

SOCIAL RESEARCH NUMBER:

27/2018

PUBLICATION DATE:

15/05/2018

A Rapid Evidence Assessment of the Effectiveness of Educational Interventions to Support Children and Young People with Autistic Spectrum Disorder

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.

This document is also available in Welsh.

A Rapid Evidence Assessment of the Effectiveness of Educational Interventions to Support Children and Young People with Autistic Spectrum Disorder

A report by SQW and Social Care Institute for Excellence (SCIE)

Authors: Maya Agur, Rachel Hallam, Joanne Barber, Jane Meagher, Lauren Roberts, Paul Ross, Deanne Mitchell and Ewan King

Views expressed in this report are those of the researcher and not necessarily those of the Welsh Government

For further information please contact:

David Roberts

Knowledge and Analytical Services

Welsh Government

Llandudno Junction

Conwy

LL31 9RZ

Tel: 03000 625485

Email: david.roberts@gov.wales

Table of contents

1.	Glossary	3
2.	Introduction	6
3.	Methodology.....	8
4.	Characteristics of the evidence	14
5.	Intervention summaries	23
6.	Key findings.....	49
7.	Conclusions and implications	62
8.	Bibliography of evidence	65
	Annex A: Database sources and search terms	69

List of tables

Table 3-1: Criteria for rating the strength of evidence provided	13
Table 3-2: Robustness of evidence.....	13
Table 4-1: Study type.....	14
Table 4-2: Country	14
Table 4-3: Age range – study focus	14
Table 4-4: Interventions identified	15
Table 6-1: Outcomes reported in the evidence	55
Table A-1: Database sources (6)	69
Table A-2: Organisation sources (54)	69
Table A-3: Google and Google Scholar search terms.....	71
Table A-4: Database searches.....	74

1. Glossary

The table below provides a glossary of terms used in this report.

Acronym/Key word	Definition
ALN	Additional learning needs
ASC	Autistic spectrum conditions
ASD	Autistic spectrum disorder
BD	Behavioural difficulties
ID	Intellectual disability
PDD-NOS	Pervasive developmental disorder - not otherwise specified
SEN	Special educational needs
TD	Typical developing
RCT	Randomised control trials
REA	Rapid evidence assessment
TEMA-3	Test of early mathematics ability (3 rd edition)
AAC	Augmentative and alternative communication
ABA	Applied behaviour analysis
ABI	Antecedent-based intervention
CABAS	Comprehensive application of behaviour analysis to schooling
CABAS	Comprehensive application of behaviour analysis to schooling
CAP	Comprehensive autism program
CBI	Cognitive behavioural intervention
CBT	Cognitive behavioural therapy

Acronym/Key word	Definition
DI	Direct instruction
DIR	Developmental individual-difference relationship-based method
DRA	Differential reinforcement of alternative behaviour
DRI	Differential reinforcement of incompatible behaviour
DRO	Differential reinforcement of other behaviour
DTT	Discrete trial teaching
EBP	Evidence based practice
ECE	Exercise
ESDM	Early start Denver model
HP	High-p procedure
IDP	Individual development plan
IT	Incidental teaching
JA	Joint attention
LEAP	Learning Experiences and Alternative Programs
MD	Modelling
MITS	Modified incidental teaching intervention
MT	Milieu teaching
NI	Naturalistic intervention
PECS	Picture exchange communication system
PEER-DM	Peers engaged in effective relationships-decision making

Acronym/Key word	Definition
PII	Parent-implemented intervention behaviours
PMII	Peer-mediated instruction and intervention
PM-PRT	Peer-mediated pivotal response treatment
PND	Percentage of non-overlapping data
PP	Prompting
PRT	Pivotal response training
SM	Self-management
SN	Social narratives
SPG	Structured play groups
SST	Social skills training
TA	Task analysis
TAII	Technology-aided instruction and intervention
TEACCH	Treatment and education of autistic and related communication handicapped children
VM	Video modelling
VS	Visual supports

2. Introduction

- 2.1 The Welsh Government commissioned SQW and the Social Care Institute for Excellence (SCIE) to undertake a rapid evidence assessment (REA) into the extent to which interventions to support learners affected by Autistic Spectrum Disorder (ASD) are effective. The purpose of the review is to facilitate the planning and delivery of early, timely and effective interventions to support children and young people with ASD.
- 2.2 The Minister for Lifelong Learning and Welsh Language introduced the Additional Learning Needs and Education Tribunal (Wales) Bill ('the Bill') into the National Assembly for Wales in December 2016. The Additional Learning Needs and Education Tribunal (Wales) Bill¹ introduces a new additional learning system, which has three overarching objectives:
- a unified legislative framework to support all children and young people with additional learning needs (ALN) from birth up to the age of 25, where they remain in education
 - an integrated, collaborative process of assessment, planning and monitoring which facilitates early, timely and effective interventions
 - a fair and transparent system for providing information and advice, and for resolving concerns and appeals.
- 2.3 The Bill provides for a single plan – the individual development plan (IDP) – which will replace the range of statutory and non-statutory plans for learners with special educational needs or learning difficulties and/or disabilities.
- 2.4 The Bill forms part of a wider package of reforms, which aim to transform the expectations, experiences and outcomes for children and young people with ALN. One key area of the transformation programme focuses on awareness raising, to facilitate those involved in the ALN system to better understand the evidence of good practice, what can be expected from interventions, the interventions most likely to be effective, and the role of professionals. This is to help inform expectations and the effective deployment of resources.

¹ <http://www.assembly.wales/laid%20documents/pri-ld10862/pri-ld10862-e.pdf>

- 2.5 This report has been prepared for the Welsh Government and provides a synthesis of the findings of the REA. These findings are intended to inform the development of a document regarding evidence based practice for practitioners and parents, to raise awareness amongst those engaging with young learners with ASD in educational settings about various interventions and their effectiveness.
- 2.6 The study involved a small advisory group, comprised of stakeholders with a key interest or recognised expertise in this field. The group convened to consult and help shape a guide for practitioners based on the findings of the REA. This element of the project was put in place to ensure the guide drew on written evidence of interventions, which appear to be effective in supporting learners with ASD, whilst also engaging with some of the leading figures within this sector.

3. Methodology

- 3.1 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.
- 3.2 The aim of the REA is to provide an assessment of the extent to which interventions to support children and young people with ASD in education settings are effective.
- 3.3 The specific objectives to meet the aim of the research involved:
- undertaking a REA to broaden the understanding of the support needs of children and young people with ASD and identify interventions to support those children and young people
 - determining the extent to which the interventions are effective
 - identifying the most effective interventions for children and young people with ASD at various stages in their learning.
- 3.4 Therefore, the study focused on research related to the efficacy and impact of interventions, in order to gather robust evidence of the relative effectiveness of different approaches in relation to outcomes for young learners with ASD.

Search approach and protocol

- 3.5 The key search concept protocol was defined as shown below (key search concepts in bold):
- **ASD** - terms included: **autism**, Autistic spectrum disorder (ASD) or conditions (ASC), Asperger's syndrome, pervasive developmental disorder² - not otherwise specified (PDD-NOS), Rett's syndrome, childhood disintegrative disorder, learning or intellectual disabilities or difficulties.
 - **Provision and needs** - terms included: **education** (for example, teach, lecture, instruct, train); **setting** (for example, college or nursery or reception or pre-school or school or academic or further education or higher education or workplace or

² Used to refer to children who have significant problems with communication and play, and some difficulty interacting with others, but are too social to be considered autistic

facilities or pupil referral unit or apprenticeship); **learning needs** (for example, learning and special or additional or needs or provision or provider).

- **Intervention, outcome and practice** – terms included: **intervention** (for example, interventions and early or timely or preventative or effective or impact or awareness or knowledge or failure); **effectiveness** (for example, effective, efficacy or ineffective); **outcomes** (for example, outcome and wellbeing or behaviour or relationship or exclusion or inclusion or employment or independence or attainment or person-centred or improvement or health or learning or attendance); **quality** (for example, quality and indicator or measure or model); **practice** (for example, practice and good or bad or poor or approved or ineffective or myth).
- **Language** – terms included: **Welsh** (for example, Welsh and language or medium or study); **bilingual** (for example, bilingual or multi-lingual or dual-language or English as a second language and learning or literacy or education or study).
- **Study type** – terms included: **review** (for example, review or report or study or analysis or assessment or evidence and systematic or literature or rapid or case or empirical); **qualitative** (for example, qualitative and review or study or evidence or research or case study or empirical or analysis); **meta-analysis**; **randomized controlled trial (RCT)**; **evaluation**; **quasi-experimental**.
- **Planning and process** – terms included: **planning** (for example, “individual development plans” or “statements of special educational needs” or “individual education plans” or “learning support plans” or “personal learning and support plans”); **personalisation** (for example, personalised and plans or education or care or lesson or support).
- **Limits** – included: **language limits** (Welsh and English) and **date limits** (2008 to current on stage one screen, then 2013 to current on stage two screen).

3.6 These concepts were translated into search strategies using subject heading and free text terms (title and abstract searches) across six databases, including 21 unique searches and 54 targeted organisation searches. A full list of the sources and search terms can be found in Annex A.

3.7 Grey literature (materials and research produced by organisations outside of the traditional commercial or academic publishing and distribution channels) searches were additionally conducted using both Google and Google Scholar. Both database and grey literature searches generated data for the REA in relation to the effectiveness of interventions. All this data was screened against the criteria below for inclusion.

Screening

3.8 The search strategy resulted in a library of 2,469 unique references after duplication checking. These were exported to specialist reference management software EPPI-Reviewer³ which enabled systematic capture of decisions about references at each stage of the process, as well as facilitating management of screening, coding and data extraction. A team of three conducted the screening, which included an information specialist and research assistant with subject and topic expertise, and a research analyst who brought expertise in evidence review methods.

3.9 To identify the most relevant references for inclusion and to exclude references that did not relate directly to our review question, we undertook screening in three stages.

3.10 Queries from stage one screening were carried into the (redeveloped) stage two and three screening; queries from the stage three full-text review were re-screened to reach consensus. The team regularly communicated to reach shared consensus throughout the screening process, to ensure consistency of decision making.

Stage One Screening (title and abstract)

3.11 This first stage focused on relevance. The title and abstract of each reference was assessed against the three exclusion codes set out below. The exclusion codes were worked through in sequential order and where a code was selected, coding for that reference stopped and the record was excluded.

³ Thomas J, Brunton J, Graziosi S (2010) *EPPI-Reviewer 4.0: software for research synthesis*. EPPI-Centre Software. London: Social Science Research Unit, Institute of Education, University of London.

3.12 The stage one exclusion codes included:

- not suitable material (for example media items such as radio interviews, newspaper articles, conference notes and opinion pieces were excluded, whilst journal articles, research reports, books/chapter and other research, including literature reviews, were included)
- not relevant material (no relationship between ASD and education/learning)
- not enough abstract information (insufficient information on which to base judgement, records with no abstract were queried and if no abstract manually found, they were then excluded).

3.13 If none of the codes were selected, the reference progressed to stage two screening.

Stage Two Screening (title and abstract)

3.14 Due to a high number of potential includes after stage one, a second stage title and abstract screening strategy was agreed. This second stage screening involved sequential code screening on the inclusion points:

- **Date:** on the basis that the first stage screening identified three systematic reviews with a good match to our review question (covering the date period 2002 to 2013), we excluded studies covering the period up to 2013
- **Study design:** on the basis that our review question is an effectiveness question, and therefore requires us to include only those studies designed to answer this, randomised or quasi-randomised control trials; impact evaluations (for example, prospective comparative evaluation); economic evaluations; and case control studies with three or more measures were included
- **Outcomes:** on the basis the study focuses on the outcomes for the young person and there is evidence of positive, negative or non-impact
- **Condition:** on the basis the study focused on at least one of the conditions on the known spectrum
- **Language:** on the basis the study was either English or Welsh

- **Location:** on the basis of focusing on the most comparable settings, we focused on studies relating to Europe⁴, Canada, America, Australia and New Zealand
- **Setting:** on the basis the setting of the study was educational or contained supported employment in relation to education provision, or the study had educational utility
- **Age:** on the basis the study was about one or more subjects aged 0-25 years old
- **Specificity of intervention:** on the basis the study related to general education provision.

3.15 The 177 studies that remained were requested by the reviewer in full-text, to enable full-text review in stage three screening.

Stage Three Screening (full-text)

3.16 Within the final stage of screening, all 177 studies were reviewed in full-text using the same criteria. Many of the query studies (where there was not enough certainty in the previous stages) were excluded at this stage due to falling outside of the inclusion parameters. A total of 35 relevant studies were selected after full-text review, and proceeded into the final stage of data extraction (list provided in Annex B).

Robustness of the evidence

3.17 REAs are designed to critically appraise existing research, considering the robustness of the evidence presented. In the final list of studies, an adapted version of the Education Endowment Foundation's (EEF) criteria⁵ for rating the strength of evidence provided within a study was used to weight the methodologies and evidence presented. The EEF criteria looks at the strength of evidence against factors such as research design, number of cases, outcome measures and validity, as opposed to the size of effect. Table 3-1 provides an overview of the criteria we used.

⁴ EU, EAA & Switzerland, Iceland, Liechtenstein and Norway; Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the UK (England, Wales, Scotland, Northern Ireland).

⁵ A systematic review of intervention research examining English language and literacy development in children with English as an Additional Language (EAL). Accessed online October 2017: <https://www.bell-foundation.org.uk/wp-content/uploads/2017/05/EALachievementMurphy-1.pdf>

Table 3-1: Criteria for rating the strength of evidence provided

Strength of evidence	Explanation	Research Design	Number of Cases	Outcome Measure	Fidelity and Validity
High	Findings make a substantial contribution to existing evidence.	Fair and clear experimental design (examples include well designed RCT).	Minimum number of 100 cases or 50 clusters or more per arm.	Robust, valid outcomes, standardised or widely acceptable.	Clearly defined interventions, no leakage or evaluation bias.
Medium	Findings make a reasonable contribution to existing evidence.	Well-matched comparison group (quasi-experimental).	A minimum number of 50 cases or 20 clusters per arm.	Robust, valid outcomes.	Reasonably clear intervention, some threats to validity.
Low	Findings add little to the existing evidence.	Comparison group with poor or no matching.	Smaller studies of less than 40 cases or 10 clusters per arm.	Concerns about validity and reliability.	Poorly specified intervention, serious threats to validity.

Source: SQW adapted from EEF guidance

3.18 The review of the robustness of the evidence was conducted by two evaluators separately. Each evaluator reviewed all 35 documents and allocated each a score based on the criteria in the table above. Where different scores were allocated by the evaluators, a third evaluator made the final scoping decision. The results are set out in Table 3-2 below.

Table 3-2: Robustness of evidence

Rating	Count
3 – High	8
2 – Medium	8
1 – Low	19

3.19 In the findings chapters we focus primarily on the 16 documents that received a score of high and medium for the robustness of evidence.

4. Characteristics of the evidence

4.1 The 35 studies reviewed in this report largely comprise systematic reviews (n=16) and randomised control trials (RCT) or quasi-experimental studies (n=10), which would generally suggest a reasonably good strength of evidence.

Table 4-1: Study type

	Count
Systematic review	16
RCT or quasi-experimental study	10
Single case experimental design	5
Meta-analysis	3
Mixed methods	1

4.2 Only three of the studies were solely focused on the UK, and there were no final included studies with a Wales-only focus.

Table 4-2: Country

	Count
UK	3
Non-UK, single country	16
Multi country	16

4.3 The final list included studies covering from birth up to age 25.

Table 4-3: Age range – study focus

	Count
0-5 years ⁶	16
5-8 years	20
9-12 years	19
13-16 years	15
16+	12

⁶ 0-5 years focuses on pre-school interventions, hence overlap with the category below in terms of age range.

- 4.4 The aim of the review is to provide an assessment of the extent to which interventions and support for learning by children and young people with ASD are effective. All of the final studies have been chosen because they meet the selection criteria of evidencing effectiveness. Almost all (n=32) of the 35 studies report on effectiveness (success) of interventions, with just under half (n=15) providing evidence of ineffectiveness (failure) and 29 of the studies providing commentary on the limitations of the study.
- 4.5 The final list of 35 studies provides evidence on 32 distinct interventions. A full list of these is provided in Table 4-4, together with a count of the number of studies which consider the intervention. Peer-mediated instruction and intervention (PMII), technology-aided instruction and intervention (TAII), self-management (SM) and discrete trial teaching (DTT) are the interventions covered most frequently.

Table 4-4: Interventions identified

List of interventions	Number of the 35 studies considering the intervention	How defined
Peer-mediated instruction and intervention (PMII)	10	Typically developing peers interact with and/or help children and young people with ASD to acquire new behaviours, communication and social skills by increasing social and learning opportunities within natural environments. Teachers/service providers systematically teach peers strategies for engaging children and young people with ASD in positive and extended social interactions in both teacher-directed and learner-initiated activities
Technology-aided instruction and intervention (TAII)	10	Instruction or interventions in which technology is the central feature supporting the acquisition of a goal for the learner. Technology is defined as “any electronic item/equipment/application/or virtual network that is used intentionally to increase/maintain, and/or improve daily living, work/productivity, and recreation/leisure

List of interventions	Number of the 35 studies considering the intervention	How defined
		capabilities of adolescents with autism spectrum disorders” (Odom et al. 2013, cited Wong et al. 2014, p96 ⁷)
Self-management (SM)	7	Instruction focusing on learners discriminating between appropriate and inappropriate behaviours, accurately monitoring and recording their own behaviours, and rewarding themselves for behaving appropriately
Discrete trial teaching (DTT)	6	An intervention method based on the science of applied behaviour analysis (ABA). It is a highly structured method of teaching skills by breaking them down into smaller, teachable components. An instructional process usually involving one teacher/service provider and one student/client and designed to teach appropriate behaviour or skills. Instruction usually involves massed trials. Each trial consists of the teacher’s instruction/presentation, the child’s response, a carefully planned consequence and a pause prior to presenting the next instruction
Comprehensive interventions	5	Multi-component programmes for example, lifelong exceptional autism programmes (LEAP), treatment and education of autistic and related communication handicapped children (TEACCH), developmental individual-difference relationship-based (DIR) Method, comprehensive application of behaviour analysis to schooling (CABAS)
Social skills	5	Group or individual instruction designed to teach

⁷ Wong, C., Odom, S L., Hume, K., Cox, A W., Fettig, A., Kucharczyk, S., Brock, M E., Plavnick, J B., Fleury, V P., and Schultz, T R. 2013, Evidence-based practices for children, youth, and young adults with Autism Spectrum Disorder. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group.

List of interventions	Number of the 35 studies considering the intervention	How defined
training (SST)		learners with ASD ways to appropriately interact with peers, adults, and other individuals. Most social skill meetings include instruction on basic concepts, role-playing or practice, and feedback to help learners with ASD acquire and practice communication, play, or social skills to promote positive interactions with peers
Video modelling (VM)	5	A visual model of the targeted behaviour or skill (typically in the behaviour, communication, play, or social domains), provided via video recording and display equipment to assist learning in or engaging in a desired behaviour or skill
Visual supports (VS)	5	Any visual display that supports the learner engaging in a desired behaviour or skill independent of prompts. Examples of visual supports include pictures, written words, objects within the environment, arrangement of the environment or visual boundaries, schedules, maps, labels, organization systems, and timelines
Behavioural interventions	4	The behavioural intervention category is comprised of interventions typically described as antecedent interventions (see below) and consequent interventions, which are used to minimise reinforcement for problem behaviour and increase reinforcement for desirable behaviour
Naturalistic intervention (NI)	4	Intervention strategies that occur within the typical setting/activities/routines in which the learner participates. Teachers/service providers establish the learner's interest in a learning event through arrangement of the setting/activity/routine, provide necessary support for the learner to engage in the

List of interventions	Number of the 35 studies considering the intervention	How defined
		targeted behaviour, elaborate on the behaviour when it occurs, and/or arrange natural consequences for the targeted behaviour or skills (intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)
Social narratives (SN)	4	Or social stories. Narratives that describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responses. Social narratives are individualised according to learner needs and typically are quite short, perhaps including pictures or other visual aids
Antecedent-based intervention (ABI)	3	Arrangement of events or circumstances that precede the occurrence of an interfering behaviour and designed to lead to the reduction of the behaviour (intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)
Milieu teaching (MT)	3	A procedure where adults embed opportunities to communicate during typical activities, based on the child's need (Lane et al. 2016, p54)
Modelling (MD)	3	Demonstration of a desired target behaviour that results in imitation of the behaviour by the learner and that leads to the acquisition of the imitated behaviour. This evidence based practice (EBP) is often combined with other strategies such as prompting and reinforcement
Structured play groups (SPG)	3	Small group activities characterised by their occurrences in a defined area and with a defined activity, the specific selection of typically

List of interventions	Number of the 35 studies considering the intervention	How defined
		developing peers to be in the group, a clear delineation of theme and roles by adult leading and/or prompting or scaffolding as needed to support the students' performance related to the goals of the activity
Differential reinforcement of Alternative, Incompatible, or Other Behaviour (DRA/I/O)	2	Provision of positive/desirable consequences for behaviours or their absence that reduce the occurrence of an undesirable behaviour. Reinforcement provided: a) when the learner is engaging in a specific desired behaviour other than the inappropriate behaviour (DRA); b) when the learner is engaging in a behaviour that is physically impossible to do while exhibiting the inappropriate behaviour (DRI); or c) when the learner is not engaging in the interfering behaviour (DRO) (intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)
Direct Instruction (DI)	2	Direct instruction is the use of straightforward, explicit teaching techniques, usually to teach a specific skill. It is a teacher-directed method, meaning that the teacher stands in front of a classroom and presents the information
Language Training	2	Language training (production) targets the ability of the individual with ASD to emit a verbal communication (that is, functional use of spoken words) (intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)
Picture	2	Learners are initially taught to give a picture of a

List of interventions	Number of the 35 studies considering the intervention	How defined
Exchange Communication System (PECS)		desired item to a communicative partner in exchange for the desired item. 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
Pivotal response training (PRT)	2	Pivotal learning variables (that is motivation, responding to multiple cues, self-management, and self-initiations) guide intervention practices that are implemented in settings that build on learner interests and initiative
Prompting (PP)	2	Verbal, gestural, or physical assistance given to learners to assist them in acquiring or engaging in a targeted behaviour or skill. Prompts are generally given by an adult or peer before or as a learner attempts to use a skill
Reinforcement (R)	2	An event, activity or other circumstance occurring after a learner engages in a desired behaviour, that leads to the increased occurrence of the behaviour in the future
Support worker assisted	2	Like peer-mediated instruction and intervention (PMII) but paraprofessionals or support staff are trained to deliver the intervention
Cognitive behavioural intervention (CBI)	1	Instruction on management or control of cognitive processes that lead to changes in overt behaviour
Exercise (ECE)	1	Increase in physical exertion as a means of reducing problem behaviours or increasing appropriate behaviours
High-p	1	A procedure where the individual is asked two to

List of interventions	Number of the 35 studies considering the intervention	How defined
procedure (HP)		<p>three high probability questions (that is, questions or requests the student is likely to answer or comply with), followed by a low-probability request (that is, targeted transition). For example, before requesting a student with ASD transitions to a task that may be aversive, the teacher might request two to three tasks (for example, give me a high five, how do you spell your name) that are typically responded to with high levels of compliance (Lequia et al. 2015, p147)</p> <p>(intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)</p>
Incidental teaching (IT)	1	<p>A procedure that promotes initiations and expands verbal communication during typical activities. A child initiates an interaction with a verbal or non-verbal request and an adult prompts an elaboration to expand the child's communicative repertoire, using a more intrusive prompt if needed (for example verbal models) (Lane et al. 2016, p54). Also includes 'modified' versions of the intervention (MITS)</p> <p>(intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)</p>
Joint attention (JA)	1	<p>Joint attention interventions which aim to develop children and young people's joint attention and joint engagement and usually involve 1:1 delivery of a play-based/turn-taking intervention by a teacher or parent (Bond et al. 2016)</p>
Multi-sensory interventions	1	<p>Intervention to develop academic skills for example, multi-sensory maths and reading comprehension programmes (Bond et al. 2016)</p>

List of interventions	Number of the 35 studies considering the intervention	How defined
Parent-implemented intervention (PII) behaviours.	1	Parents provide individualised intervention to their child to improve/increase a wide variety of skills and/or to reduce interfering. Parents learn to deliver interventions in their home and/or community through a structured parent training programme (intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)
Peer-mediated pivotal response treatment (PM-PRT)	1	Combine features of peer-mediated interventions with pivotal response training (intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)
Task analysis (TA)	1	A process in which an activity or behaviour is divided into small, manageable steps in order to assess and teach the skill. Other practices, such as reinforcement, video modelling, or time delay, are often used to facilitate acquisition of the smaller steps (intervention not discussed in chapter 4 because it is not covered by the high/medium quality documents)

5. Intervention summaries

Peer-mediated instruction and intervention (PMII)

Typically developing peers interact with and/or help children and young people with ASD to acquire new behaviours, communication skills and social skills by increasing social and learning opportunities within natural environments⁸.

Teachers/service providers systematically teach peers strategies for engaging children and young people with ASD in positive and extended social interactions in both teacher-directed and learner-initiated activities.

The included studies provide a substantial evidence base suggesting that PMII is an effective intervention for developing social interaction amongst pre-school and primary school aged children diagnosed with ASD. However, evidence of the efficacy of PMII to improve comprehension and employment skills is mixed.

- 5.1 There is a considerable evidence base on the effectiveness of PMII, but elements across the different intervention types vary greatly. Bond et al. (2016) identified PMII as one of the intervention categories with most evidence. Nine peer-mediated interventions focused on developing social interaction were reviewed. All studies focused on children aged 5-14 years old, diagnosed with ASD or high functioning autism (HFA), and attending mainstream schools. The studies involved developing interventions with peers to support children with ASD and/or teach peers skills to enable them to interact more successfully with children with ASD. Overall, the studies suggest naturalistic peer-mediated interventions are effective for improving social interaction.
- 5.2 Garrote et al. (2017) also found “group activities” to be effective for increasing social interactions. These included a range of interventions: cooperative learning (n=2); peer tutoring (n=3); Circle of Friends (n=3); structured plan and friendship activates (n=1); multi-component intervention (n=1); interest clubs (n=1); and therapeutic group counselling (n=1). Eight of these studies involved the entire class, whilst four

⁸ ‘Learning opportunities in natural environments’ refers to teaching interventions in the ‘real world’, rather than teaching interventions in a structured setting, such as therapy.

involved a group of volunteer peers. Implementation primarily involved teachers, researchers, and/or research assistants. Most studies reviewed showed positive intervention effects on the social interactions between pupils with special educational needs (SEN) and their typically developing (TD) peers regarding the frequency, duration, and/or quality of the social interactions. However, four studies showed mixed or neutral effects.

- 5.3 Höher et al. (2016) similarly reviewed social interactions between children with ASD and their TD peers. Interventions included training TD peers to respond to interaction initiations and social advances from participants with ASD, and teaching social interaction skills to children with ASD. Höher et al. (2016) found no statistically significant difference between studies that trained peers to respond to participants with ASD and studies that did not train peers. Furthermore, no difference between effects from researcher or teacher implementers were found. Ozuna et al. (2015) found peer-mediated studies had mixed effectiveness for supporting social interactions across three studies each conducted in different settings.
- 5.4 Chang and Locke (2016) also reported that PMII improved participants' social skills. Across the five studies reviewed, one study examined pre-school-aged children, and the other four included primary school-aged children with ASD that had average to above average cognitive functioning. Across all studies, peers were selected via teacher nomination but the setting varied depending on the study. Treatment length and intensity varied greatly from four hours per day over six months (Corbett et al. 2014 cited in Chang and Locke 2016), to three 25-30 minute sessions a week over six months (Kamps et al. 2014 cited in Chang and Locke 2016).
- 5.5 Four studies on 'cooperative learning' interventions to improve comprehension skills were reviewed by Finnegan and Mazin (2016). Eleven students with ASD, aged 7-13 years old, participated in the studies alongside TD peers. Each study used a different cooperative learning arrangement: peer tutoring, class wide peer tutoring, cooperative teaching groups and cooperative pairs. Teachers and paraprofessionals provided reinforcement and corrective feedback to participants with ASD. Effectiveness varied across the four interventions, however all four

showed the number of correct responses to comprehension measures increased when participants with ASD engaged in cooperative learning with their peers.

- 5.6 Finally, Gilson et al. (2017) reviewed two studies that involved peer instruction to introduce employment skills to participants diagnosed with intellectual disability (ID). Both studies were conducted in the work place and included peer-delivered training (Agran et al. 1992 cited in Gilson et al. 2017) or peer instruction (Wacker and Berg 1984 cited in Gilson et al. 2017). One study had a strong positive effect, whilst the other had a positive effect that was not strong.

Comprehensive Interventions

There is a large evidence base for the effectiveness of comprehensive interventions; however, the quantity of evidence reduces significantly as the age of learners increases.

Multi-component programmes for example, lifelong exceptional autism programmes (LEAP), treatment and education of autistic and related communication handicapped children (TEACCH), developmental individual-difference relationship-based (DIR) method⁹, comprehensive application of behaviour analysis to schooling (CABAS)¹⁰.

- 5.7 Bond et al. (2016) reviewed both pre-school comprehensive interventions (n=10) and school-based comprehensive interventions (n=3). Comprehensive pre-school interventions were identified as one of the areas with most evidence by Bond et al. (2016). The interventions were delivered at home or at school (special or mainstream) to children aged 3-7 years. Most interventions ran for between six

⁹ “The Developmental, Individual Difference, Relationship-Based model of intervention (DIR) provides a developmental framework for interdisciplinary assessment and intervention for autism spectrum and related disorders. It is a comprehensive foundation model that utilizes affect-based interactions and experiences tailored to individual needs to promote development” (Wieder S. 2013, Developmental, Individual Difference, Relationship-Based (DIR) Model, p37. In: Volkmar F. R. (ed) Encyclopaedia of Autism Spectrum Disorders. Springer, New York, NY).

¹⁰ CABAS is an international certification for programs characterized by: individualized instruction, continuous measurement of teaching and student responses, graphical display of teachers and students performance, the use of scientifically-tested tactics, logically and empirically tested curricular sequences, socially significant goals of instruction, positive teaching environments and teachers trained as strategic scientists of education/therapy (Greer, R D., Keohane, D D., and Healy, O. 2002, Quality and comprehensive applications of behavior analysis to schooling, The Behavior Analyst Today 3 (2):120-132).

months and one year. The studies aimed to address several areas including learning, social skills, ASD severity and adaptive functioning. The studies provide some evidence to support more intensive interventions of 13 or more hours per week.

- 5.8 Three studies explored school age comprehensive interventions. The studies included children aged 3-11 years old attending special classes or special schools. The interventions focused on training staff in evidence-based practices (STAR and COMPASS). The studies found collaborative planning with parents and coaching had positive effects on pupil goal attainment, however one study acknowledged that variability of implementation is likely to have affected the results (Mandell et al. 2013 cited in Bond et al. 2016).
- 5.9 Four studies explored the effectiveness of specific multi-component programmes. Boyd et al. (2014) compare the relative effects of LEAP and TEACCH (both comprehensive treatment programmes) approaches for pre-school children with ASD. The interventions were delivered to children aged 3-5 years by teachers (who had attended formal training) over the course of a school year. The TEACCH approach focuses on the person with autism and the development of a programme around this person's skills, interests and needs, rather than their deficits. LEAP seeks to develop social and emotional growth, enhance language and communication abilities in work and play activities, facilitate choice making, increase capacity to cope with transitions and improve behaviour. TEACCH and LEAP were effective programmes, demonstrating significant change over time in the areas of communication, academic achievement and fine motor skills, but the control group similarly made progress in these areas.
- 5.10 Sainato et al. (2015) explored an inclusive, comprehensive treatment programme for kindergarten children with ASD, over four school years. The intervention was implemented throughout the daily routine by teachers and classroom assistants. Following the intervention, the group had statistically significant higher mean scores in all skill domains except adaptive behaviour and spoken language.
- 5.11 Similarly, Vivant et al. (2014) investigated the Early Start Denver Model (ESDM), a manualised comprehensive intervention programme. The ESDM programme was

delivered to pre-schoolers (aged 0 -6 years old) in a community long-day care service over the course of a year. Teachers delivered 15-25 hours per week of ESDM to the children involved, with a staff-child ratio of 1:3. In comparison to the control group, children in the ESDM group showed significantly higher gains in developmental rate and receptive language.

- 5.12 The Comprehensive Autism Program (CAP)¹¹ for 3-5-year-olds, state-school students with ASD was explored by Young et al. (2016). All teachers, para-educators and speech-language pathologists associated with the students enrolled in the study were trained to deliver CAP and parents were also supported and encouraged to participate. The study found CAP had small positive impacts on the students' receptive language and on their social skills as rated by teachers. However, these effects were moderated by severity of ASD.

Social Skills Training (SST)

Group or individual instruction is designed to teach learners with ASD ways to appropriately interact with peers, adults, and other individuals. Most social skill meetings include instruction on basic concepts, role-playing or practice, and feedback to help learners with ASD acquire and practice communication, play, or social skills to promote positive interactions.

The included studies provide moderate evidence that SST is an effective intervention to improve social interactions. However, across the studies the number of participants varied substantially, which limits generalisation.

- 5.13 Garrote et al. (2017) reviewed nineteen studies that evaluated the effects of teaching interaction strategies. In most of the studies, interaction strategies were only taught to typically developing (TD) pupils and interventions were implemented by teachers alone or in collaboration with the researchers. The nineteen studies included pupils with special educational needs (SEN), aged 2-10 years. The number

¹¹ Intervention practices recommended for CAP implementers included: DTT (15 min per school day of 1:1 instruction recommended); behavioural strategies within routines (used throughout the day and 15 min per school day of 1:1 instruction); and PRT (used throughout the day and 15 min per school day of 1:1 instruction).

of participants per study varied from one to ninety-five. The majority of the pupils (n=132 out of 163) were diagnosed with ASD¹².

- 5.14 Thirteen¹³ of the nineteen studies reviewed by Garrote et al. (2017) evaluated the effects of teaching interaction strategies to TD peers to increase or improve their social interactions with pupils with SEN. The interventions predominately involved the initiation and maintenance of social interactions during episodes of free play (for example, suggesting games, initiating a conversation, or making compliments). Two studies evaluated the programme “Stay, Play, Talk”. In this intervention, selected TD pupils (or all TD classmates) learned strategies to initiate and maintain interaction with their peers with intellectual disability (ID). The remaining six studies¹⁴, also taught pupils with SEN or visual and hearing impairments how to better interact with their TD peers. Most of the nineteen reviewed studies showed positive intervention effects on the social interactions between pupils with SEN and their TD peers regarding the frequency, duration, and/or quality of the social interactions.
- 5.15 Bond et al. (2016) reviewed four studies that focused on SST. The studies included participants aged 4-17-years-old and were conducted in mainstream and specialist settings. These 1:1 and group interventions were delivered by specialist teachers and/or researchers for short periods during the school day and often included the use of PRT procedures, social scripts and/or prompts to teach social initiation. The studies provide moderate evidence for social initiation training; however, additional evidence is required because all the studies involved small samples. The studies on multi-component social interventions also included the use of SST. Delivery of SST included manualised researcher delivered after-school social skills groups for pupils with simultaneous parent groups and training teaching staff to deliver manualised social skills groups.

¹² Also included nine participants that had ID, seventeen pupils had a developmental delay (DD), three had BD, one had a hearing impairment, and one had a visual impairment.

¹³ Batchelor and Taylor (2005); Goldstein and Cisar (1992); Goldstein et al. (1997); Goldstein et al. (1992); Harjusola-Webb et al. (2012); Harper et al. (2008); Kohler et al. (2007); Mason et al. (2014); McGrath et al. (2003); Owen-DeSchryver et al. (2008); Pierce and Schreibman (1997); Storey et al. (1993); Thiemann and Goldstein (2004) (cited in Garrote et al. 2017).

¹⁴ Banda et al. (2010); Hundert and Houghton (1992); Kamps et al. (1992, 2015); Katz and Girolametto (2013); Nelson et al. (2007) (cited in Garrote et al. 2017).

- 5.16 Five studies¹⁵ in the Gilson et al. (2017) review focused on improving students' interactions with co-workers or supervisors in the workplace setting, using communication boards or books. The interventions - included between one and five participants diagnosed with ID. Finally, the PEER-DM intervention, explored by Khemka et al. (2016), can be described as incorporating elements of SST interventions, as the curriculum provided practice in fostering age-appropriate pro-social interactions and positive personal relationships by including decision-making scenarios that explore both positive and negative peer pressure.

Self-management (SM)

Instruction focusing on learners discriminating between appropriate and inappropriate behaviours, accurately monitoring and recording their own behaviours, and rewarding themselves for behaving appropriately.

The included studies explored the effectiveness of self-management on a range of dependent outcomes (including academic behaviours, problem behaviours, reading comprehension, and employment skills). Across the studies the outcomes were mixed, but Carr et al. (2014) concluded that self-management is highly effective for improving academic behaviours and reducing problem behaviours.

- 5.17 Carr et al. (2014) reviewed twenty-three studies on self-management and concluded the results indicated that self-management is highly effective for improving academic behaviours and reducing problem behaviours of students diagnosed with ASD. PND scores¹⁶ showed self-management interventions appear effective across all age ranges, particularly with adolescents. With regards to setting, PND scores indicated self-management procedures are effective in a range of settings (home, community, clinic and multiple). However, ability seemed to

¹⁵ Allgood et al. (2009); Heller et al. (1994); Heller, Allgood, Davis, Arnold, Castelle, and Taber (1996); Heller, Allgood, Ware, Arnold and Castelle (1996); Rodi and Hughes (2000) (cited in Gilson et al. 2017).

¹⁶ Note the percentage of non-overlapping data (PND) metric was used to measure the strength of treatment effect of the interventions. The PND calculation between treatment and baseline phases involved drawing a line through the highest baseline data point (or lowest, depending on the expected treatment effect) parallel to the sessions axis and determining the proportion of treatment data points that exceed this line (Scruggs and Mastropieri, 1998).

modify treatment effectiveness, with mean PND scores of 90.8% (highly effective) and 77.1% (effective) obtained for high-and low-functioning participants respectively.

- 5.18 Self-management interventions were classified as having insufficient evidence by Bond et al. (2016). This is not surprising given only two studies, with two children in each one, were reviewed. Finnegan and Mazin (2016) similarly reviewed two studies on self-management but these studies included thirty-two participants with ASD (aged 10-18 years). Asberg and Dahlgren-Sandberg (2010) (cited in Finnegan and Mazin 2016) worked with participants in small groups while O'Connor and Klein (2004) (cited in Finnegan and Mazin 2016) worked with participants on a one-on-one basis. Both studies were conducted over a relatively short period of time¹⁷. Despite this, the two studies demonstrated students with ASD can independently use strategies that will facilitate their reading comprehension.
- 5.19 Twelve self-management instruction interventions were reviewed by Gilson et al. (2017). These involved participants acquiring new skills with the assistance of a self-initiated or self-managed system, such as an auditory prompting system (n = 7), handheld computers (n = 3), or a self-monitoring checklist (n = 2). Studies were conducted in a variety of settings; school (n=3), workplace (n=7), community (n=1) and both a school and workplace (n=1). Eight interventions had a strong positive effect on employment skills outcomes, one had a positive effect that was not as strong and three had a mixed effect.¹⁸

¹⁷ The Asberg and Dahlgren-Sandberg (2010) study was conducted over four weeks, 20-30 minute sessions. The O'Connor and Klein (2004) study included only one, 60-minute session.

¹⁸ It should be noted that participants involved across all studies had intellectual disability (ID), as opposed to ASD. Therefore, this should be considered because the needs of students with ASD can differ from students with ID.

Technology-aided instruction and intervention (TAII)

Instruction or interventions in which technology is the central feature supporting the acquisition of a goal for the learner. Technology is defined as “any electronic item/equipment/application/or virtual network that is used intentionally to increase/maintain and/or improve daily living, work/productivity, and recreation/leisure capabilities of adolescents with autism spectrum disorders” (Odom et al. 2013, cited in Wong et al. 2014, p96¹⁹).

The included studies provide mixed results for the effectiveness of TAII on primary and secondary school learners diagnosed with ASD. Positive outcomes were found for the use of TAII to improve employment skills, behaviour, emotion recognition and academic skills (maths and science vocabulary) but TAII was found to have little effect on reading comprehension.

- 5.20 Finnegan and Mazin (2016) reviewed two studies, which used supported electronic texts. Nine participants diagnosed with ASD (aged 7-14 years) were included across both studies. One study compared the effects of Wynn Wizard (supported electronic text) and traditional oral storytelling over eleven weeks, and found varied effectiveness on comprehension (Armstrong and Hughes 2012 cited in Finnegan and Mazin 2016). Knight et al. (2014) (cited in Finnegan and Mazin 2016) utilised all the in-built features of BookBuilder²⁰ (CAST 2014), which guided the reader with questions and explanations. The intervention was conducted over forty sessions but it was found not to be effective in increasing reading comprehension. Overall, electronic supported text showed little to no effect on reading comprehension measures in students with ASD.
- 5.21 Most of the studies reviewed by Gilson et al. (2017) incorporated technology (n=21). Twelve studies used video-based instruction as their primary intervention approach, this included video modelling alone, video prompting and feedback, and comparison

¹⁹ Wong, C., Odom, S L., Hume, K., Cox, A W., Fettig, A., Kucharczyk, S., Brock, M E., Plavnick, J B., Fleury, V P., and Schultz, T R. 2013, Evidence-based practices for children, youth, and young adults with Autism Spectrum Disorder. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group.

²⁰ These features included: vocabulary definitions, illustrations, text-to-speech, concept maps, and an embedded coach.

of video-based instruction modes. These took place in the workplace or school setting. Three studies used audio-based instruction, which entailed audio cuing or covert audio coaching. Again, interventions were delivered in the workplace or school. Six studies involved using augmentative and alternative communication (AAC)-assisted instruction for students with complex communication needs. Instructional methods included picture dictionaries, dual communication boards, task-referenced icons on AAC and milieu training. Across all the video-based, audio-based and AAC-assisted interventions, either strong positive effects or positive effects were found except for one video-based intervention, which found mixed effects.

- 5.22 Bond et al. (2016) reviewed seven studies which can be considered as TAI's.²¹ Three studies, which used computer-assisted emotion recognition interventions, focused on the use of computer programmes and video modelling to improve emotion recognition. The interventions were delivered 1:1 by the researcher and/or school staff to children aged 5-10 years attending a variety of settings (including a mainstream primary school and after-school centre). The studies found improvement in the ability to identify emotions and the programmes were rated positively by school staff. Computer-assisted interventions to reduce challenging behaviour were the focus of two studies. Both studies included a small number of children aged 11-14 years who attended resourced²² or mainstream schools. One study found video modelling increased the effectiveness of social stories in reducing off-task behaviour and the other found self-modelled picture prompts on a handheld computer increased task engagement. In addition, two studies explored computer-aided instruction to improve maths and science skills. The participants were aged 11-15 years, and attended a resourced provision or mainstream school in a general education class. The studies provide evidence of socially valid interventions to improve problem solving in maths and acquisition of science vocabulary.

²¹ Other interventions in the Bond et al. (2016) review, such as VM, could also be included in this section, however, as they have also been discussed in a previous section they have been excluded from this paragraph.

²² Resourced schools receive additional funding/resources and offer teaching staff with additional knowledge, skills and expertise in a particular area of SEN, specialist environments, tailored learning plans and input from additional specialists.

Discrete Trial Teaching (DTT)

An intervention method based on the science of applied behaviour analysis (ABA). It is a highly structured method of teaching skills by breaking them down into smaller, teachable components. An instructional process usually involving one teacher/service provider and one student/client and designed to teach appropriate behaviour or skills. Instruction usually involves massed trials. Each trial consists of the teacher's instruction/presentation, the child's response, a carefully planned consequence and a pause prior to presenting the next instruction.

Overall, the studies, which included the use of DTT, suggest that DTT is an effective intervention, particularly in helping adolescents to develop their academic skills. However, there is a lack of conclusive evidence with regards to the most effective intervention setting, duration, intensity and delivery.

- 5.23 The Maths Recovery programme, a form of DTT, was the focus of a study by Tzanakaki et al. (2014). The Maths Recovery intervention group received 1:1 tuition, across 12 weeks, from a teaching assistant or one of the study's authors who is a qualified teacher. The intervention group made post-intervention improvements on a test of early mathematics ability (TEMA-3), which covered numeracy tasks, counting items, reading and writing numbers, subtraction and addition. In some cases, adherence to the proposed level of intervention intensity (four to five sessions per week) was not possible causing variation in intervention across participants in the intervention group.
- 5.24 Bond et al. (2016) rated DTT as having moderate evidence. The four studies reviewed focused on discrete skills teaching informed by behavioural principles to develop pre-academic/academic skills. Although each of these studies only included four or less participants, they provided evidence of the effectiveness of behavioural approaches, such as model-lead-test and fluency training in the acquisition of discrete skills²³. The four studies were each conducted in different settings:

²³ Discrete skills include reading single words, learning science vocabulary and recognising letters or numbers.

inclusive pre-school, child's home, special education class and resourced school. Furthermore, the implementation of interventions varied greatly across the studies²⁴ and intervention practitioners included both researchers and teachers.

- 5.25 Khemka et al. (2016) explore the Peers Engaged in Effective Relationships-Decision Making (PEER-DM) curriculum, a 4-step decision-making curriculum. PEER-DM can be described as incorporating elements of DTT due to the curriculum being highly structured and divided into teachable objectives. All six 30-45 minute long training sessions were delivered by graduate student trainers in a school based setting. Adolescents in the intervention group were better able to resist peer pressure following the delivery of the PEER-DM curriculum.

Modelling (MD)

Demonstration of a desired target behaviour that results in imitation of the behaviour by the learner and that leads to the acquisition of the imitated behaviour. This evidence based practice (EBP) is often combined with other strategies such as prompting and reinforcement.

Modelling was found to have mixed outcome effects across the included studies, thus conclusive evidence regarding the effectiveness of modelling is limited.

- 5.26 All the studies reviewed by Höher et al. (2016) consistently used peer or adult modelling. Analysis showed that using modelling alongside prompt and reinforcement was highly effective but was not statistically different to interventions that used only prompt and reinforcement. However, this result does not mean modelling should not be used. The reading comprehension instruction used by Roux et al. (2015) included the use of modelling, for example in the identification of anaphoric relations sessions. During the first two sessions, the assistant explained the use of nine personal pronouns and then modelled a strategy to identify the referent of the pronoun in the text.

²⁴ For example, the Axe and Sainato (2010) study (cited in Bond et al. 2016) included sixty 1:1 intervention sessions with the researcher, whereas Van Rie and Heflin (2009) (cited in Bond et al. 2016) delivered the intervention through five minute daily sessions with the researcher until 80% correct response in academic conditions.

- 5.27 One study in the Gilson et al. (2017) review trained a student to perform data entry with task-referenced icons on his augmentative and alternative communication (AAC) device. Furthermore, three further studies focused on simulation instruction, in which participants were taught to perform employment skills in one location (for example, school or day programme) and then were evaluated on the skill in an actual community job site. Strong intervention effects on employment skills were found in one study, and the other two showed positive effects.

Visual supports (VS)

Any visual display that supports the learner engaging in a desired behaviour or skill independent of prompts. Examples of visual supports include pictures, written words, objects within the environment, arrangement of the environment or visual boundaries, schedules, maps, labels, organization systems, and timelines.

Both Finnegan and Mazin (2016) and Gilson et al. (2017) suggest visual supports are a highly effective intervention, for both improving reading comprehension and employment skills respectively. However, the studies focussed on very different dependent variables (comprehension skills and employment skills) and used a variety of intervention techniques which occurred across a range of settings. It is, therefore, difficult to make overall conclusions.

- 5.28 Graphic organisers (diagrams which help individuals classify ideas and communicate more effectively) were concluded to be the most effective intervention by Finnegan and Mazin (2016). Five studies used graphic organisers, each of which used a different type: thinking maps (Mashal and Kasirer 2011), wh-question organisers (Bethune and Wood 2013) story maps (Stringfield et al. 2011), Venn diagrams (Carnahan and Williamson 2013) and character event maps (Williamson et al. 2014). All five studies cited in Finnegan and Mazin (2016) provide evidence that visual supports are an effective intervention to support reading comprehension in learners with ASD.
- 5.29 The length of the intervention varied between the five studies, thus this does not appear to impact the effectiveness of the intervention. In addition, the length of

sessions were short (sessions were 10 to 15 minutes long²⁵), which suggests graphic organisers can be an effective method if time is a constraint. Studies incorporated some degree of teacher-led instruction and most were conducted in small group or classroom-like settings. Finnegan and Mazin (2016) argue the results suggest interventions such as graphic organisers can be applied in classroom settings.

- 5.30 The studies reviewed by Gilson et al. (2017) include picture or tactile-based instruction based on picture prompts (n = 3), tactile cues (n=1), photo activity schedule book (n=1), picture-cue training (n=1) or exploded view drawings (n=1). Picture and tactile interventions had a 100% positive effect on employment skills outcomes. Five out of the seven studies were conducted in a school setting, two in a workplace and the setting of one was unclear²⁶, therefore suggesting that **visual supports can be implemented effectively in a range of settings.**

Behavioural interventions

The behavioural intervention category is comprised of interventions typically described as antecedent interventions and consequent interventions.

Two high quality studies suggest behavioural interventions can be effectively implemented in a variety of settings and by a range of implementers to reduce challenging behaviours and improve both communication and social skills. Furthermore, the evidence suggests that behavioural interventions can be effective for learners aged pre-school to secondary school.

- 5.31 Höher et al. (2016) reviewed nineteen studies on the effects of behaviourally based interventions for children with ASD in inclusive settings. Teachers, followed by researchers, were the most common implementers. Twelve studies also trained TD peers to respond to interaction initiations and social advances from participants with ASD. Höher et al. (2016) found behavioural based interventions effective in improving the social interaction skills of students with ASD. The analysis by Höher

²⁵ Note not all studies reported the length of sessions.

²⁶ Note the Carson et al. (2008) (cited in Finnegan and Mazin. 2016) study which explored a photo activity schedule book intervention was conducted in both a school and workplace setting.

et al. (2016) found no difference in the intervention effect according to age (pre-school versus primary school-aged) or intervention implementer (teacher versus researcher) but interventions using planned reinforcement demonstrated the greatest magnitude of change.

- 5.32 Seven studies on behavioural interventions to reduce challenging/interfering behaviours were reviewed by Bond et al. (2016). Most included 4-11 year-olds attending either specialist, mainstream or pre-school educational settings. Teachers or parents were successfully trained to deliver the interventions in most of the studies. The studies reviewed provided good evidence for behavioural interventions, particularly for increasing on-task behaviour, communication and task engagement. The range of studies indicated these interventions can be flexibly adapted to different settings and delivered easily and effectively by school staff and parents. The review also included two studies on behavioural interventions to improve communication. These studies included a small number of participants, aged 5-16 years, attending specialist educational provision. They provide evidence for the use of behavioural approaches to increase spontaneous communication and reduce stereotypical language; however additional evidence is required to reach robust conclusions.

Direct Instruction (DI)

Direct instruction is the use of straightforward, explicit teaching techniques, usually to teach a specific skill. It is a teacher-directed method, meaning the teacher stands in front of a classroom and presents the information.

There is a relatively small evidence base but the included studies suggest that direct instruction can be an effective intervention for improving both reading comprehension and employment skills, such as interacting with customers and completing clerical, retail and cleaning tasks.

- 5.33 Finnegan and Mazin (2016) found DI results in positive effects on improving the comprehension scores of students with ASD. Two studies, each including two

participants with autism, used direct instruction²⁷. Both studies used the curriculum *Corrective Reading Thinking Basics: Comprehension Level A*, which researchers taught in small groups and implemented instructional procedures as directed in the instructor's manual. Furthermore, both interventions cited in Finnegan and Mazin (2016) were very similar in length and intensity: Flores and Ganz (2007) included 40 sessions, each 20 minutes long, and Flores and Ganz (2009) included 35 sessions, also each 20 minutes long. In both studies, scores on all tasks improved. However, it is not possible to draw general conclusions from these two studies about the effectiveness of DI for improving the reading comprehension skills of an individual with ASD.

- 5.34 The Gilson et al. (2017) review includes eleven studies which used DI to improve employment skills. Instructors often used prompting cues or hierarchies sometimes within a package of instructional procedures (for example, modelling and praise). Interventions were mostly implemented by non-teachers in school settings (n=8) but also in the workplace (n=4).²⁸ Most DI interventions found positive effects (60%) and three found strong positive effects (30%).

Prompting (PP)

Verbal, gestural or physical assistance given to learners to assist them in acquiring or engaging in a targeted behaviour or skill. Prompts are generally given by an adult or peer before or as a learner attempts to use a skill.

There is a small quantity of evidence on the effectiveness of prompting but the included studies suggest that incorporating the use of prompting can help to enhance the effectiveness of an intervention.

- 5.35 All the studies included in the Höher et al. (2016) review on behaviourally based interventions consistently used prompts (and/or positive reinforcement). Across nineteen studies the interventions included social story, visual scripts and peer training. Analysis suggested that interventions using prompt and reinforcement

²⁷ Flores and Ganz (2007); and, Flores and Ganz (2009) (cited in Finnegan and Mazin (2016)).

²⁸ Note some studies were implemented in two settings.

without the use of modelling can be equally effective as interventions which also use modelling. This suggests that interventions using only prompt and reinforcement can be just as effective as interventions incorporating modelling as well. This is a promising finding because it may be more feasible for teachers to implement the use of prompt (and reinforcement) in inclusive settings, requiring less additional time than modelling. However, this finding should be considered with caution due to the small number of studies analysed.

- 5.36 The reading comprehension intervention used by Roux et al. (2015) did not explicitly mention prompting. However, it can be argued that certain aspects of the programme incorporated the use of prompting. For example, in the vocabulary and text reading sessions the assistant read a word then asked students to reread it. The assistant then gave a brief definition of the word and an example sentence including the word, following which a student repeated the definition and formulated a new sentence with the word (this routine was repeated for eight words). The study found the reading comprehension ability of students with high-functioning ASD can be improved through a reading comprehension programme.

Social Narratives (SN)

Also known as social stories. Narratives that describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responses. Social narratives are individualised according to learner needs and typically are quite short, perhaps including pictures or other visual aids.

The included studies provide moderate evidence for the effectiveness of social narrative interventions for reducing challenging behaviours and supporting social interactions.

- 5.37 Bond et al. (2016) identified narrative interventions as having moderate evidence. Narrative interventions to reduce challenging/interfering behaviour were adopted in five studies in the Bond et al. (2016) review. Children aged 7-13 years, attending a range of education provisions (including, mainstream general education classes, resourced provision and a special school), participated in these studies. All five studies had three or less participants. Important findings included that social stories

could be delivered effectively by school staff; and combining differential reinforcement of other behaviour with social stories further decreased challenging behaviour. Therefore, the evidence suggests social narrative interventions, and in particular social stories, are a flexible intervention, which can be delivered easily by school staff, adapted to different settings and delivered using various formats including alongside other interventions.

- 5.38 Ozuna et al. (2015) similarly found social stories to be a promising intervention. The review includes three studies, which used social stories, plus one study, which used social cue cards, and one intervention that used concept mastery routines. The social stories interventions were conducted in a range of settings (school cafeteria, participant's home and classroom), and included a maximum of two participants. The effectiveness of social stories was mixed: out of the three social stories interventions, two were considered fairly to highly effective (Litras et al. 2010; Reichow and Sabornie 2009 cited in Ozuna et al. 2015), while one was not effective (Hanley-Horchdorfer et al. 2010 cited in Ozuna et al. 2015). The study which used social cue cards (Caballero and Connell 2010 cited in Ozuna et al. 2015) was conducted in a school setting with three males diagnosed with ASD. This study had the highest effectiveness rating. Finally, the use of concept mastery routines (Laushey et al. 2009 cited in Ozuna et al. 2015) in school with four participants with autism was found to be fairly to highly effective²⁹.

Structured play groups (SPG)

Structured play groups are small group activities designed to help develop play and social engagement skills. They are characterised by their carefully defined activities, which encourage peer interaction and build social and communication skills; for example, skills such as sharing and taking turns. The groups normally include peers who can act as models and activities or themes selected to foster interactive play, supported with instructional techniques by teachers and other adults in the form of scaffolding learning.

²⁹ Although these studies contain a small number of participants, they are discussed in the systematic review by Ozuna et al. (2015), which is one of the 16 high or medium quality studies included in this REA.

The included studies provide moderate evidence 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.

- 5.39 Twelve studies measuring the effects of group activities on the social participation of children with SEN were reviewed by Garrote et al. (2017). Across the studies two intervention strategies were implemented: group activities in the academic context (peer tutoring and cooperative learning) and group activities in the social context (for example, support groups, interest clubs, group counselling, friendship activities, and structured play). In most studies, the group activities were moderated by teachers alone or in collaboration with the researchers. The participants were aged 3 to 13 years, and were mainly described as having behavioural difficulties (BD)³⁰. Five studies evaluated the effects of cooperative learning and peer tutoring involving pupils with SEN and their TD peers³¹. In addition, seven studies focused on group activities related to social topics³². The group interventions involved structured play, friendship activities, interest clubs, weekly therapeutic group counselling and 'Circle of Friends' support groups. Both cooperative learning and peer tutoring, and regularly implemented support group meetings (i.e., 'Circles of Friends') were found to be effective, but there is insufficient evidence to draw firm conclusions.
- 5.40 Bond et al. (2016) reviewed five studies on play-based interventions. Two Lego Therapy interventions included group sessions with children aged 7 to 11-years-old. One study was conducted in a mainstream primary school (Andras 2012 cited in Bond et al. 2016) and one in a clinic (Owens et al. 2008 cited in Bond et al. 2016). The intervention used a structured approach to constructing models to develop social skills. Both studies found positive outcomes for Lego Therapy. Three play-based interventions were conducted with children aged 4-8 years. These three researcher-delivered interventions typically consisted of short (5-6 minutes), 1:1

³⁰ The participants are described as having BD (n=138), LD (n= 34), ID (n=26), ASD (n=15) and DD (n=3).

³¹ Dugan et al. (1995); Fuchs et al. (2002); Jacques et al. (1998); Kamps et al. (1994); Sideridis et al. (1997) (cited in Garrote et al. 2017).

³² Frea et al. (1999); Koegel et al. (2012); Shechtman (1997); Frederickson and Turner (2003); Frederickson et al. (2005); Kalyva and Avramidis (2005); Hunt et al. (1997) (cited in Garrote et al. 2017).

delivered sessions and 15-30 minutes of group work daily. The interventions focussed on teaching key skills such as turn-taking and pretend play, with opportunities to generalise to group situations. Overall, these studies provide moderate evidence for play-based interventions with pre-school and early primary school children.

Support worker assisted

Like 'peer assist' interventions, but paraprofessionals or support staff are trained to deliver the intervention.

The included studies provide inconclusive evidence regarding the effectiveness of support worker assisted interventions.

- 5.41 Garrote et al. (2017) reviewed four studies that trained paraprofessionals. These included participants described as having ASD (n=31) or behavioural difficulties (BD) (n=3), aged 5-11 years. Paraprofessionals received a short training course to learn how to facilitate social interactions between pupils with SEN and their TD peers. The training involved techniques in modelling, triggering and positive reinforcement to stimulate the initiation and maintenance of social interactions. All three studies found training and coaching paraprofessionals had a positive effect on social interactions between pupils with ASD and their peers with medium to large effect sizes.
- 5.42 One study described as coaching naturalistic teaching strategies to support social skills (Meadan et al. 2012) was included in the review by Ozuna et al. (2015). This study (involving three males with autism in pre-school) was not effective in increasing social interaction in children with ASD.

Video modelling (VM)

A visual model of the targeted behaviour or skill (typically in the behaviour, communication, play, or social domains), provided via video recording and display equipment, to assist learning or engaging in a desired behaviour or skill.

The included studies found mixed evidence for VM interventions to support

communication and social interaction, particularly for learners aged 16 years and over.

- 5.43 Four communication interventions using VM were considered by Bond et al. (2016). Three studies focused on children aged 4-6 years and one study involved post 16 year-old young people. The interventions took place in either resourced mainstream³³ or special schools. The studies provide moderate evidence for video modelling to support communication for 4-6-year-old children. Mixed outcomes for the intervention with post 16-year-olds means there is insufficient evidence and further research is required.
- 5.44 Ozuna et al. (2015) identified two studies which tested the effects of video modelling in a school setting to support social interactions. One study was highly effective in supporting social interaction (Boudreau and Harvey 2013 cited in Ozuna et al. 2015) and the other, which compared video to in-vivo modelling, was not effective in increasing social interaction (Wilson 2012 cited in Ozuna et al. 2015).

Joint attention (JA)

Joint attention interventions aim to develop children and young people's joint attention and joint engagement, and usually involve 1:1 delivery of a play-based/turn-taking intervention by a teacher or parent (Bond et al. 2016).

Joint attention interventions delivered to pre-school learners were rated as one of the interventions with the most evidence of efficacy in the Bond et al. (2016) review for improving both joint attention and joint engagement.

- 5.45 Joint attention interventions were rated as one of two interventions with most evidence in the Bond et al. (2016) review. All four studies reviewed by Bond et al. (2016) included pre-school participants. In three studies, interventions were delivered 1:1, and across all studies a variety of education settings were used

³³ A resourced mainstream school is an additionally resourced school in which there is a special Learning Difficulties and Disabilities (LDD) provision. The LDD provision may be referred to as 'a unit' or 'specialist facility'. In such settings, pupils normally spend some of their time taught by specialist teachers and some of their time in mainstream classes with their typically developing peers.

(including a mainstream pre-school setting and an independent ASD special school). Interventions were often delivered by a teacher or parent for short daily sessions over 8–12 weeks with external supervision. The studies found the children in the intervention groups were more likely to demonstrate significant positive change in joint attention and joint engagement compared to control groups. Therefore, these studies provide evidence for JA interventions with pre-school children across a range of education settings.

Multi-sensory interventions

Intervention to develop academic skills for example, multi-sensory maths and reading comprehension programmes (Bond et al. 2016).

Multi-sensory interventions to develop academic skills were identified as having a small amount of evidence of efficacy in the Bond et al. (2016) review.

- 5.46 Two studies using multi-sensory interventions were undertaken with children aged 7–14 years with ASD (n=6) and intellectual disabilities (n=3) attending specialist provision for children with ASD. The intervention in each study was delivered 1:1 by a teacher. The studies provide evidence for the effectiveness of multi-sensory maths and reading comprehension programmes, however, further research is required due to the small quantity of evidence.

Picture Exchange Communication System (PECS)

Learners are initially taught to give a picture of a desired item to a communicative partner in exchange for the desired item. 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.

Bond et al. (2016) found PECS to be an effective intervention for improving communication skills.

- 5.47 Three studies included in the Bond et al. (2016) review evaluated the effectiveness of PECS for developing the communication skills of children attending special

education settings. These studies were undertaken with children aged 3–10 years and were predominantly implemented by teachers and researchers. Overall, all three studies provide evidence for the effectiveness of PECS to improve communication skills, thus PECS was identified as an intervention with a moderate level of evidence.

Pivotal response training (PRT)

Pivotal learning variables (that is motivation, responding to multiple cues, self-management, and self-initiation) guide intervention practices that are implemented in settings which build on learner interests and initiative.

Ozuna et al. (2015) found PRT to be an effective intervention to support social interaction and suggest this may be attributable to the highly motivating way in which PRT is implemented.

- 5.48 A literature synthesis by Ozuna et al. (2015) suggests PRT is an effective evidence-based intervention to support social interaction in children with ASD. The review includes four studies using PRT that were mainly conducted in participants' homes or school settings. Interventions varied in design, including PRT with embedded social condition/interaction, facilitated social play with initiation training and high interest activities and clubs. PRT was highly effective in supporting joint attention but displayed mixed results in terms of supporting eye contact, with one study proving it to be highly effective (Vernon 2012 cited in Ozuna et al. 2015) and another showing it to be not effective (Koegel et al. 2009 cited in Ozuna et al. 2015). However, PRT interventions were found to be highly effective for supporting initiating interactions.

Reinforcement

An event, activity or other circumstance occurring after a learner engages in a desired behaviour, which leads to the increased occurrence of the behaviour in the future.

There is a small quantity of evidence on the effectiveness of reinforcement, but the

included studies suggest reinforcement can effectively be used alongside other interventions.

- 5.49 Thirteen of the nineteen studies reviewed by Höher et al. (2016) used reinforcement as the behavioural component. Interventions included reinforcement using visual scripts, peer imitation and buddy skills. Comparison of interventions including the use of planned reinforcement, were compared to those that did not use planned reinforcement³⁴. Interventions including planned reinforcement had a large overall effect size and a narrow confidence interval was obtained. In comparison, interventions that did not use planned reinforcement were associated with smaller effects and wider confidence intervals. This means interventions using planned reinforcement demonstrated the greatest magnitude of change. This, therefore, suggests interventions in inclusive settings may need to incorporate planned reinforcement until students acquire the required skills for natural reinforcement³⁵.
- 5.50 Analysis also suggests interventions incorporating reinforcement (and prompt) can be just as effective as interventions which also incorporate modelling.

Milieu teaching

A procedure where adults embed opportunities to communicate during typical activities, based on the child's needs (Lane et al. 2016, p54).

The evidence base provided by the included studies is insufficient to draw any general conclusions.

- 5.51 Ozuna et al. (2015) found pre-linguistic milieu teaching (Franco et al. 2013 cited in Ozuna et al. 2015) to be fairly effective but acknowledged further research is required. The study included six participants with moderate to severe autism and was delivered in participants' homes.

Cognitive Behavioural Intervention (CBI)

³⁴ Planned reinforcement refers to reinforcement that was part of the intervention protocol.

³⁵ A type of reinforcement that occurs naturally from adopting appropriate behaviour, for example you may need to give some rewards initially to teach a child to use the toilet but the natural reinforcement is hygiene and consistent success.

Instruction on management or control of cognitive processes that leads to changes in overt behaviour.

Evidence of the effectiveness of CBI is limited, with only one high-quality study evaluating CBI.

- 5.52 Luxford et al. (2016) evaluated the effectiveness of a school-based Cognitive Behavioural Therapy (CBT) programme on symptoms of anxiety, social worry and social responsiveness. The study included thirty-five pupils with ASD from four mainstream secondary schools. Eighteen pupils received six, 90-minute CBT sessions led by the same researcher in all four schools. Teaching assistants (TAs) supported the delivery of the intervention, allowing strategies learnt within CBT sessions to be reinforced across the school day, and to remind and encourage the pupils to use learned strategies when required. Thus, this model actively targeted the generalisation of skills outside of the CBT session, in a naturalistic environment. Following CBT intervention, adolescents with ASD (versus a waiting-list comparator group) showed greater reductions in anxiety symptoms, school anxiety and social worry as reported by teachers, parents and participants themselves, and these results were maintained after six weeks.

Exercise

Increased physical exertion as a means of reducing problem behaviours or increasing appropriate behaviours.

The high-quality studies provide a small evidence base suggesting that exercise is an effective intervention but the quantity of evidence is too small to draw any general conclusions.

- 5.53 Two studies reviewed by Bond et al. (2016) used exercise interventions. One study used an aquatic intervention to develop motor skills. The study included sixteen participants, aged 6-8 years, with a prior diagnosis of high functioning autism (HFA) or ASD. A swimming programme was delivered by the researcher, for a total of twenty sessions (two sessions per week, 90 minutes per session). Pre-post measures showed significant improvement in Aquatic Readiness scores and

significant improvement in academic behaviour and antisocial behaviour. The other study examined the Get Ready to Learn (GRTL) classroom yoga programme in reducing challenging behaviour among children with ASD. The study included twenty-four primary aged special school children diagnosed with ASD. The intervention group participated in the GRTL programme every day for 16 weeks (15-10 minutes). Following the intervention, teacher ratings of maladaptive behaviour for the programme students decreased significantly, compared with the control participants.

6. Key findings

- 6.1 It is important to reiterate the work undertaken is an REA and not a systematic review, with the aim of identifying the most relevant literature in order to meet the overall project aim and objectives, and extracting the key messages from these documents. The key findings emerging from this process are outlined below.

Intervention implementation and methodologies

Implementers

- 6.2 Across the included studies, the predominant **implementers of the interventions were teachers**. This is likely because most interventions were carried out in a school setting but also because teachers can effectively implement many of the strategies with fidelity.³⁶ Additional implementers of interventions were typically peers, teaching assistants or other paraprofessionals, and the children and adolescents with ASD themselves.

Teachers

- 6.3 A variety of teacher-led interventions were implemented across the studies, many of which have shown a significant difference between the outcomes of the intervention group and control group. In Roux et al. (2015) study, higher attainment scores were achieved by the intervention group when **reading comprehension instruction** was implemented. Additionally, Garrote et al. (2017) highlight **teaching interaction strategies such as stay, play, talk and keys to play** as effective. Sainato et al. (2015) **comprehensive treatment model** was also effective, with significant differences between the intervention and comparison groups. Students in the intervention groups made **improvements in non-verbal IQ, academic achievement, oral expression and oral listening comprehension**. On the other hand, the comparison group made no significant improvements in these areas.
- 6.4 However, it is important to note there are also studies where teacher led interventions were not as effective compared to the control group. Khemka et al. (2016) taught curriculum, PEER-DM (Peers Engaged in Effective Relationships-

³⁶ Asaro-Sadler (2014)

Decision Making) used modelling, guided practice, interactive activities and visuals to introduce concepts of peer pressure to students with ASD. These students were more effective at decision making in the post-test than the control group, however when considering risk perception, there was no significant difference in results between intervention and control group. Similarly, Boyd et al. (2014) introduced TEACCH and LEAP programmes to two intervention groups and compared to a control group who were taught non-model specific practices. Even though TEACCH and LEAP were effective programmes, demonstrating significant change over time in the areas of communication, academic achievement and fine motor skills, the control group also made progress in these areas.

Peers

- 6.5 Peers are identified by a number of studies as effective intervention implementers, albeit with caveats and limitations regarding many of the findings. Finnegan and Mazin (2016) asserted that **peer tutoring** (cooperative learning between students with ASD and typically developing students) was a highly effective tool to improve reading comprehension in a school setting. Furthermore, both Gilson et al. (2017) and Carr et al. (2014) quantified the effectiveness of peer-delivered interventions through calculating effect sizes. Carr et al. (2014) calculated a PND³⁷ of 82.8% and Gilson et al. (2017) stated a 100% positive or strong positive effect. However, it is important to note that Gilson et al.'s (2017) quantification was limited to two studies, due to the lack of research in this area.
- 6.6 This is echoed by other studies, including Chang and Locke (2016), who write that **peer mediated interventions** are effective in improving social skills but the available literature leaves gaps, which could affect the reliability of the intervention. Höher et al. (2016), on the other hand, suggest that peer interventions do not make a difference if reinforcements are provided to ASD students by other implementers.

³⁷ Percentage of Non-Overlapping Data. A way of calculating effect sizes from synthesising single-subject research.

Self-Implementation

- 6.7 Self-implementation evidence emerged from several of the studies, although the reported effectiveness is mixed. One effective academic self-management intervention is a **graphic organiser**³⁸, which allows pupils to apply comprehension skills to text they have not seen before. However, this did require some teacher support, and overall, independent interventions were less effective in this study than those supported by teachers.
- 6.8 Carr et al. (2014) aimed to quantify the effectiveness of self-management through the use of PND calculations. When self-management interventions such as **self-reinforcements** (for example, gold stars, edibles, toys, etc.) were used as an intervention strategy, there was a strong positive effect of 83.2%. Contrastingly, Carr et al. (2014) then state that the PND was 99.7% when none of these reinforcements were used. As De Bruin et al. (2013) asserts **there is not sufficient evidence to consider self-management based interventions effective.**

Other Implementers

- 6.9 Researchers and parents as implementers are less common in the literature, but there are some studies that support their effectiveness. For example, Bond et al. (2016) champions **play-based or turn-taking interventions implemented by parents** and Luxford et al. (2016) advocates the researcher-led **Exploring Feelings CBT intervention**. Even though there is evidence to suggest both can be effective, there is not enough to argue that these interventions wouldn't be just as effective if implemented by a teacher or peer in certain circumstances.

Training requirements of implementers

- 6.10 Some studies discuss the training needed by implementers. In Boyd et al. (2014) extra training for teachers was needed due to the structured nature of the intervention for example, LEAP and TEACCH. Luxford et al. (2016) state that **additional training for staff and parents is always needed** to allow for the effective generalisation of skill. Chang and Locke (2016) suggest that implementers may need more structured training to promote social interactions amongst children

³⁸ Finnagan and Mazin (2016)

and adolescents with ASD, as in one study, the effectiveness was found to be diminished due to lack of sufficient training for peers.

Intervention length

- 6.11 There was a range of intervention duration and the studies suggest that **duration does not impact on effectiveness**. This is a common theme across the evidence, for example, Boyd et al. (2014) TEACCH and LEAP programmes ran for two to three years (teachers could only participate for one year), whereas Luxford et al. (2016) intervention, concerning anxiety, lasted only six weeks. The shorter time period was not detrimental to Luxford et al.'s (2016) study, as participants were reported as having decreased anxiety levels which were maintained to the six week follow up. The longer time period did not impact on the effectiveness of Boyd et al.'s (2014) study either, with participants showing a clear reduction in autism characteristics.

Intervention setting

- 6.12 There are gaps in the literature when it comes to the impact of the setting. Most of the studies took place in a school setting. Other settings include a residential camp, the local community and the home. Even though many of the studies in a school were considered effective, there is not enough evidence to provide a view on the effect of other settings. Although, in Ganz et al. (2014) meta-analysis, **when augmentative and alternative communication support (AAC) was implemented in a general education setting, it was significantly more effective than when it was implemented in other settings** (such as the home or a therapy room)³⁹.
- 6.13 Some of the evidence emphasises the need for continuity between the school setting and the home. In Luxford et al. (2016) Exploring Feelings programme, teachers implement the intervention but homework tasks are provided to be done with parents in the home setting, to enhance the effectiveness of generalisation. Bond et al. (2016) and Young et al. (2016) also assert collaboration between agencies is important in supporting children with ASD.

³⁹ AAC refers to a continuum of communication supports for individuals who lack functional speech. It is important to note that Ganz's study was considered low quality for the purposes of this review.

Methodologies

Delivery

- 6.14 There are some studies, which advocate 1:1 delivery of interventions as effective. Bond et al. (2016) highlight numerous 1:1 interventions as effective, for example, the 1:1 delivery of behavioural interventions, which encouraged a decrease in challenging behaviour following the intervention. Other effective 1:1 interventions included play based methods and discrete skills. Although, it is important to note that alternative studies of discrete trial teaching⁴⁰ report mixed effects. A Maths Recovery intervention was taught 1:1, resulting in significant gains on the TEMA-3 (The Test of Early Mathematics Ability 3rd edition) compared to a control group, but failed to show statistically significant differences in oral counting and number identification. Vivant et al. (2014), on the other hand, promoted a 1:3 group ratio in their study, which allowed for significantly more gains in receptive language and developmental rate compared to the control group.
- 6.15 Therefore, it is not possible to conclude that 1:1 interventions are more effective than group methods.

Technology

- 6.16 The use of technology is common across the studies, including the use of video prompts and modelling. In one literature review⁴¹, it is asserted that **video prompts** were more effective than verbal prompts across the studies (with PND scores of 96.9% and 80.2% respectively) however video prompts were used less frequently than verbal prompts. It is suggested this could be due to the novelty of using technology in a classroom setting for children. Bond et al. (2016) enhances this idea, citing two studies which use technology. The first used **video modelling** to successfully develop communication skills and the second used **computer-assistant emotion recognition** as a monitoring device to aid staff in identifying emotions of ASD pupils.

⁴⁰ Tzanakaki et al. (2014)

⁴¹ Carr et al. (2014)

6.17 There are some studies, however, which provide an alternative view on the effectiveness of technology. In Finnegan and Mazin's (2016) literature review, supported electronic texts were found to be ineffective for students with ASD. Additionally, Ozuna et al. (2015) found that video modelling was not effective in improving joint attention for ASD pupils in their review of SEN pupils' social interactions.

6.18 The evidence appears contradictory and inconclusive regarding the efficacy of technology in assisting learning by children and young people with ASD.

Non-technological methodologies

6.19 In contrast, non-technological strategies, such as live prompts and modelling, tactile/picture interventions and positive reinforcements were used frequently and effectively in an educational setting with young ASD pupils:

- Pivotal response treatment (PRT) proved highly effective in both high quality and low quality evidence⁴²
- In Bond et al. (2016) review, picture exchange and Lego therapy were both effective, non-technological interventions
- Gilson et al. (2017) cited picture and tactile interventions as having a 100% strong positive effect, whereas video interventions had a more mixed effect.

6.20 However, Höher et al. (2016) asserted that combining an array of interventions was the most effective method, particularly when positive reinforcement (for example, praise, edibles, etc.) was used alongside other interventions. They also noted in their review of the literature, video modelling was more effective than live modelling. It is therefore difficult to distinguish if the use of technology is more or less effective than live methods, as it could depend on a range of factors, such as the proposed outcome of the intervention, how it is implemented, the severity of ASD or the individual.

⁴² High quality evidence: Ozuna et al. (2015). Low quality evidence: Lane et al. (2016)

Outcomes

6.21 The most commonly reported outcomes were **improvements in academic performance and social communication for individuals**. The outcomes are presented in table 6-1 below, and explored in more detail over subsequent paragraphs.

Table 6-1: Outcomes reported in the evidence

	Count
Pre-academic/academic	15
Social	15
Reduction in challenging/interfering behaviours	6
Communication	6
Self-regulation domain	5
Joint attention – shared attention in an activity by two individuals (positively)	4
School readiness skills	4
Vocational	4
Adaptive/self-help	2
Mental health	2
Play	2

Source: SCIE and SQW

Please note that this table has been compiled based on outcomes identified and categorised in the studies, using our own coding of the outcomes emerging.

Improvements in academic performance/attainment

6.22 Various forms of intervention effected the attainment of people with ASD. Two studies explored the effects of reading comprehension interventions:

- Finnegan and Mazin (2016) reviewed four studies on this subject, and graphic organisers appeared to be the most effective intervention to support reading comprehension in students with ASD; in all four studies, the intervention was effective in improving scores on participants' responses to comprehension questions. Furthermore, students could maintain and generalise the skills they had been taught by applying the intervention to new chapters or stories.

- Similarly, Roux et al. (2015) found the reading comprehension of students with high-functioning ASD can be improved through reading comprehension instruction. Compared to those in the control condition, students in the intervention group were better able to identify anaphoric relations and main ideas with greater accuracy, and had higher scores than their peers in the control group for the retell of the text without instructed vocabulary. The study also reported maintenance effects as the intervention group continued to score higher than the control group on knowledge of definition and identification of main ideas.

- 6.23 Numeracy intervention, specifically the Maths Recovery Programme, resulted in post-intervention gains on a test of early mathematics ability (TEMA-3⁴³) compared to the control group. The intervention group also made better progress than the control group on the EN-CBM test (early numeracy curriculum based measurement). However, the differences were not statistically significant. The Maths Recovery intervention group had an additional follow-up test on mathematical ability (TEMA-3) approximately seven months after the end of the intervention. The scores suggested maintenance of the intervention gains over time⁴⁴.
- 6.24 A comprehensive intervention programme for children with ASD resulted in post-intervention higher mean standard scores across all skill domains (cognition, academic achievement, communication, and adaptive behaviour) compared to the control group. The children participating in the intervention programme made statistically significant gains in nonverbal intelligence, academic achievement, and language scores over children's scores in the comparison classrooms. Children in the comparison classrooms made either no improvement or decreased in their standardised test scores (comprehensive achievement composite and oral language composite mean scores decreased in the control group between pre-and post-intervention)⁴⁵.

⁴³ TEMA-3 is a comprehensive measure that covers a wide range of numeracy skills, including verbal counting, counting items, reading and writing numbers, saying the number that comes after a given number, and story problems involving additions/subtractions.

⁴⁴ Tzanakaki et al. (2014)

⁴⁵ Sainato et al. (2015)

6.25 Eight intervention approaches to teach employment skills to secondary students with intellectual and developmental disabilities (IDD) emerged in the Gilson et al. (2017) review. Each intervention approach found positive effects on the employment skills of secondary school students across at least 75% of studies⁴⁶. However, only around 20% of participants across the studies were diagnosed with autism⁴⁷. The most effective interventions were picture and tactile intervention (100% strong positive effect) and peer-delivered interventions (100% positive/strong positive effect) but firm conclusions cannot be made due to the lack of comparative studies.

Social skills

6.26 All the studies included in the Chang and Locke (2016) review reported that PMI improved participants' social skills (for example, social initiations, social responses, social communication) post-intervention. Garrote et al. (2017) compiled a review of 35 studies to investigate facilitating the social participation of pupils with SEN in mainstream schools. It was concluded that whilst the majority of studies report a positive impact of interventions, not all intervention types could be regarded as evidence-based due to insufficient research. Teaching social interaction skills to typically developing (TD) pupils in pre-school and primary school classrooms is the only intervention that can be considered evidence-based to improve social interactions⁴⁸ among pupils with ASD (and other disabilities). Evidence⁴⁹ also suggests that behaviourally based interventions can be highly effective for improving social interaction skills of young children with ASD included in general education.

6.27 Ozuna et al. (2015) reviewed a range of intervention studies to improve social interactions in children with ASD. Most studies addressed more than one dependent measure including: joint attention (for example, sharing, engagement, maintaining interaction and two-way play), initiating interaction (for example, verbal greetings,

⁴⁶ Dependent measures included task analysis, rate of target behaviour and social components

⁴⁷ This is a systematic review and the discussion on effectiveness covers all studies. It is not possible to separate out those participants which do and do not have ASD.

⁴⁸ i.e. frequency, duration, and/or quality of the social interactions

⁴⁹ Höher et al. (2016)

inviting to play, and requesting an activity), responding and eye contact. Overall, pivotal response treatment (PRT), Social Stories™, peer-mediated strategies, and video modelling are promising interventions to support social interaction. However, several interventions were not effective in supporting social interaction including the comparison of video to in-vivo modelling⁵⁰ and coaching teachers in naturalistic teaching strategies⁵¹. Twelve of the sixteen studies in this review reported follow-up results which were similar to the intervention results in all twelve studies.

- 6.28 A range of social interventions for ASD are covered in the Bond et al. (2016) review. Social initiation training interventions (including PRT and the use of social scripts and prompts to teach social initiation) reported positive outcomes including increased social initiation and engagement, but progress was not maintained for some children post-intervention. Computer assisted emotion recognition interventions resulted in improvements in the ability of participants to identify emotions and the programmes were rated positively by school staff. Outcomes for children receiving peer-mediated interventions included: increased peer interaction, improvements in social skills, and the potential for increased social inclusion. Two studies using Lego therapy also reported improvements in social interaction post-intervention.
- 6.29 In a study by Young et al. (2016) outcomes for students receiving a Comprehensive Autism Programme (CAP) were compared to a business as usual group. Both groups made improvements in most outcome areas including adaptive behaviours (daily living skills), cognitive ability (including perceptions, attention, memory and reasoning), expressive language (spontaneous speech and communication expressed by vocalisations accompanied by gestures or other means) and social skills. However, hierarchical linear modelling analysis revealed that CAP did have a small positive impact on students' outcomes for social skills and receptive language at school compared to students' outcomes in the business as usual schools.
- 6.30 A comparison of outcomes between children using LEAP (Learning Experiences and Alternative Programs), TEACCH and a non-model specific (NMS) special

⁵⁰ Wilson (2012)

⁵¹ Meadan et al. (2012)

education programme produced statistically significant changes in children's outcomes across the school year for all three interventions. Outcome measures covered cognitive, behavioural, psychological and social variables. Children in the TEACCH group made significant changes over time across a range of measures including social interaction (rated by teachers and parents). For students in the LEAP programme there was significant change across time for teacher rated social interaction but this was not found for parent reported social interaction. This is surprising given that the primary method of instruction is peer-mediated instructional strategies but it may reflect parent expectations⁵².

Psychological wellbeing

- 6.31 Two studies focused on interventions to improve psychological wellbeing. The effectiveness of cognitive behavioural therapy (CBT) for anxiety in adolescents diagnosed with ASD was explored by Luxford et al. (2016). Adolescents receiving CBT showed greater reductions in anxiety symptoms, school anxiety and social worry as reported by teachers, parents and participants themselves, compared to control participants. Reduction in anxiety can increase the wellbeing of a pupil, reduce distractibility and consequently contribute to academic improvement.
- 6.32 Evidence from a study by Bradley (2016) (note this was not one of the 16 high or medium quality studies) suggested that peer mentoring for students with ASD increased levels of self-esteem, increased social satisfaction and decreased levels of bullying experienced by students.
- 6.33 Research found the ability of adolescents with disabilities to resist negative peer pressure can be improved through a decision-making curriculum (PEER-DM)⁵³. Students with ASD in the intervention group had significantly greater effective decision-making action responses involving negative peer pressure at post-test than the control group. However, there was no significant difference between the intervention and control group when considering risk perception of knowledge of peer relationship concepts.

⁵² Boyd et al. (2014)

⁵³ Khemka et al. (2016)

Behaviour

- 6.34 A meta-analysis by Carr et al. (2014) on the effectiveness of self-management interventions (measured using a wide-range of dependent variables including social skills, academic behaviour, living skills and problem behaviours) suggests self-management is highly effective for improving academic behaviours and reducing problem behaviours.
- 6.35 Challenging/interfering behaviour interventions are classified as one of the intervention categories with 'most evidence' by Bond et al. (2016). The studies demonstrate decreases in challenging behaviour following intervention, and social validity measures indicate that behavioural interventions can be adapted across a range of education settings and effectively delivered by school staff.

Effectiveness

Severity of ASD and effectiveness

- 6.36 Most studies fail to address whether the effectiveness of an intervention depends on severity of ASD. Boyd et al. (2014) found children and young people with ASD in the LEAP, TEACCH or NMS intervention group experienced reductions in autism characteristics across time regardless of the method. However, findings suggest children in the TEACCH intervention group with lower (versus higher) cognitive ability 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 autism, and thus greater scope for improvement; or it may suggest that they benefitted more from some of the environmental and behavioural supports used in TEACCH⁵⁴. Furthermore, treatment effects for CAP were moderated by severity of ASD; the strongest positive impact on receptive language was for students with mild to moderate ASD⁵⁵.
- 6.37 Several of the studies acknowledge the need for future research to explore how severity of ASD affects intervention effectiveness (for example; Höher et al. 2016 and Chang and Locke 2016).

⁵⁴ Boyd et al. (2014).

⁵⁵ Young et al. (2016).

Age and effectiveness

- 6.38 Only five of the studies reviewed focus on participants aged 14 and over⁵⁶. Carr et al. (2014) reviewed self-management interventions aimed at skill acquisition and/or improving behaviour of ASD students, and concluded there is substantial evidence to support self-management intervention across a range of age groups (5 to 25 years old). In the meta-analysis by Höher et al. (2016), age was not included in the selection criteria; despite this they only identified two studies which included children over 13 years old. This resulted in a lack of conclusions regarding effective practice in supporting older learners.
- 6.39 Across the 85 studies in the Bond et al. (2016) review, only 2% of participants across the studies were young people aged 16 to 18 years.
- 6.40 The studies demonstrate a clear gap in the evidence base regarding the effectiveness of interventions targeted at older young people diagnosed with ASD, and whether the effectiveness of interventions differs with age.

⁵⁶ Gilson et al. (2017); Carr et al. (2014); Luxford et al. (2016); Finnegan and Mazin (2016); Khemka et al. (2016).

7. Conclusions and implications

- 7.1 The findings from the REA highlight a number of key learning points and commonalities around interventions for improving outcomes for children and young learners with ASD. The findings suggest, by and large, 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 evidence also suggests the provision of training to implementers is important in increasing the effectiveness of the intervention.**
- 7.2 Whilst most of the interventions took place in a school setting, many studies discuss the importance of continuity between the formal learning setting and the home. This suggests that the role of parents as implementers of an intervention can potentially be as important as the teachers' role, particularly in reinforcing and replicating the strategies implemented in the classroom. This indicates that **including parents in the training regarding the intervention or approach may in some cases be beneficial, to allow them to better support the implementation of the intervention at home.** For example, Luxford et al. (2016) engaged parents in the intervention through the inclusion of homework tasks, and concluded that the involvement of parents was reflected in the positive outcomes on symptoms of anxiety and social worry in adolescents with ASD.
- 7.3 The evidence suggests that generally, the length of time the intervention runs for does not affect the level of effectiveness. This is perhaps to be expected, given the variation of approaches and techniques explored in the evidence base, some of which lend themselves to shorter implementation timescales than others. **The evidence suggests however that the more comprehensive the intervention is, the longer it can run continuously without losing effectiveness.** Even more encouragingly, many studies included a longitudinal element to measure the sustainability of the outcomes for young people. These showed that for many of the interventions, **positive outcomes were sustained over time.** For example, Luxford et al. (2016) reported that at a six week follow up adolescents had maintained reductions in anxiety symptoms. In addition, Tzanakaki (2014) reported

maintenance of improvements to mathematic ability seven months post-intervention.

- 7.4 The studies reviewed in the REA include a variety of intervention approaches, some of which are based on technology. While technology does seem to promote the effectiveness of some of the interventions, the outcomes were variable on the whole. 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. For example, Finnegan and Mazin (2016) found that electronic supported text had little or no effect on the reading comprehension ability of students with ASD. Similarly, Ozuna et al. (2015) concluded that video modelling was not an effective intervention to support social interactions in children with ASD. By and large it appears that non-technological approaches tend to be more effective with young people with ASD than those based on technology. That said, the evidence suggests **the use of multiple approaches (technological and non-technological) is preferable, as specific approaches have different levels of effectiveness, depending on the young person's characteristics.**
- 7.5 The studies reviewed in the REA provide a list of specific interventions found to be effective in achieving positive outcomes for young people with ASD in a number of areas, including literacy, mathematics, social skills and tackling challenging behaviour. It would be beneficial to create a **library of resources** based on this list of interventions, to allow practitioners in different settings to get familiar with the interventions and consider which might be most appropriate for their setting and young learners. The evidence review for practitioners and parents which will follow this REA will help to bridge this current gap in resources.
- 7.6 The review also highlighted a number of gaps in the research and evidence base. For example, there is little evidence in relation to the effectiveness of parents as implementers of interventions; little research done in settings other than the school; and the evidence is inconclusive in relation to the effectiveness of different modes of delivery (i.e. 1:1 or in groups).

7.7 Moreover, there are gaps in the existing evidence base regarding the influence of the severity of the ASD or the age of the child or young person on the effectiveness of the intervention.

8. Bibliography of evidence

Asaro-Saddler, K. 2014, *Self-Regulated strategy development: Effects on writers with Autism Spectrum Disorders*. Education and Training in Autism and Developmental Disabilities 49 (1): 78-91.

Bennett, K D., and Dukes, C. 2013, *Employment instruction for secondary students with autism spectrum disorder: A systematic review of the literature*. Education and Training in Autism and Developmental Disabilities 48 (1):67-75. ^{*57}

Bond, C., Symes, W., Hebron, J., Humphrey, N., and Morewood, G. 2016, *Educating persons with Autistic Spectrum Disorder – A systematic literature review*, Ireland: NCSE Research Reports NO: 20.

Boudreau, A M., Corkum, P., Meko, K., and Smith, I M. 2015, *Peer-mediated pivotal response treatment for young children with autism spectrum disorders: A systematic review*. Canadian Journal of School Psychology 30 (3):218-235. *

Boyd, B A., Hume, K., McBee, M T., Alessandri, M., Gutierrez, A., Johnson, L., Sperry, L., and Odom, S L. 2014, *Comparative efficacy of LEAP, TEACCH and non-model-specific special education programs for pre-schoolers with Autism Spectrum Disorders*, Journal of Autism and Developmental Disorders 44 (366):366-380.

Bradley, R. 2016, *'Why single me out?' Peer mentoring, autism and inclusion in mainstream secondary schools*. British Journal of Special Education 43 (3):272-288.

Carr, M E., Moore, D W., and Anderson, A. 2014, *Self-Management Interventions on Students with Autism: A Meta-Analysis of Single-Subject Research*, Exceptional Children 81 (1):28-44.

Chang, Y-C., and Locke, J. 2016, *A systematic review of peer-mediated interventions for children with autism spectrum disorder*, Research in Autism Spectrum Disorders 27:1-10.

Christensen-Sandfort, R J., and Whinner, S B. 2013, *Impact of milieu teaching on communication skills of young children with autism spectrum disorder*. Topics in Early Childhood Special Education 32 (4):211-222. *

⁵⁷ Items in the bibliography list marked with an Asterisk were included in the 35 documents reviewed in the REA but are not discussed in this report due to low scores in the quality of evidence assessment.

- De Bruin, C L., Deppeler, J M., Moore, D W., and Diamond, N T. 2013, *Public school–based interventions for adolescents and young adults with an autism spectrum disorder: A meta-analysis*. Review of Educational Research 83 (4):521-550.
- Finnegan, E., and Mazin, A L. 2016, *Strategies for increasing reading comprehension skills in students with Autism Spectrum Disorder: A review of the literature*, Education & Treatment of Children 39 (2):187-220.
- Ganz, J B., Rispoli, M J., Mason, R A., and Hong, E R. 2014, *Moderation of effects of AAC based on setting and types of aided AAC on outcome variables: An aggregate study of single-case research with individuals with ASD*. Developmental Neurorehabilitation 17 (3):184-192.
- Garrote, A., Dessemontet, R S., and Opitz, E M. 2017, *Facilitating the social participation of pupils with special educational needs in mainstream schools: A review of school-based interventions*, Educational Research Review 20:12–23.
- Gilson, C B., Carter, E W., and Biggs E E. 2017, *Systematic review of instructional methods to teach employment skills to secondary students with Intellectual and Developmental Disabilities*, Research and Practice for Persons with Severe Disabilities 42 (2):89 - 107.
- Gunn, K C M., and Delafield-Butt, J T. 2016, *Teaching children with autism spectrum disorder with restricted interests: A review of evidence for best practice*. Review of Educational Research 86 (2):408-430. *
- Höher, Camargo, S P., Rispoli, M., Ganz, J., Hone, E R., Davis, H., and Mason, R., 2016, *Behaviorally based interventions for teaching social interaction skills to children with ASD in inclusive settings: A meta-analysis*, Journal of Behavioral Education 25:223-248.
- Khemka, I., Hickson, L., and Mallory, S B. 2016, *Evaluation of a decision-making curriculum for teaching adolescents with disabilities to resist negative peer pressure*, Journal of Autism and Developmental Disorders 46:2372-2384.
- Knight, V F., Mckissick, B R., and Saunders, A F. 2013, *A Review of Technology-Based Interventions to Teach Academic Skills to Students with Autism Spectrum Disorder*, Journal of Autism and Developmental Disorders 43 (11):2628–2648. *

- Koegel, R., Kim, S., and Koegel, L. 2013, *Improving Socialization for High School Students with ASD by Using Their Preferred Interests*. Journal of Autism and Developmental Disorders 43(9):2121–2134. *
- Kossyvasi, L., and Papoudi, D. 2016, *A review of play interventions for children with autism at school*, Journal of Disability, Development and Education 63 (1): 45-63. *
- Lane, J D., Lieberman-Betz, R., and Gast, D L. 2016, *An analysis of naturalistic interventions for increasing spontaneous expressive language in children with autism spectrum disorder*, The Journal of Special Education 50 (1):49-61.
- Lequia, J., Wilkerson, K L., Kim, S., and Lyons, G L. 2015, *Improving Transition Behaviors in Students With Autism Spectrum Disorders - A Comprehensive Evaluation of Interventions in Educational Settings*. Journal of positive behaviour interventions 17(3):146 - 158.
- Luxford, S., Hadwin, J A., and Kovshoff, H. 2016, *Evaluating the effectiveness of a school-based cognitive behavioural therapy intervention for anxiety in adolescents diagnosed with Autism Spectrum Disorder*, Journal of Autism and Developmental Disorders: 1-13.
- Mackey, M., and Nelson, G. 2015, *Twins with autism: utilising video feedback to improve job-related behaviours*, British Journal of Special Education 42:390-410. *
- O'Malley, P., Lewis E M B., Donehower, C., and Stone, D. 2014, *Effectiveness of using iPads to increase academic task completion by students with Autism*, Universal Journal of Educational Research 2 (1):90-97. *
- Ozuna, J., Mavridis, A., and Hott, B L. 2015, *Interventions to Support Social Interaction in Children with Autism Spectrum Disorders: A Systematic Review of Single Case Studies*, Exceptionality Education International 25 (2):107-125.
- Reutebuch, C K., El Zein, F., and Roberts, G J. 2015, *A systematic review of the effects of choice on academic outcomes for students with autism spectrum disorder*, Research in Autism Spectrum Disorders 20:1-16. *
- Root, J R., Stevenson B S., Davis, L L., Geddes-hall, J., and Test, D W. 2017, *Establishing computer-assisted instruction to teach academics to students with Autism as an Evidence-Based Practice*, Journal of Autism and Developmental Disorders 47:275-284. *

Roux, C., Dion, E., Barrette, A., Dupéré, V., and Fuchs, D. 2015, *Efficacy of an intervention to enhance reading comprehension of students with high-functioning autism spectrum disorder*, Remedial and Special Education 36 (3):131-142.

Sainato, D M., Morrison, R S., Jung, S., Axe, J., and Nixon, P A. 2015, *A Comprehensive Inclusion Program for Kindergarten Children with Autism Spectrum Disorder*, Journal of Early Intervention 37 (3):208 - 225.

Strasberger, S K., and Ferreri, S J. 2014, *The effects of peer assisted communication application training on the communicative and social behaviours of children with autism*. Journal of Developmental and Physical Disabilities 26:513-526. *

Tzanakaki, P., Hastings, R P., Grindle, C F., Hughes J C., and Hoare, Z. 2014, *An individualized numeracy curriculum for children with intellectual disabilities: A single blind pilot randomized controlled trial*, Journal of Developmental and Physical Disabilities 26:615-632.

Vivant, G., Paynter, J., Duncan, E., Fothergill, H., Dissanayake, C., Rogers, S J., and the Victorian ASELCC Team, 2014, *Effectiveness and feasibility of the Early Start Denver Model implemented in a group-based community childcare setting". Journal of Autism and Developmental Disorders 44 (12):3140-3153.*

Wright, B., Marshall, D., Adamson, J., Ainsworth H., Ali, S., Allgar, V., Moore, D C., Cook, E., Dempster, P., Hackney, L., McMillan, D., Trepel, D., and Williams, C. 2016, *Social Stories™ to alleviate challenging behaviour and social difficulties exhibited by children with autism spectrum disorder in mainstream schools: design of a manualised training toolkit and feasibility study for a cluster randomised controlled trial with nested qualitative and cost-effectiveness components*. Health Technology Assessment 20 (6):1-258. *

Young, H E., Falco, R A., and Hanita M. 2016, *Randomized, Controlled Trial of a Comprehensive Program for Young Students with Autism Spectrum Disorder*, Journal of Autism and Developmental Disorders 46 (2):544-560.

Annex A: Database sources and search terms

Table A-1: Database sources (6)

- Applied Social Sciences Index and Abstracts (ASSIA)
- British Education Index (BEI)
- Cochrane
- Educational Resources Information Centre (ERIC)
- PsycINFO
- Social Care Online (SCO)

Table A-2: Organisation sources (54)

- Advocacy Matters Wales
- Ambitious About Autism
- ASD info Wales
- Autism & Uni
- Autism Alliance
- Autism Education Trust
- Autism Focused Intervention Resources and Modules
- Autism Initiatives
- Autism Network Scotland
- Autism RPP
- Autism SA
- Autism Speaks
- Autism Toolbox
- Autism UK independent
- Autistica
- Autism Links
- Awares
- Best practice autism.com
- Cerebra
- Children's Right Alliance for England
- Development Autism Research Technology
- Educate Autism

- Engage to Change
- Gov.Uk
- Gov.Wales
- Inclusive Education
- Institute of Welsh Affairs
- Learning Disability Wales
- MUSEC briefings
- NASEN
- National Assembly for Wales
- National Autism Centre
- National Council for Special Education
- National Informal Stem Education Network
- National Institute for Health and Care Excellence
- NCSE online database (NI)
- NFER
- NHS Wales
- Organisation for Autism Research
- Positive Partnerships
- Research Autism
- Shaping Autism Research in the UK
- Snap Cymru
- Testing Treatments Interactive
- The London Leadership Strategy
- The National Autistic Society
- The National Autistic Society (Cymru)
- The National Clearing House on Autism Practice & Evidence
- The National Professional Development Centre on Autism Spectrum Disorder
- The Ontario Association for Behaviour Analysis INC.
- TKI
- Wales Autism Research Centre
- Wales Institute of Social & Economic Research, Data & Methods
- Wendy Rinaldi

Table A-3: Google and Google Scholar search terms

Google search terms (39)

- Autism Autistic Asperger's "Rett syndrome" "Childhood disintegrative disorder" systematic OR meta-analysis "Pervasive developmental disorder not otherwise specified PDD NOS" 2008 filetype:pdf
- Autism autistic aspergers special education english as a second reviews
- Autism educational ineffective dangerous harmful interventions
- Awareness autism higher education reviews UK
- Awtistiaeth effeithiolrwydd ymchwil empirig filetype:pdf
- Bilingual autism resource guide "special education"
- Bilingual research autism child
- Control groups autism "higher education" effectiveness
- Control groups autism "higher education" effectiveness college university
- Control groups autism education effectiveness
- Controversial intervention special education additional learning needs "autism"
- Effectiveness autism autistic aspergers special education "literature review"
- Effectiveness intervention autism asperger's "education" OR special "pervasive developmental disorder"
- Guidance for teachers "autism" ASD
- Implementing the education act in schools wales "autism"
- Interventions autism educational settings "additional learning needs"
- Interventions autism higher education "systematic"
- Interventions for autism in the classroom
- Models of decision making autism educational interventions
- National integrated autism service review
- Pervasive developmental disorder nos education systematic review filetype:pdf
- Picking interventions teachers autism
- Picking interventions teachers autism "mistakes" bad
- Special educational needs autism "effectiveness" "outcomes" RCT
- Teachers parents decision making personalisation co production autism OR asd OR rett OR asperger's "childhood disintegrative disorder" "pervasive developmental disorder not otherwise specified"

- Teaching autistic children welsh-medium filetype:pdf
- Teaching welsh autism resources
- Theory of Mind in autism spectrum disorder "education" effectiveness autism
- Wales welsh language "special education" autism interventions
- Welsh Gaelic and Cymraeg version autism special education review filetype:pdf
- Welsh language learners with autism
- Welsh medium secondary education reviews autism "asd" filetype:pdf
- Welsh-medium special educational provision standards "autism" filetype:pdf
- What works "special education" autism interventions filetype:pdf

Google Scholar search terms (67)

- Autism Spectrum Disorder monolingual bilingual "education"
- "Educational utility" Autism
- "Independent specialist colleges" autism autistic spectrum disorders
- Education OR learn OR teach OR student "Rett syndrome"
- "Individual education plans" autism
- "Individualised Education Plan" autism
- "Interpersonal relationships" "systematic review" education autism autistic aspergers
- "limited outcome" autism autistic spectrum disorders "education"
- "Negative consequence" autism autistic spectrum disorders "education" education
- "No difference" autism autistic spectrum disorders "education" education
- "Social model" disability education "autism"
- "Special education" "autism" "Asperger" views
- Allintitle: "Childhood disintegrative disorder"
- Allintitle: "Childhood disintegrative disorder" special education
- Education OR learn OR teach OR student "Childhood disintegrative disorder"
- Allintitle: "Pervasive developmental disorder not otherwise specified"
- Allintitle: "pervasive developmental disorder" education
- Allintitle: asperger's education "effectiveness"

- Education OR learn OR teach OR student "Pervasive developmental disorder not otherwise specified"
- Allintitle: autism education "effectiveness"
- Allintitle: autism education "systematic review"
- Allintitle: education OR learn OR teach OR student "Rett syndrome" -older -adult
- Allintitle: rett education "effectiveness"
- Asd OR autism OR aspergers comprehensive educational interventions
- Assess barriers "additional learning needs" autism aspergers asd asc
- Autism "statements of special educational needs"
- Autism bad practice poor
- Autism education "Relationship Development Intervention Program" systematic review
- Autism education "systematic review"
- Autism education "triad of impairments" systematic review
- Autism for general education teachers
- Awtistiaeth effeithiolrwydd ymchwil empirig
- Bilingual "comprehensive educational interventions"
- (BISCUIT) autism "special education"
- Comparative compare effectiveness education OR learn OR teach OR student "Rett syndrome" -older -adult
- "Childhood disintegrative disorder" "special education"
- "Comprehensive treatment models" autism education
- Culturally and linguistically diverse (CLD) students "autism" "autistic spectrum disorder"
- Effectiveness autism "education"
- Effectiveness comparison groups autism "education"
- Effectiveness comparison groups autism education education education
- Empirical autism education
- Environmental factors care planning special education autism
- Individual education plans autism "reviews"
- Individual education plans autism "systematic reviews"
- Ineffective autism autistic spectrum disorders "education"

- International review of the evidence on best practice in educational provision for Children on the autism spectrum
- Intervention teach autism Asperger "special education"
- Language welsh autism "special education"
- Lgbt education "autism" autistic
- Measuring effectiveness autism education
- Minorities education "autism" autistic effectiveness intervention
- Models teach autism aspergers "special education"
- Outcome autism autistic spectrum disorders "education" education
- Picture Exchange Communication System (PECS) "systematic review"
- Pivotal Response Treatment "systematic review"
- Refugee education "autism" autistic
- Single case study "effectiveness" three measures autism "education" education
- Single case study three measures autism "education" education
- Welsh-medium bilingual educational resources "autism"
- Welsh-speaking "autistic spectrum disorder"
- Autism educational ineffective dangerous harmful interventions
- Autism educational implementation UK
- Autism educational ineffective OR dangerous OR harmful

Table A-4: Database searches

4. ERIC Search one:

((SU.EXACT("Pervasive Developmental Disorders") OR SU.EXACT("Asperger Syndrome") OR SU.EXACT("Autism")) OR (SU.EXACT("Mental Retardation") OR SU.EXACT("Pervasive Developmental Disorders") OR SU.EXACT("Developmental Disabilities")) OR SU.EXACT("Learning Disabilities") OR (SU.EXACT("Mental Retardation") OR SU.EXACT("Mild Mental Retardation") OR SU.EXACT("Moderate Mental Retardation") OR SU.EXACT("Severe Mental Retardation")))) AND (TI,AB(autism) OR TI,AB(autistic) OR TI,AB(Asperger's) OR TI,AB(pervasive development disorder) OR TI,AB(Rett's syndrome) OR TI,AB(childhood disintegrative disorder) OR TI,AB(triad of impairments))) AND ((SU.EXACT("Education") OR SU.EXACT("Special Schools") OR SU.EXACT("Regular and Special Education Relationship") OR SU.EXACT("Special Education") OR

SU.EXACT("Special Classes") OR SU.EXACT("Special Education Teachers") OR
 SU.EXACT("Special Programs")) OR (SU.EXACT("Learning Activities") OR
 SU.EXACT("Learning") OR SU.EXACT("Learning Experience")) OR (SU.EXACT("Schools")
 OR SU.EXACT("Educational Facilities")) OR SU.EXACT("Universities") OR
 SU.EXACT("Early Childhood Education") OR SU.EXACT("Apprenticeships") OR
 SU.EXACT("Higher Education") OR SU.EXACT("Adult Education") OR SU.EXACT("Nursery
 Schools") OR (SU.EXACT("Academic Ability") OR SU.EXACT("Academic Failure") OR
 SU.EXACT("Academic Achievement") OR SU.EXACT("Academic Education"))) AND
 (TI,AB(special education) OR TI,AB(learning needs) OR TI,AB(additional learning) OR
 TI,AB(learning provision) OR TI,AB(learning provider) OR TI,AB(special school) OR
 TI,AB(special students) OR TI,AB(college) OR TI,AB(pupil referral unit) OR TI,AB(work) OR
 TI,AB(early years) OR TI,AB(pre-school) OR TI,AB(teach) OR TI,AB(lecture) OR
 TI,AB(instruct) OR TI,AB(train))) Limits applied Narrowed by: Entered date: 2008 - 2016;
 Peer reviewed: Peer reviewed

5. ERIC Search two:

(SU.EXACT.EXPLODE("Pervasive Developmental Disorders") OR
 SU.EXACT.EXPLODE("Asperger Syndrome") OR SU.EXACT.EXPLODE("Autism")) AND
 (SU.EXACT("Prereferral Intervention") OR SU.EXACT("Early Intervention") OR
 SU.EXACT.EXPLODE("Intervention") OR SU.EXACT("Response to Intervention")) AND
 (SU.EXACT("Education") OR SU.EXACT("Bilingual Education Programs") OR
 SU.EXACT("Academic Education") OR SU.EXACT("Adult Basic Education") OR
 SU.EXACT("Adult Education") OR SU.EXACT("Special Education") OR
 SU.EXACT("Bilingual Education")) Limited by: Peer reviewed, Language: English, Welsh,
 Narrowed by: Entered date: 2008 – 2016

6. ERIC Search three:

(SU.EXACT.EXPLODE("Pervasive Developmental Disorders") OR
 SU.EXACT.EXPLODE("Asperger Syndrome") OR SU.EXACT.EXPLODE("Autism")) AND
 TI,AB((systematic or literature or rapid or case) and (review or study or analysis or evidence
 or report or assessment)) AND (SU.EXACT("Education") OR SU.EXACT("Regular and
 Special Education Relationship") OR SU.EXACT("Special Education") OR
 SU.EXACT("Special Education Teachers") OR SU.EXACT("Related Services (Special

Education))) Limited by: Peer reviewed, Language: English, Welsh, Narrowed by: Entered date: 2008 – 2016

7. ERIC search four:

(SU.EXACT.EXPLODE("Pervasive Developmental Disorders") OR SU.EXACT.EXPLODE("Asperger Syndrome") OR SU.EXACT.EXPLODE("Autism")) AND TI,AB(Random* or meta-analysis or qualitative) AND (SU.EXACT("Education") OR SU.EXACT("Regular and Special Education Relationship") OR SU.EXACT("Special Education") OR SU.EXACT("Special Education Teachers") OR SU.EXACT("Related Services (Special Education)")) Limits applied; Limited by: Peer reviewed, Language: English, Welsh, Narrowed by: Entered date: 2008 – 2016

8. ERIC search five:

(SU.EXACT.EXPLODE("Pervasive Developmental Disorders") OR SU.EXACT.EXPLODE("Asperger Syndrome") OR SU.EXACT.EXPLODE("Autism")) AND (SU.EXACT("Education") OR SU.EXACT("Regular and Special Education Relationship") OR SU.EXACT("Special Education") OR SU.EXACT("Special Education Teachers") OR SU.EXACT("Related Services (Special Education)")) AND TI,AB(("individual development plans" or "statement of special education" or "individual education plan" or "learning support plan" or "personal learning and support plan")) OR (SU.EXACT("School Planning") OR SU.EXACT("Cooperative Planning") OR SU.EXACT("Language Planning") OR SU.EXACT("Educational Facilities Planning") OR SU.EXACT("Educational Planning") OR SU.EXACT("Career Planning") OR SU.EXACT("College Planning") OR SU.EXACT("Planning") OR SU.EXACT("Facility Planning")) OR TI,AB(personal and (plan or education or care or lesson or support)) OR TI,AB(personalisation) Limited by: Peer reviewed

Language: English, Welsh Narrowed by: Entered date: 2008 - 2016

9. ERIC search six:

(SU.EXACT.EXPLODE("Pervasive Developmental Disorders") OR SU.EXACT.EXPLODE("Asperger Syndrome") OR SU.EXACT.EXPLODE("Autism")) AND (SU.EXACT("Education") OR SU.EXACT("Regular and Special Education Relationship") OR SU.EXACT("Special Education") OR SU.EXACT("Special Education Teachers") OR

SU.EXACT("Related Services (Special Education)") AND (TI,AB (effectiveness)) OR TI,AB(outcome and (well-being or behaviour or relationship or exclusion or inclusion or employment or independence or attainment or person-centred or improvement or health or learning)) OR TI,AB(Practice and (good or bad or poor or approved or ineffective or myth or fail)) OR TI,AB(bilingual or multi-lingual or dual-lingual or welsh and (learning or literacy or education or study)) OR TI,AB(empirical) Limited by: Peer reviewed, Language: English, Welsh, Narrowed by: Entered date: 2008 – 2016

10. ERIC search seven:

(SU.EXACT.EXPLODE("Pervasive Developmental Disorders") OR SU.EXACT.EXPLODE("Asperger Syndrome") OR SU.EXACT.EXPLODE("Autism")) AND (SU.EXACT("Education") OR SU.EXACT("Regular and Special Education Relationship") OR SU.EXACT("Special Education") OR SU.EXACT("Special Education Teachers") OR SU.EXACT("Related Services (Special Education)")) Limited by: Peer reviewed, Language: English, Welsh, Narrowed by: Entered date: 2008 – 2016

11. ERIC search eight:

TI,AB("Discrete Trial Teaching" OR "Lovaas Model" OR "Floortime" OR "Difference Relationship Model" OR "Picture Exchange Communication System" OR "Pivotal Response Treatment" OR "Relationship Development Intervention" OR "Social Communication Emotional Regulation Transactional Support" OR "Training and Education of Autistic" and "Related Communication Handicapped Children" OR "Verbal Behavior")Limits applied; Narrowed by: Entered date: 2008 - 2017; Peer reviewed: Peer reviewed

12. ASSIA search one:

((SU.EXACT("Infantile autism") OR SU.EXACT("Autism")) OR (SU.EXACT("Asperger's syndrome") OR SU.EXACT("Pervasive developmental disorders"))) OR SU.EXACT("Rett syndrome") OR SU.EXACT("Childhood disintegrative disorder") OR (SU.EXACT("Learning disabled adult children") OR SU.EXACT("Learning disabled infants") OR SU.EXACT("Learning disabled adolescent boys") OR SU.EXACT("Learning disabled adolescents") OR SU.EXACT("Learning disabled adolescent girls") OR SU.EXACT("Learning disabilities") OR SU.EXACT("Learning disabled people") OR

SU.EXACT("Learning disabled boys") OR SU.EXACT("Learning disabled children")) AND
 TI,AB(autism or autistic or asperger or "pervasive developmental disorder" or "rett's
 syndrome" or "childhood disintegrative disorder" or "triad of impairment")) AND
 (((SU.EXACT("Educational needs") OR SU.EXACT("Education")) OR SU.EXACT("Special
 education") OR SU.EXACT("Learning") OR (SU.EXACT("Higher education") OR
 SU.EXACT("Junior secondary schools") OR SU.EXACT("Apprentices") OR
 SU.EXACT("Pupil referral units") OR SU.EXACT("Public schools") OR
 SU.EXACT("Language schools") OR SU.EXACT("Junior high schools") OR
 SU.EXACT("Apprenticeships") OR SU.EXACT("Workplaces") OR SU.EXACT("Grammar
 schools") OR SU.EXACT("Academic staff") OR SU.EXACT("Pupils") OR SU.EXACT("Junior
 schools") OR SU.EXACT("Religious schools") OR SU.EXACT("Further education") OR
 SU.EXACT("Elementary schools") OR SU.EXACT("Comprehensive schools") OR
 SU.EXACT("Independent schools") OR SU.EXACT("Academic achievement") OR
 SU.EXACT("Nursery schools") OR SU.EXACT("Reception") OR SU.EXACT("Primary
 schools") OR SU.EXACT("High schools") OR SU.EXACT("Private schools") OR
 SU.EXACT("Facilities") OR SU.EXACT("Colleges") OR SU.EXACT("Preparatory schools")))
 OR TI,AB("Special education*" and (needs or students or teachers or lecturers or pupils or
 provision or providers or schools or facilities or models or program)) OR TI,AB(Learning and
 (additional or needs or provision or provider)) OR TI,AB(college or nursery or reception or
 pre-school or school or academic or further education or higher education or workplace or
 facilities or "pupil referral unit" or apprenticeship) OR (SU.EXACT("Special needs preschool
 children") OR SU.EXACT("Special needs children") OR SU.EXACT("Special needs
 students") OR SU.EXACT("Special needs adolescents") OR SU.EXACT("Special needs
 young people") OR SU.EXACT("Special needs people") OR SU.EXACT("Bilingual special
 needs children") OR SU.EXACT("Special needs young adults") OR SU.EXACT("Special
 schools") OR SU.EXACT("Special needs young children") OR SU.EXACT("Special units")))
 AND (((SU.EXACT("Early intervention programmes") OR SU.EXACT("Psychological
 intervention") OR SU.EXACT("Intervention") OR SU.EXACT("Independent intervention") OR
 SU.EXACT("Brief interventions") OR SU.EXACT("Naturalistic intervention") OR
 SU.EXACT("Interventions") OR SU.EXACT("Psychosocial intervention") OR
 SU.EXACT("Social interventions")) OR (SU.EXACT("Organizational effectiveness") OR
 SU.EXACT("Cost effectiveness") OR SU.EXACT("Effectiveness") OR SU.EXACT("Clinical

effectiveness")) OR SU.EXACT("Outcomes") OR (SU.EXACT("Quality of service") OR SU.EXACT("Quality") OR SU.EXACT("Quality assessment")) OR (SU.EXACT("Practice based education") OR SU.EXACT("Reflective practice") OR SU.EXACT("Empirical practice movement") OR SU.EXACT("Practice") OR SU.EXACT("Best practice") OR SU.EXACT("Classroom practice")) OR (TI,AB(Interventions and (early or timely or preventative or effective or impact or awareness or knowledge or failure or assessment)) OR TI,AB(Outcome and (well-being or behaviour or relationship or exclusion or inclusion or employment or independence or attainment or person-centred or improvement or health or learning)) OR TI,AB(Quality and (indicator or measure or model or assessment)) OR TI,AB(Practice and (good or bad or poor or approved or ineffective or myth or effective or failure)))) Entered date: 2008 - 2017; Peer reviewed: Peer reviewed

13. ASSIA search two:

((SU.EXACT("Infantile autism") OR SU.EXACT("Autism")) OR (SU.EXACT("Asperger's syndrome") OR SU.EXACT("Pervasive developmental disorders")) OR SU.EXACT("Rett syndrome") OR SU.EXACT("Childhood disintegrative disorder") OR (SU.EXACT("Learning disabled adult children") OR SU.EXACT("Learning disabled infants") OR SU.EXACT("Learning disabled adolescent boys") OR SU.EXACT("Learning disabled adolescents") OR SU.EXACT("Learning disabled adolescent girls") OR SU.EXACT("Learning disabilities") OR SU.EXACT("Learning disabled people") OR SU.EXACT("Learning disabled boys") OR SU.EXACT("Learning disabled children")))) AND TI,AB(autism or autistic or asperger or "pervasive developmental disorder" or "rett's syndrome" or "childhood disintegrative disorder" or "triad of impairment")) AND (((SU.EXACT("Educational needs") OR SU.EXACT("Education")) OR SU.EXACT("Special education") OR SU.EXACT("Learning") OR (SU.EXACT("Higher education") OR SU.EXACT("Junior secondary schools") OR SU.EXACT("Apprentices") OR SU.EXACT("Pupil referral units") OR SU.EXACT("Public schools") OR SU.EXACT("Language schools") OR SU.EXACT("Junior high schools") OR SU.EXACT("Apprenticeships") OR SU.EXACT("Workplaces") OR SU.EXACT("Grammar schools") OR SU.EXACT("Academic staff") OR SU.EXACT("Pupils") OR SU.EXACT("Junior schools") OR SU.EXACT("Religious schools") OR SU.EXACT("Further education") OR SU.EXACT("Elementary schools") OR SU.EXACT("Comprehensive schools") OR

SU.EXACT("Independent schools") OR SU.EXACT("Academic achievement") OR
 SU.EXACT("Nursery schools") OR SU.EXACT("Reception") OR SU.EXACT("Primary
 schools") OR SU.EXACT("High schools") OR SU.EXACT("Private schools") OR
 SU.EXACT("Facilities") OR SU.EXACT("Colleges") OR SU.EXACT("Preparatory schools"))
 OR TI,AB("Special education*" and (needs or students or teachers or lecturers or pupils or
 provision or providers or schools or facilities or models or program)) OR TI,AB(Learning and
 (additional or needs or provision or provider)) OR TI,AB(college or nursery or reception or
 pre-school or school or academic or further education or higher education or workplace or
 facilities or "pupil referral unit" or apprenticeship) OR (SU.EXACT("Special needs preschool
 children") OR SU.EXACT("Special needs children") OR SU.EXACT("Special needs
 students") OR SU.EXACT("Special needs adolescents") OR SU.EXACT("Special needs
 young people") OR SU.EXACT("Special needs people") OR SU.EXACT("Bilingual special
 needs children") OR SU.EXACT("Special needs young adults") OR SU.EXACT("Special
 schools") OR SU.EXACT("Special needs young children") OR SU.EXACT("Special units"))
 AND (((SU.EXACT("Welsh language") OR SU.EXACT("Welsh studies")) OR
 SU.EXACT("Wales") OR (SU.EXACT("Bilingual immigrants") OR SU.EXACT("Bilingual
 preschool children") OR SU.EXACT("Bilingual education") OR SU.EXACT("Bilingual
 people") OR SU.EXACT("Bilingual special needs children") OR SU.EXACT("Bilingual
 infants") OR SU.EXACT("Bilingualism") OR SU.EXACT("Bilingual children")) OR
 (SU.EXACT("Bilingual surveys") OR SU.EXACT("Multilingualism")) OR SU.EXACT("English
 as a second language")) OR (TI,AB((Bilingual or multi-lingual or dual-lingual) and (learning
 or literacy or education or study or student or pupil or teacher or school)) OR TI,AB(wales or
 welsh) OR TI,AB(Welsh and (language or medium or study or education))))Limits applied
 Narrowed by: Entered date: 2008 - 2017

14. ASSIA search three:

((SU.EXACT("Infantile autism") OR SU.EXACT("Autism")) OR (SU.EXACT("Asperger's
 syndrome") OR SU.EXACT("Pervasive developmental disorders")) OR SU.EXACT("Rett
 syndrome") OR SU.EXACT("Childhood disintegrative disorder") OR (SU.EXACT("Learning
 disabled adult children") OR SU.EXACT("Learning disabled infants") OR
 SU.EXACT("Learning disabled adolescent boys") OR SU.EXACT("Learning disabled
 adolescents") OR SU.EXACT("Learning disabled adolescent girls") OR

SU.EXACT("Learning disabilities") OR SU.EXACT("Learning disabled people") OR
 SU.EXACT("Learning disabled boys") OR SU.EXACT("Learning disabled children")) AND
 TI,AB(autism or autistic or asperger or "pervasive developmental disorder" or "rett's
 syndrome" or "childhood disintegrative disorder" or "triad of impairment")) AND
 (((SU.EXACT("Educational needs") OR SU.EXACT("Education")) OR SU.EXACT("Special
 education") OR SU.EXACT("Learning") OR (SU.EXACT("Higher education") OR
 SU.EXACT("Junior secondary schools") OR SU.EXACT("Apprentices") OR
 SU.EXACT("Pupil referral units") OR SU.EXACT("Public schools") OR
 SU.EXACT("Language schools") OR SU.EXACT("Junior high schools") OR
 SU.EXACT("Apprenticeships") OR SU.EXACT("Workplaces") OR SU.EXACT("Grammar
 schools") OR SU.EXACT("Academic staff") OR SU.EXACT("Pupils") OR SU.EXACT("Junior
 schools") OR SU.EXACT("Religious schools") OR SU.EXACT("Further education") OR
 SU.EXACT("Elementary schools") OR SU.EXACT("Comprehensive schools") OR
 SU.EXACT("Independent schools") OR SU.EXACT("Academic achievement") OR
 SU.EXACT("Nursery schools") OR SU.EXACT("Reception") OR SU.EXACT("Primary
 schools") OR SU.EXACT("High schools") OR SU.EXACT("Private schools") OR
 SU.EXACT("Facilities") OR SU.EXACT("Colleges") OR SU.EXACT("Preparatory schools")))
 OR TI,AB("Special education*" and (needs or students or teachers or lecturers or pupils or
 provision or providers or schools or facilities or models or program)) OR TI,AB(Learning and
 (additional or needs or provision or provider)) OR TI,AB(college or nursery or reception or
 pre-school or school or academic or further education or higher education or workplace or
 facilities or "pupil referral unit" or apprenticeship) OR (SU.EXACT("Special needs preschool
 children") OR SU.EXACT("Special needs children") OR SU.EXACT("Special needs
 students") OR SU.EXACT("Special needs adolescents") OR SU.EXACT("Special needs
 young people") OR SU.EXACT("Special needs people") OR SU.EXACT("Bilingual special
 needs children") OR SU.EXACT("Special needs young adults") OR SU.EXACT("Special
 schools") OR SU.EXACT("Special needs young children") OR SU.EXACT("Special units")))
 AND (((SU.EXACT("Reviews") OR SU.EXACT("Systematic reviews") OR
 SU.EXACT("Literature reviews")) OR (SU.EXACT("Qualitative research") OR
 SU.EXACT("Qualitative analysis") OR SU.EXACT("Qualitative data") OR
 SU.EXACT("Qualitative methods")) OR SU.EXACT("Meta-analysis") OR
 (SU.EXACT("Clustor randomized trials") OR SU.EXACT("Clinical randomized controlled

trials") OR SU.EXACT("Single blind randomized controlled trials") OR
SU.EXACT("Randomized consent design") OR SU.EXACT("Randomized controlled trials")
OR SU.EXACT("Cluster randomized controlled trials") OR SU.EXACT("Double blind
randomized trials") OR SU.EXACT("Double blind randomized controlled trials")) OR
(SU.EXACT("Evidence based research") OR SU.EXACT("Evidence based")) OR
SU.EXACT("Empirically supported treatment")) OR (TI,AB(research or review or report or
study or analysis and (systematic or literature or evidence or rapid or case or person-
centred)) OR TI,AB(Qualitative and (review or study or evidence or analysis))))Limits
applied Narrowed by: Entered date: 2008 - 2017; Peer reviewed: Peer reviewed

15. ASSIA search four:

((SU.EXACT("Infantile autism") OR SU.EXACT("Autism")) OR (SU.EXACT("Asperger's
syndrome") OR SU.EXACT("Pervasive developmental disorders")) OR SU.EXACT("Rett
syndrome") OR SU.EXACT("Childhood disintegrative disorder") OR (SU.EXACT("Learning
disabled adult children") OR SU.EXACT("Learning disabled infants") OR
SU.EXACT("Learning disabled adolescent boys") OR SU.EXACT("Learning disabled
adolescents") OR SU.EXACT("Learning disabled adolescent girls") OR
SU.EXACT("Learning disabilities") OR SU.EXACT("Learning disabled people") OR
SU.EXACT("Learning disabled boys") OR SU.EXACT("Learning disabled children")))) AND
TI,AB(autism or autistic or asperger or "pervasive developmental disorder" or "rett's
syndrome" or "childhood disintegrative disorder" or "triad of impairment")) AND
(((SU.EXACT("Educational needs") OR SU.EXACT("Education")) OR SU.EXACT("Special
education") OR SU.EXACT("Learning") OR (SU.EXACT("Higher education") OR
SU.EXACT("Junior secondary schools") OR SU.EXACT("Apprentices") OR
SU.EXACT("Pupil referral units") OR SU.EXACT("Public schools") OR
SU.EXACT("Language schools") OR SU.EXACT("Junior high schools") OR
SU.EXACT("Apprenticeships") OR SU.EXACT("Workplaces") OR SU.EXACT("Grammar
schools") OR SU.EXACT("Academic staff") OR SU.EXACT("Pupils") OR SU.EXACT("Junior
schools") OR SU.EXACT("Religious schools") OR SU.EXACT("Further education") OR
SU.EXACT("Elementary schools") OR SU.EXACT("Comprehensive schools") OR
SU.EXACT("Independent schools") OR SU.EXACT("Academic achievement") OR
SU.EXACT("Nursery schools") OR SU.EXACT("Reception") OR SU.EXACT("Primary

schools") OR SU.EXACT("High schools") OR SU.EXACT("Private schools") OR SU.EXACT("Facilities") OR SU.EXACT("Colleges") OR SU.EXACT("Preparatory schools")) OR TI,AB("Special education*" and (needs or students or teachers or lecturers or pupils or provision or providers or schools or facilities or models or program)) OR TI,AB(Learning and (additional or needs or provision or provider)) OR TI,AB(college or nursery or reception or pre-school or school or academic or further education or higher education or workplace or facilities or "pupil referral unit" or apprenticeship) OR (SU.EXACT("Special needs preschool children") OR SU.EXACT("Special needs children") OR SU.EXACT("Special needs students") OR SU.EXACT("Special needs adolescents") OR SU.EXACT("Special needs young people") OR SU.EXACT("Special needs people") OR SU.EXACT("Bilingual special needs children") OR SU.EXACT("Special needs young adults") OR SU.EXACT("Special schools") OR SU.EXACT("Special needs young children") OR SU.EXACT("Special units")) AND (((SU.EXACT("Individualized education programmes") OR SU.EXACT("Individualized programmes") OR SU.EXACT("Individualized")) OR SU.EXACT("Personalization") OR (SU.EXACT("Person centred approach") OR SU.EXACT("Person centred")) OR SU.EXACT("Planning")) OR (TI,AB("Individual development plans" or "statements of special educational needs" or "individual education plans" or "learning support plans" or "personal learning and support plans" or "individualized Education Program" or "individualized education plan") OR TI,AB(personalised or person-centred and (plans or education or care or lesson))))Limits applied, Narrowed by: Entered date: 2008 – 2017

16. ASSIA search five:

TI,AB("Discrete Trial Teaching" OR "Lovaas Model" OR "Floortime" OR "Difference Relationship Model" OR "Picture Exchange Communication System" OR "Pivotal Response Treatment" OR "Relationship Development Intervention" OR "Social Communication Emotional Regulation Transactional Support" OR "Training and Education of Autistic" and "Related Communication Handicapped Children" OR "Verbal Behavior")Limits applied; Narrowed by: Entered date: 2008 – 2017

17. British Education Index search one

Search Terms	Search Options	
S12	S5 AND S9 Limiters - Scholarly (Peer Reviewed) Journals; Publication Date: 20080101-20171231	(238)
S11	S5 AND S9 Limiters - Publication Date: 20080101-20171231	(240)
S10	S5 AND S9	(284)
S9	S6 OR S7 OR S8	(10,277)
S8	TX (Learning and (additional or needs or provision or provider))	(8,076)
S7	TX ("Special educational" and (needs or students or teachers or lecturers or pupils or provision or providers or schools or facilities or models or program))	(1,628)
S6	DE "SPECIAL education" OR DE "SPECIAL education -- Evaluation" OR DE "SPECIAL education -- Research" OR DE "SPECIAL education -- Standards" OR DE "SPECIAL education educators" OR DE "SPECIAL education literature" OR DE "SPECIAL education schools" OR DE "SPECIAL education teachers" OR DE "SPECIAL education teachers -- Education" OR DE "SPECIAL education teachers -- Training of" OR DE "SPECIAL education teachers -- Training of -- Graduate work" OR DE "SPECIAL needs students" OR DE "SPECIAL needs services"	(1,645)
S5	S1 OR S2 OR S3 OR S4	(1,904)
S4	TX autism or autistic or asperger's or "pervasive developmental disorder" or "rett's syndrome" or "childhood disintegrative disorder"	(1,876)
S3	DE "LEARNING disabled children -- Education" OR DE "LEARNING disabled persons -- Education" OR DE "LEARNING disabled persons -- Education (Higher)" OR DE "LEARNING disabled persons -- Education -- Research"	(30)
S2	DE "PERVASIVE developmental disorder not otherwise specified"	(1)

S1	DE "AUTISM" OR DE "AUTISM in adolescence" OR DE "AUTISM in children" OR DE "AUTISM spectrum disorders" OR DE "AUTISM spectrum disorders -- Alternative treatment" OR DE "AUTISM spectrum disorders in women" OR DE "AUTISTIC children" OR DE "AUTISTIC children -- Education" OR DE "AUTISTIC children -- Education -- Law & legislation" OR DE "AUTISTIC people" OR DE "AUTISTIC people -- Education" OR DE "AUTISTIC people -- Education (Higher)"	(1609)
----	--	--------

18. Cochrane Database search one:

#1 MeSH descriptor: [Autistic Disorder] explode all trees

#2 MeSH descriptor: [Asperger Syndrome] explode all trees

#3 MeSH descriptor: [Child Development Disorders, Pervasive] explode all trees

#4 MeSH descriptor: [Rett Syndrome] explode all trees

#5 MeSH descriptor: [Learning Disorders] explode all trees

#6 MeSH descriptor: [Intellectual Disability] explode all trees

#7 #1 or #2 or #3 or #4 or #5 or #6

#8 MeSH descriptor: [Education, Special] explode all trees

#9 #7 and #8

19. PsycINFO search one:

(((((SU.EXACT("Learning Disabilities") OR SU.EXACT("Learning Disorders") OR SU.EXACT("Intellectual Development Disorder")) OR (SU.EXACT.EXPLODE("Autism Spectrum Disorders") OR SU.EXACT("Rett Syndrome")) OR TI,AB("autistic or autism or Asperger or Rett or "pervasive developmental disorder not otherwise specified" or "childhood disintegrative disorder" or "triad of impairments" or "learning disabilities" or "learning disorders"))) AND ((SU.EXACT("Education") OR SU.EXACT("Bilingual Education")) OR (SU.EXACT("Special Education Students") OR SU.EXACT("Early Intervention") OR SU.EXACT.EXPLODE("Special Education") OR SU.EXACT("Special Needs") OR SU.EXACT("Special Education Teachers"))) OR TI,AB("special educational needs" OR "special educational needs and disabilities" OR "special education" OR "special school" OR "special students" OR "special teachers" OR "additional learning")) OR TI,AB(education AND

(need OR teach OR learn OR instruct OR train)) OR TI,AB(college OR nursery OR reception OR pre-school OR school OR academic OR further education OR higher education OR workplace OR facilities OR "pupil referral unit" OR apprenticeship OR university OR academic) OR TI,AB(learning AND (special OR additional OR needs OR provision OR provider)) OR SU.EXACT("Learning")) AND (((SU.EXACT("Response to Intervention") OR SU.EXACT("Early Intervention") OR SU.EXACT("Prevention") OR SU.EXACT("Intervention") OR SU.EXACT("School Based Intervention") OR SU.EXACT("Workplace Intervention")) OR (SU.EXACT("Teacher Effectiveness Evaluation") OR SU.EXACT("Teacher Effectiveness") OR SU.EXACT("Treatment") OR SU.EXACT("Treatment Outcomes") OR SU.EXACT("Clinical Trials") OR SU.EXACT("Costs and Cost Analysis") OR SU.EXACT("Treatment Effectiveness Evaluation")) OR (SU.EXACT("Evidence Based Practice") OR SU.EXACT("Practice") OR SU.EXACT("Best Practices")) OR (SU.EXACT("Quality of Care") OR SU.EXACT("Educational Quality") OR SU.EXACT("Quality of Life"))) OR TI,AB(intervention and (early or timely or preventative or effective or impact or awareness or knowledge or failure or evidence or person-centred)) OR TI,AB(Outcome and (well-being or behaviour or relationship or exclusion or inclusion or employment or independence or attainment or person-centred or improvement or health or learning or measure)) OR TI,AB(practice and (good or best or bad or poor or approved or ineffective or myth or failure))) AND (la.exact("ENG") AND po.exact(("Human" OR "Male" OR "Female") NOT ("Outpatient" OR "Inpatient" OR "Animal"))) AND su.exact("Adulthood (18 yrs & older)" OR "Childhood (birth-12 yrs)" OR "School Age (6-12 yrs)" OR "Adolescence (13-17 yrs)" OR "Young Adulthood (18-29 yrs)" OR "Preschool Age (2-5 yrs)" OR "Infancy (2-23 mo)" OR "Neonatal (birth-1 mo)")) AND rtype.exact("Journal" OR "Peer Reviewed Journal" OR "Journal Article") AND pd(20080101-20171231) AND PEER(yes)) AND (TI,AB((systematic or literature or rapid or case) and (review or study or analysis or evidence or report or assessment)) OR (SU.EXACT("Literature Review") OR SU.EXACT("Meta Analysis")) OR TI,AB((randomi*ed control trial)) OR TI,AB((meta-analysis)) OR TI,AB((qualitative)))

20. PsycINFO search two:

((SU.EXACT("Learning Disabilities") OR SU.EXACT("Learning Disorders") OR SU.EXACT("Intellectual Development Disorder")) OR (SU.EXACT.EXPLODE("Autism

Spectrum Disorders") OR SU.EXACT("Rett Syndrome")) OR TI,AB(autistic or autism or Asperger or Rett or "pervasive developmental disorder not otherwise specified" or "childhood disintegrative disorder" or "triad of impairments" or "learning disabilities" or "learning disorders")) AND (SU.EXACT("Multilingualism") OR SU.EXACT("Multicultural Education") OR SU.EXACT("Bilingualism") OR SU.EXACT("Foreign Language Learning") OR SU.EXACT("English as Second Language") OR SU.EXACT("Foreign Languages") OR SU.EXACT("Teaching") OR SU.EXACT("Bilingual Education"))Limits applied, Narrowed by: Entered date: 2008 - 2017; Language: English; Source type: Scholarly Journals; Dissertations & Theses; Age group: Childhood (birth-12 yrs); School Age (6-12 yrs); Adulthood (18 yrs & older); Preschool Age (2-5 yrs); Adolescence (13-17 yrs); Young Adulthood (18-29 yrs); Infancy (2-23 mo); Neonatal (birth-1 mo); Peer reviewed: Peer reviewed Exclude: Language: French; Japanese; German; Portuguese; Chinese; Spanish; Catalan; Greek; Slavic language; Source type: Books; Conference Papers & Proceedings;Age group: Thirties (30-39 yrs); Middle Age (40-64 yrs); Aged (65 yrs & older); Very Old (85 yrs & older); Limits applied Narrowed by: Entered date: 2008 - 2017; Peer reviewed: Peer reviewed

21. PsycINFO search three:

((SU.EXACT("Learning Disabilities") OR SU.EXACT("Learning Disorders") OR SU.EXACT("Intellectual Development Disorder")) OR (SU.EXACT.EXPLODE("Autism Spectrum Disorders") OR SU.EXACT("Rett Syndrome")) OR TI,AB(autistic or autism or Asperger or Rett or "pervasive developmental disorder not otherwise specified" or "childhood disintegrative disorder" or "triad of impairments" or "learning disabilities" or "learning disorders")) AND lo(wales)Limits applied Narrowed by: Entered date: 2008 - 2017; Peer reviewed: Peer reviewed

22. PsycINFO search four:

((SU.EXACT("Learning Disabilities") OR SU.EXACT("Learning Disorders") OR SU.EXACT("Intellectual Development Disorder")) OR (SU.EXACT.EXPLODE("Autism Spectrum Disorders") OR SU.EXACT("Rett Syndrome")) OR TI,AB(autistic or autism or Asperger or Rett or "pervasive developmental disorder not otherwise specified" or "childhood disintegrative disorder" or "triad of impairments" or "learning disabilities" or "learning disorders")) AND (TI,AB("Individual development plans" or "statements of special

educational needs" or "individual education plans" or "learning support plans" or "personal learning and support plans" or "Individualized Education Program" or "individualized education plan") OR TI,AB((Personalised or person-centred) and (plans or education or care or lesson)) OR (SU.EXACT("Individualized Instruction") OR SU.EXACT.EXPLODE("Individual Education Programs")) OR (SU.EXACT("Educational Programs") OR SU.EXACT("Educational Program Planning") OR SU.EXACT("Educational Program Evaluation"))))Limits applied; Narrowed by: Entered date: 2008 - 2017; Peer reviewed: Peer reviewed;
Age group: Adulthood (18 yrs & older); Childhood (birth-12 yrs); School Age (6-12 yrs); Adolescence (13-17 yrs); Young Adulthood (18-29 yrs); Preschool Age (2-5 yrs); Infancy (2-23 mo); Neonatal (birth-1 mo) Exclude: Age group: Thirties (30-39 yrs); Middle Age (40-64 yrs); Aged (65 yrs & older); Very Old (85 yrs & older)

23. PsycINFO search five:

TI,AB("Discrete Trial Teaching" OR "Lovaas Model" OR "Floortime" OR "Difference Relationship Model" OR "Picture Exchange Communication System" OR "Pivotal Response Treatment" OR "Relationship Development Intervention" OR "Social Communication Emotional Regulation Transactional Support" OR "Training and Education of Autistic" and "Related Communication Handicapped Children" OR "Verbal Behavior"))Limits applied; Narrowed by: Entered date: 2008 - 2017;
Language: English; Source type: Scholarly Journals; Dissertations & Theses;
Age group: Childhood (birth-12 yrs); Adulthood (18 yrs & older); Preschool Age (2-5 yrs); School Age (6-12 yrs); Young Adulthood (18-29 yrs); Adolescence (13-17 yrs); Infancy (2-23 mo); Peer reviewed: Peer reviewed Exclude: Language: Spanish; Japanese; Portuguese; German; French; Chinese; Turkish; Age group: Thirties (30-39 yrs); Middle Age (40-64 yrs); Aged (65 yrs & older); Very Old (85 yrs & older)

24. Social Care Online:

(New Combined Search: autism [- SubjectTerms:"autism" including this term only - OR SubjectTerms:"autistic spectrum conditions" including this term only - OR SubjectTerms:"aspergers syndrome" including this term only - OR SubjectTerms:"learning disabilities" including this term only] AND A FT [- AbstractOmitNorms:"autism" - OR AbstractOmitNorms:"autistic" - OR AbstractOmitNorms:"asperger s" - OR

AbstractOmitNorms:"pervasive development disorder"- OR AbstractOmitNorms:"rett s syndrome" - OR AbstractOmitNorms:"childhood disintegrative disorder" - OR AbstractOmitNorms:"triad of impairments"] AND SEND [- SubjectTerms:"special education" including this term only - OR SubjectTerms:"special educational needs" including this term only - OR SubjectTerms:"learning styles" including this term only - OR SubjectTerms:"education" including this term only - OR AbstractOmitNorms:"special education" - OR AbstractOmitNorms:"additional learning"] AND (A comb: autism [- SubjectTerms:"autism" including this term only - OR SubjectTerms:"autistic spectrum conditions" including this term only - OR SubjectTerms:"aspergers syndrome" including this term only - OR SubjectTerms:"learning disabilities" including this term only] OR A FT [- AbstractOmitNorms:"autism" - OR AbstractOmitNorms:"autistic"- OR AbstractOmitNorms:"asperger s"- OR AbstractOmitNorms:"pervasive development disorder" - OR AbstractOmitNorms:"rett s syndrome"- OR AbstractOmitNorms:"childhood disintegrative disorder" - OR AbstractOmitNorms:"triad of impairments"]