gaze, orient their own gaze to follow it, and then look in the same direction. Joint engagement is the process in which a child learns to interact with the same object or event as another person. These interventions usually involve 1:1 delivery of play based/turn-taking activities by a teacher or parent.	Joint attention 1 study	3-5		x		Joint attention interventions were found to be effective for pre-school aged children. Improvements were noted in both joint attention and joint engagement.	Joint attention interventions for pre-school children are one of the interventions with the most evidence in the current review.	When this column is blank it there is no rating for robustness available
Peer-mediated instruction and intervention (PMII) Children and young people without ASD interact with and/or help autistic learners to acquire new behaviours, communication skills and social skills, by increasing social and learning opportunities within natural environments. Teachers or service providers systematically teach children and young people without ASD strategies for engaging their peers with ASD in positive and extended social interactions, in both teacher-directed and learner-initiated activities.	Social interventions 10 studies	2- 19	x	X	X	PMII was found to be effective . Improvements were noted in social skills and in social interaction . Outcomes included increased peer interaction, improvements in social skills, and the potential for increased social inclusion. The evidence was inconclusive for the effectiveness of PMII to improve comprehension and employment skills .	Peer-mediated interventions: the studies in this group provide positive evidence for involving peers in supporting children with ASD, resulting in social skills improvements and in one study, wider improvements in social inclusion. Three studies provide positive evidence of maintenance at follow-up.	

Social Skills Training (SST)	Social	2-	Х	Х	SST was found to be effective	Social initiation training	Research Autism
SST involves group or individual instruction,	interventions	21			but there is a gap in the evidence	The studies in this group	
designed to teach learners with	E studios				regarding the use of different SST	provide moderate evidence for	V V
ASD ways to appropriately interact with others.	5 studies				techniques across different age	social initiation training;	SIGN
This can include instruction on					groups.	additional evidence is needed in	
basic concepts, role-playing, and providing					Improvements were noted in the	this area as the included studies	1++
feedback to help learners with					frequency, length and quality of social	all involved small samples,	Computer-based
ASD to acquire and practice communication,					interaction between children and	which limits generalisation.	interventions
play or social skills, to promote					young people with ASD and their		showed
more positive interactions.					peers without ASD.		promising results
The interventions mainly involved starting and					There is moderate evidence that SST		2-2+
sustaining social interactions during free play					is an effective intervention to improve		
(for example, suggesting games, initiating a					social interaction, however, across the		
conversation, or paying compliments), use of					studies the number of participants		
social scripts (for example, cue cards or comic					varied substantially, and much of the		
strips) and / or prompts to teach social					evidence is based on small numbers of		
initiation.					participants.		
Modelling	Social	2-	Х	Х	Modelling was used in interventions		
Modelling involves a desired behaviour or	interventions	22			to promote reading comprehension		
action being demonstrated to the	3 studios				and employment skills. Modelling was		
child or young person with ASD, to encourage	5 studies				found to have strong effects on		
imitation or mirroring of the behaviour. This in					promoting employment skills, such as		
turn can then lead to the child or young person					interacting with others and		
displaying that behaviour without the need for					completing clerical tasks amongst		
further modelling.					young people with ASD, when used		
Modelling may be considered to be a teaching					alongside prompting and		
strategy rather than an 'intervention', and is					reinforcement approaches. However,		
often combined with other strategies, such as					there is no conclusive evidence		
prompting and reinforcement.					regarding the effectiveness of		
					modelling used on its own.		
Prompting	Social	2-	Х		The evidence suggests that		SIGN
Prompting is the verbal, gestural or physical	interventions	10			incorporating the use of prompting		Social stories
assistance given to learners to					into interaction with autistic learners		

assist them in acquiring or engaging in a targeted behaviour or skill. Prompts are generally given by an adult or peer either before or as a learner attempts to use a skill or demonstrate a particular behaviour. As with modelling, prompting may be considered to be a teaching strategy, rather than an 'intervention'. Prompting is used in: social stories - short descriptions of a particular situation, event or activity,which include specific information about what to expect in that situation and why. visual scripts - written and pictorial examples of phrases or sentences which children with ASD can use to cue themselves regarding appropriate topics of conversation or other verbal interactions peer training - training children and young people without ASD to interact with and/or help children and young people with ASD.	2 studies				can help to enhance the effectiveness of other interventions. Evidence suggests that prompting and positive reinforcements can be effective with or without modelling of the desired behaviour or skill. However, the evidence is based on a small number of studies.	3 While the studies showed considerable variation, most reported only a small clinical effect on behaviour. Social Stories [™] may be easy to implement and require few resources, but those using them should be aware that the potential for improvement may be limited.
Reinforcement Reinforcement involves an event, activity or other circumstance occurring after a learner engages in a desired behaviour, which is intended to encourage the learner to repeat that behaviour in the future. For example, children and young people with ASD being able	Social interventions 2 studies	2- 10	X		There is inconclusive and limited evidence as to its efficacy. The evidence suggests that reinforcement can effectively be used alongside other interventions for	

to choose or participate in an activity they enjoy because they complete a task that is required of them (such as homework), to encourage them to do their homework in future. Reinforcement can also be in the form of praise to encourage desired behaviour, and may be considered a teaching strategy rather than an 'intervention'. There is, however, inconclusive and limited evidence as to its efficacy. Prompting and reinforcement are often used simultaneously.						supporting children and young people with ASD. The evidence suggests that planned reinforcement (where activities and actions are planned in advance) can be more effective than unplanned reinforcement.		
Pivotal response training (PRT) Pivotal response training uses a child or young person's interests as motivators, to engage them in learning opportunities. It focuses on four key areas of child development (motivation, responding to multiple cues, self-management and self-initiation) to guide the intervention.	Social interventions 2 studies		х	х	x	PRT was found to be effective in supporting social interactio n and joint attention , but progress was not maintained for some children post- intervention. The evidence is inconclusiv e with regards to the effect of PRT on improving eye contact .	The current review only found a small amount of evidence for Pivotal Response Training (PRT) as a discrete intervention. The review notes its limited timeframe which had only 2 PRT studies while a previous review by Wong found it promising as it covered a longer time frame.	Research Autism
Multicomponent interventions- they either included several interventions, such as social skills training or peer support or involved parents in addition to a child focused programme.	Social interventions	5- 17	x				Overall, multi-component social interventions are one of the groups of studies with most evidence in the current review. However, these interventions did not take place in schools and changes reported were not consistent across all measures or respondents, perhaps reflecting the wide range of skills being measured. Independent replication of these results is needed in	

Play based interventions are those which use	Play					addition to research in order to help establish the active ingredients of these interventions and identify how they can work in school settings.
toys of leisure materials to support learning.	interventions					
Structured play groups (SPG) Structured play groups are small group activities designed to help develop play and social engagement skills. They involve carefully defined activities which encourage peer interaction and build social and communication skills; for example, developing skills such as sharing and taking turns. The structured play groups normally include peers who can act as role models, and activities or themes which encourage interactive play, supported with instructional techniques (for example, explaining or demonstrating, sometimes involving the use of models, objects, pictures, equipment etc.) by teachers and other adults in the form of 'scaffolding learning' (breaking up learning into smaller pieces and providing support for that learning). SPG includes • structured play (when an adult provides resources, starts play or joins in	Play based interventions 3 studies	3- 13	x	x	 The evidence suggests that SPG is an effective intervention for improving the social skills of children aged 3 to 13 years old. However, the evidence base is small. The evidence also included supportbased activities such as: weekly therapeutic group counselling (although it should be noted that group activities may not be appropriate for some individuals with ASD, who might find this difficult) 'Circle of Friends' support groups (whereby a peer group is encouraged to look at their own behaviour while developing an understanding of another child's behaviour and difficulties, to develop strategies and practical solutions to help that individual). 	Studies focusing on play represented a relatively small proportion of the current evidence base. • Play-based interventions have moderate evidence for younger children • The available evidence significantly decreased with age. The included studies provide moderate evidence for play- based approaches and some evidence for Lego Therapy [®] during the timeframe of 2008– 2013.

 with children's play to offer some direction) Lego therapy (using Lego as a means of encouraging communication) friendship activities (including adapting songs and games so that opportunities occur for peers to demonstrate positive, affectionate or friendship behaviours to targeted students) interest clubs (for example, a cooking and crafts club). 						
Challenging / interfering behaviour interventions are those focused on decreasing or eliminating behaviours which interfere with the individual's ability to learn.	Challenging/ interfering interventions					
Behavioural interventions The behavioural intervention category is comprised of 'antecedent interventions' and 'consequent interventions'. Antecedents are things, events or people that come immediately before behaviour. Antecedents can be related to the time, the physical environment, activities happening, or people present. Antecedent events can also include the absence of something, such as being ignored or not able to do something the child or young person would like to do. Consequent interventions are used to encourage desirable behaviour, by rewarding positive behaviour and discouraging less	Challenging/ interfering Interventions 4 studies	2- 27		There is good evidence for increasing on-task behaviour, communication and task engagement. They can be highly effective for improving the social interaction skills of young children within mainstream education with ASD.	Studies with children aged 4-11 provided positive evidence for the use of behavioural approaches , often following on from a functional analysis of behaviour particularly for increasing on-task behaviour, communication and task engagement.	SIGN Early intensive behavioural intervention programmes described. See P. 29 for details. The conclusion is as follows: Access to support from staff trained in applied behaviour analysis- based technologies (eg PECS, discrete trial training, task analysis, prompting, fading or shaping) to build

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desirable behaviours. They occur after the behaviour, e.g. as a result of a desired behaviour being displayed.								independence in adaptive, communication and social skills should be
								considered for children with ASD.
Self-management (SM)	Challenging/	3-	х	х	Х	The evidence suggests that SM is	This review looked at 2 studies	
Self-management involves children and young	Interventions	27				highly effective in	of self-monitoring	
people being given instruction to help them to						improving academic behaviours,	interventions. It concluded	
identify appropriate (and inappropriate)	7 studies					reading comprehension and	additional evidence was needed	
behaviours, encouraging them to demonstrate						reducing problem behaviours	to extent the small amount of	
appropriate behaviours, and rewarding						(Particularly effective with	positive evidence.	
themselves for behaving appropriately.						adolescents).	Again 2 studies were identified	
The evidenced self-management systems							which showed evidence of	
included:						However, the severity of the child or	increased on-task behaviour but	
 using an auditory prompting system - 						young person's ASD has proven to be	the evidence base is still too	
delivering prompts through						a key factor in determining	small.	
technology to support users with task						effectiveness, with those with high		
completion and behaviour management						functioning ability achieving better		
using handheld computers - for example,						outcomes than those with lower		
use of a handheld computer prompting						functioning abilities.		
system, to enable students to						T I I I I I I I I I I 		
independently switch from task to task in		_				There is substantial evidence for SM		
an employment setting		5-				interventions that aim to develop new		
using timers to learn time management		25				skills and/or improve benaviour.		
using a self-monitoring checklist - for								
example, students were taught to self-								
monitor their work rate on job tasks and								
evaluate daily performance against criteria.								
Social narratives/stories (see also Prompting)	Challenging/ interfering	3-	Х	Х	Х	There is moderate evidence that social	There is moderate evidence for	Research Autism
These describe social situations in some detail,	Interventions	15				stories are effective in reducing	7-13 year olds for the	?
by highlighting relevant cues and offering	4 studies					challenging behaviours and	application of narrative	SIGN
examples of appropriate responses. Social	4 studies					supporting social interactions.	approaches such as social	2+
narratives are individualised according to							stories and power cards. They	2 '

learner needs. They are typically quite short and can include pictures or other visual aids.							help to extend the current evidence base by demonstrating that: social stories delivered through the medium of power point were more effective than paper format ; social stories could be delivered effectively by school staff; combining differential reinforcement of other behaviour with social stories further decreased challenging behaviour; and power cards can be used to increase the following of instructions.	
Discrete Trial Teaching (DTT) Discrete Trial Teaching is a highly structured method of teaching skills by breaking them down into smaller components. It is an instructional process usually involving one teacher/adult and one child or young person, where instructions are given in the most concise manner possible (for example, instead of asking 'which brick is yellow?', the instructions could be 'touch yellow'. If the child was unable to complete the task, the teacher/adult could provide a prompt). DTT is a structured version of Applied Behaviour Analysis (ABA). It is designed to teach appropriate behaviours or skills. Each trial consists of the teacher/adult's instruction/presentation, the child's response, and a carefully planned	Challenging/ interfering Interventions 6 studies	4- 21	X	X	x	Overall, the evidence suggests that DTT is an effective intervention , particularly in helping adolescents to develop their academic skills (including reading single words, learning science vocabulary and recognising letters or numbers). However, there is a lack of conclusive evidence with regards to the most effective duration and intensity.		Research Autism

consequence (i.e. a reinforcing incentive or praise). As an intensive intervention, the instruction would be repeated until mastered.	Challenging/	5-	X	X	The evidence suggests that exercise-	A swimming programme is cited	SIGN
Increased physical exertion can serve as a means of reducing problem behaviours or increasing appropriate behaviours.	interfering Interventions 1 study	11			 based interventions are effective in improving academic behaviour and reducing antisocial behaviour. However, there is a small evidence base overall regarding the use of exercise to support the learning and development of children and young people with ASD. Exercise activities evidenced as proving effective include swimming (twice a week for 90 minutes a session) and yoga (daily for 10-15 minutes) sessions. 	which showed significant improvement in Humphries Assessment of Aquatic Readiness scores and significant improvement in the academic behaviour and antisocial behaviour scales of the School Social Behaviour Scale 2.	2+ Meta-analysis of small trials of various physical activities concluded that exercise for individuals with ASD may be beneficial for improving motor skills and social interaction. Further, larger, more rigorous trials are needed to support the findings.
Adaptive / self-help Adaptive/self-help approaches are those focused on developing independent life and personal care skills.	Adaptive / self-help					This review found 2 quality studies for children aged 5-8 and found a small amount of evidence for the interventions cited. These were a visual cueing study and a video modelling prompt system to	Research Autism

						support transitions from place to place.	
Visual supports Visual supports are any visual displays that support the learner engaging in a desired behaviour or skill, independent of prompts. They include pictures, written words, objects, arrangement of the environment or visual boundaries, schedules, maps, labels, organisation systems, graphic organisers and timelines	Adaptive / self-help 5 studies	3- 22	х	X	The evidence indicates that visual supports (e.g. graphic organisers) can prove highly effective for improving reading comprehension and visual supports can improve employment skills. The length of the intervention did not appear to impact its effectiveness.		Research Autism Visual schedules ? SIGN Visual supports 1-3
Technology-aided instruction and intervention (TAII) Technology-aided instruction and intervention uses technology in order to support children and young people's learning.	Adaptive / self-help 10 studies	3- 22	x	X	 TAll interventions were found to be effective in improving employment skills, behaviour, emotion recognition and academic skills (maths and science vocabulary). Computer assisted emotion recognition interventions resulted in improvements in the ability to identify emotions. However, TAII was found to have little to no effect on reading comprehension. 	Two studies provide evidence of socially valid interventions to improve problem solving in maths and acquisition of science vocabulary. However, given the small samples, additional evidence is needed to extend the small amount of evidence found in the current review. Computer assisted emotion recognition interventions- moderate but growing evidence base in this area. Further research is needed regarding implementation in order to understand how these interventions can be delivered most effectively and the extent to which learning is generalised.	
Communication interventions	Communi -cation				Several interventions which fall under this category did not have evidence of	Communication interventions represented a moderate	Research Autism Milieu

Communication interventions are those focused an individual's ability to express wants, needs, choices, feelings or ideas.					a sufficiently high quality. These are Milieu teaching (3 studies), incidental teaching, language training and task analysis.	proportion of the available evidence base.	?
Picture Exchange Communication System (PECS) PECS consists of six phases which are: (1) 'how' to communicate, (2) distance and persistence, (3) picture discrimination, (4) sentence structure, (5) responsive requesting, and (6) commenting.	Communi -cation 2 studies	3- 10		x	PECS was found to be an effective intervention for improving communication skills. However, the evidence is considered to be moderat e due to the small number of studies available.	There is moderate evidence for the effectiveness of PECS for children attending specialist settings. Studies also illustrate how PECS can successfully be implemented by teachers as a classroom intervention and its effectiveness can be improved by the addition of video modelling.	Research Autism SIGN 3 Most evidence at preschool stage
Video modelling In video modelling approaches, a visual model of a desired behaviour or skill was provided via video recording and display equipment, to assist children and young people to learn or use the desired behaviour or skill. For example, in one study, participants used a visual cueing system (VCS) to tell the events of their school day to school staff and family members.	Communi -cation 5 studies	4- 22	х	x	The studies showed mixed outcomes. This means that there is insufficient conclusive evidence to determine the effectiveness of video modelling in supporting communication and social interaction.	There is moderate evidence for video modelling to support communication from this review but at present only for 4–6 year-old children.	Research Autism ?
Pre-academic / academic skills interventions Pre-academic/academic skills interventions are those typically focused on school-based task performance.	academic				Multi-sensory interventions fall under this category but don't have evidence regarding effectiveness as the studies were not of a sufficiently high quality.	Two studies were found to provide evidence for multi- sensory maths and reading comprehension programmes. Further research is needed to extend the small evidence base in this area.	

							This review noted one positive study for improving school readiness. It also records one study which showed improvement in solving word problems. Both studies only had 3 participants.
Direct Instruction Direct instruction is the use of straightforward, explicit teaching techniques, usually to teach a specific skill. It is a teacher-directed method, meaning a teacher or worker stands in front of a classroom or setting providing information or demonstrating a skill, which the children / young people then follow.	Academic 2 studies	10- 22	х	х		The evidence suggests that direct instruction can be an effective intervention for improving both reading comprehension and employment skills however numbers of studies/participants are small so can't conclude re effectiveness.	There is moderate evidence for the effectiveness of discrete skills teaching informed by behavioural principles.
Comprehensive interventions Comprehensive interventions are programmes which bring together elements of several different interventions, to create a personalised programme of interventions which is as individual as the child or young person themselves. Comprehensive interventions have several different parts to them. Examples of comprehensive interventions include Learning Experiences and Alternative Program (LEAP), Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH), Developmental Individual- Difference Relationship-Based (DIR) method and Comprehensive Application of Behaviour Analysis to Schooling (CABAS). These are explored below.	Academic 5 studies	0- 11	x	x	x	Comprehensive interventions were found to be effective in promoting communication, academic achievement, language and fine motor skills Evidence on the effectiveness of such interventions for over 11's is limited . The most intensive interventions (of 13 hours or more per week) tend to be the most effective .	Pre-school comprehensive programmes (10 studies) In the majority of studies, comparison and intervention groups both made progress on standardised measures; however, ASD specific interventions had better outcomes in most domains. Those receiving the ASD specific interventions were likely to make more progress in particular areas such as adaptive behaviour, language and development. The studies also provide some evidence to support more intensive interventions of 13 or

				more hours per week when compared to intervention as usual. The child's individual profile of need (Reed and Osborne, 2012) may also influence the choice of intervention. Research is needed to explore a study which suggested that more intensive ABA-informed interventions might be most effectively targeted towards facilitating the learning, intellectual development and behaviour of those children with more severe ASD. Primary school multi- component interventions (3 studies) There is some evidence to support the above.	
The TEACCH approach focuses on the person with autism and the development of a programme around this person's skills, interests and needs. It is a programme designed for visual learners. The intervention requires implementers to undergo formal training.	academic		Boyd et al. (2014) found children and young people with ASD in the LEAP, TEACCH or non-model specific (NMS) intervention group experienced reductions in autism characteristics across time, regardless of the method used to support them. However, findings suggest children in the TEACCH intervention group with lower (versus higher) cognitive ability		Research Autism

LEAP is designed for children with ASD who are not ready to learn in a traditional classroom setting, by creating an individualised programme tailored specifically for them. The programme seeks to develop social and emotional growth, enhance language and communication abilities in work and play activities, support decision making, increase capacity to cope with transitions, and	academic		showed greater improvement in autism severity. This may be explained by children with lower cognitive abilities being more likely to have more severe symptoms of ASD, and thus greater scope for improvement. Alternatively, it may suggest that they benefitted more from some of the environmental and behavioural supports used in TEACCH Children in the TEACCH group made significant changes over time across a range of measures including social interaction (rated by teachers and parents). Boyd et al. (2014) found children and young people with ASD in the LEAP, TEACCH or non-model specific (NMS) intervention group experienced reductions in autism characteristics across time, regardless of the method used to support them. For students in LEAP there was significant change over time for	LEAP was noted as an example of the increasing breadth and eclecticism of ASD programme development. Although LEAP is based upon ABA, and includes elements such as PECS, PRT and errorless learning, its delivery is integrated into the classroom setting. It also includes peer-	Research Autism
setting, by creating an individualised programme tailored specifically for them. The programme seeks to develop social and emotional growth, enhance language and			the LEAP, TEACCH or non-model specific (NMS) intervention group experienced reductions in autism characteristics across time, regardless	eclecticism of ASD programme development. Although LEAP is based upon ABA, and includes elements such as PECS, PRT and	V
communication abilities in work and play activities, support decision making, increase capacity to cope with transitions, and improve behaviour. Implementers are required to undergo			of the method used to support them. For students in LEAP there was significant change over time for teacher-rated social interaction, but this was not found for parent-	errorless learning, its delivery is integrated into the classroom setting. It also includes peer- mediated learning and skills training for families.	
formal training.			reported social interaction. This may reflect parental expectations.	In a study comparing LEAP with controls the children showed significantly more progress than controls in the areas of ASD, learning, language and social skills.	

Cognitive Behavioural Interventions (CBI) Cognitive Behavioural Interventions are talking therapies that can help people to manage or control cognitive processes that affect thoughts, behaviours and emotions.	Cognitive 1 study	11- 14			CBI's were found to be effective for reducing anxiety symptoms, including school anxiety and social worry, amongst children aged 11 to 14 years old with ASD. However, the evidence of effectiveness is limited, with only one high quality study.		Research Autism SIGN 2++ 2+ No evidence identified for children with ASD and intellectual disability
Cognitive skills training (described in the SIGN guidelines) These are described under different headings in the Welsh (2018) review and the NCSE (2016) review.	A systemati imitation, p however, w SIGN 1++	c revie lay (jo as a pi	ew of int en roblei	cognitiv gageme n.	e skills training in children and adolescents nt with mother), emotion recognition and	s with ASD reported improvements initiations of joint attention. Gener	in theory of mind alisation,
Sensory-based interventions (SBI) described in the SIGN guidelines are usually classroom based, devised, but often not directly administered, by OTs. These use sensory strategies such as deep touch pressure or movement breaks (and possibly equipment such as weighted vests or therapy balls) to influence a child's state of arousal and adaptive behaviour.	Studies of S improveme SIGN 1+	Bls ide nt.	entifie	d in a s	vstematic review were of low quality and s	howed limited consistent	

Table 2 Summary of Educational Interventions and levels of Effectiveness

Conclusions of the Welsh (2018) rapid evidence assessment

- The authors note that interventions delivered by teachers tend to be the most effective. Peers can also be effective implementers, but mostly in interventions focused on developing specific skills (for example, reading, decision making).
- The provision of training to implementers is important in increasing the effectiveness of the intervention.
- The importance of continuity between the school setting and home was highlighted indicating that including parents in the implementation of a programme is important.
- The length of time for which the intervention runs does not affect the level of effectiveness. The evidence does, however, suggest that the more comprehensive the intervention is, the longer it can run continuously without losing effectiveness.
- The evidence indicates that technology assisted approaches are not necessarily more effective than non-technological approaches on the whole, and in some cases technology based approaches appear to be less effective. The evidence does suggest that the use of multiple approaches (technological and non-technological) is preferable, as specific approaches have different levels of effectiveness, depending on the characteristics of the young person.
- There are gaps in the evidence: for example on the relative effectiveness of different modes of delivery or the influence of the age of the child or the severity of the ASD.

Conclusions of the Bond et al (2016) review

'All strands of the review indicate that a number of approaches can be effective for children with ASD. The case studies and guidance documents supported the view that ASD is a spectrum disorder for which a continuum of educational provision and range of interventions are needed. This is supported by the findings from the systematic review, which indicates that there is evidence for a number of individual and combined interventions, some of which may be specific to particular groups, profiles of need, age ranges or intervention foci while others have potentially broader applications. Although some interventions showed promise for very specific problems, interventions that address core areas of difficulty related to ASD are important in order to meet the range of primary needs of children.' P. 139

Appendix 1

Welsh Government (2019) 'Support for Children and Young People with Autistic Spectrum Disorder (ASD) in educational settings'

This report is based on a rapid evidence assessment (REA) of research studies (Welsh Government 2018), which involved reviewing and appraising existing research and considering the effectiveness of approaches to support children and young people aged up to 25 years with ASD. Effectiveness includes, but is not limited to, achieving positive outcomes for children and young people with ASD. These outcomes include attainment, attendance, inclusion, and social and emotional development.

A REA is a tool used to provide a rigorous synthesis of available evidence. REAs provide a balanced assessment of what is already known about an issue and critically appraise existing research. REAs are systematic in method but do not follow a full systematic literature review process.

The search provided 2,469 unique references. Three stages of screening were undertaken by a team of three. The 177 studies remaining were read in full and screened according to agreed criteria. Thirty five studies were chosen on this basis. Full details in Welsh Government (2019).

Bond, C., Symes, W., Hebron, J. Humphrey N., and Morewood, G. (2016) 'Educating Persons with Autistic Spectrum Disorder – A Systematic Literature Review' University of Manchester National Council for Special Education Research Reports No. 20

Three 'strands' of evidence gathering were undertaken for the current review. For the primary systematic literature review strand, a systematic process was adopted in order to ensure rigour in the selection and review of studies. The review process identified 1,021 possible articles for inclusion. Following a process of applying inclusion and exclusion criteria and the application of criteria to determine the quality of the evidence, methodological appropriateness of the evidence and effectiveness of the intervention, 85 studies were included and determined to be best evidence.

The systematic review process was complemented by two supplementary strands, which explored how educational provision for children and young people is articulated in policy and practice. These were not used in the current summary of effective interventions.

SIGN (2016) 'Assessment, diagnosis and interventions for autism spectrum disorders: A national clinical guideline'

The evidence base for this guideline was synthesised in accordance with SIGN methodology. A systematic review of the literature was carried out using an explicit search strategy devised by an Evidence and Information Scientist. Databases searched include Medline, Embase, Cinahl, PsycINFO and the Cochrane Library. The year range covered was 2006–2014. Internet searches were carried out on various websites including the US National Guidelines Clearinghouse. The main searches were supplemented by material identified by individual members of the development group. Each of the selected papers was evaluated by two members of the group using standard SIGN methodological checklists before conclusions were considered as evidence.

Research Autism

Evaluation process for the ratings

- The Information Manager and relevant subject experts agree to write and/or update a factsheet on an intervention. The subject expert advises the Information Manager on the key points and key references for that intervention. The Information Manager then undertakes a literature review to identify any other relevant references. The review includes searching a range of key databases, such as Autism Data and Pub Med. The Information Manager looks at the summaries of the materials, discards any which do not meet the agreed criteria, and then obtains full copies of all of the remaining references.
- Each reference is then analysed against a standard checklist to determine the scientific validity of the research. This checklist is an amended version of the checklists developed by the National Institute of Health and Care Excellence for similar purposes. The checklist enables us to answer key questions such as:
 - What is the purpose of this study?
 - Did it achieve its purpose?
 - Were the researchers independent?
 - Was the study relevant to people on the autism spectrum?
 - What kind of study was it? For example, was it a random controlled trial?
 - Was the research carried out in a rigorous and robust manner?
 - Did the study include sufficient information about the participants?
 - Did the study include sufficient information about the intervention?
 - Were the measures used to evaluate the intervention appropriate?
 - What was the result of the study?
- The key findings are then put into an evidence table which allows us to compare information from a range of studies. The Information Manager then pulls all of this information together, using an agreed template, and adds additional information about the intervention for people who know nothing about the subject. The information is then proof-read by another member of staff.
- The materials are then sent to three subject experts, including our Research Director, for comments and criticism. If necessary, the Information Manager amends the information based on the feedback from the three subject experts. The amended version is then sent to three member of the Readers Panel, a group of users which includes people on the autism spectrum, parents/carers and service providers. They check the information for accuracy, relevance and accessibility.
- The final version is then sent to the Scientific and Advisory Committee for sign off, after which the information is published on our website. Another member of staff checks that the Information Manager has followed all appropriate procedures and then signs off the document production checklist.

References

Humphrey N. (Ed.) 2015 'Autism and Education Volume IV Improving Experiences and Outcomes of Education for Learners with ASC' SAGE reference

SIGN (2016) 'Assessment, diagnosis and interventions for autism spectrum disorders' A National Clinical Guidance

Welsh Government (2018) 'A Rapid Evidence Assessment of the Effectiveness of Educational Interventions to Support Children and Young People with Autistic Spectrum Disorder'

Welsh Government (2019) 'Support for Children and Young People with Autistic Spectrum Disorder (ASD) in educational settings'