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Support for children and young people with hearing impairment in educational settings

Support for children and young people with hearing impairment in educational settings

Audience

Parents/carers and practitioners supporting children and young people with hearing impairment in educational settings.

Overview

This guide provides an overview of the extent to which interventions delivered in educational settings are effective in realising positive outcomes for children and young people with hearing impairment. It was produced by the University of Birmingham. The views expressed in this guide are those of the authors and not necessarily those of the Welsh Government.

Action required

This document may be of interest to practitioners and parents/carers when planning provision to support children and young people with hearing impairment.

Further information

Enquiries about this document should be directed to:
Additional Learning Needs Branch
Support for Learners Division
The Education Directorate
Welsh Government
Cathays Park
Cardiff
CF10 3NQ

e-mail: additionallearningneedsbranch@gov.wales

@WG_Education

Facebook/EducationWales

Additional copies

This document can be accessed from the Welsh Government's website at gov.wales/additional-learning-needs

Related documents

A Rapid Evidence Assessment of the effectiveness of educational interventions to support children and young people with hearing impairment (Welsh Government, 2019)

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.
This document is also available in Welsh.

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Purpose and aim

This report provides a summary of evidence about the effectiveness of educational approaches for supporting deaf children and young people from a commissioned rapid evidence assessment (REA). The aim of the report is to support practitioners when planning and delivering timely and effective support for deaf children and young people. The report focuses on learners aged 0-25 years, but some of the findings may be transferrable to older learners.

The report may be of interest to:

- parents/carers
- teachers, including Teachers of the Deaf (ToD), classroom-based support staff, early years workers and further education lecturers
- special educational needs coordinators (SENCOs)/additional learning needs coordinators (ALNCos)
- headteachers, principals and senior leaders in educational settings
- local authority educational services, including specialist services such as educational psychologists
- educational audiologists
- social workers
- health professionals
- third sector organisations
- advocacy services, dispute resolution services and the Special Educational Needs Tribunal for Wales (SENTW).

The report does not set out what approaches must, or must not, be provided for deaf children and young people. Practitioners do not therefore have to use the approaches set out in this report, but can use this evidence along with their own experience and knowledge when making decisions about approaches to support deaf children and young people.

Not all approaches outlined in the report may be suitable for all deaf children and young people. Approaches are likely to need to be tailored to each learner based on their needs and to the specific educational setting (including home-based interventions). Educators may find it useful, therefore, to monitor how well their selected approaches are working for their learners, so they know whether those approaches are having the desired effects or need to be altered.

Background

This report is based on an assessment of research studies that have considered the effectiveness of intervention approaches to support deaf children and young people[1]. The assessment was a commissioned REA and was undertaken in 2018 by members leading the Teaching of Children with Hearing Impairment programmes at the University of Birmingham.

The commissioned REA summarised the findings of the most reliable research studies on this topic published between 1981 and 2017. It reviewed approaches that had been studied in any setting where children and young people receive education, such as home, preschools, schools and further education institutions. The literature was presented within 11 core educational strategy areas: communication, literacy, mathematics, access to examinations, mobility and independence, cognitive skills, social and emotional functioning, use of technology, teaching support, teaching strategies, and inclusion. The literature searches were carried out in four databases, using a range of search terms and inclusion/exclusion criteria.

Eighty-five studies met the criteria and these were then rated for 'quality' using standard criteria commonly used for REAs: 59 of the 85 sources (69 per cent) were judged to be of 'moderate' to 'strong' quality, while 26 sources (31 per cent) were judged to be of 'impressionistic' to 'moderate' quality.

The evidence was not found to be comprehensive; there were gaps in the evidence base and in some cases the evidence on effectiveness was considered to be inconclusive or only indicative. In addition, not all of the studies identified were robust enough to be included.

This report does not attempt to summarise all interventions and approaches available to support deaf children, but presents a framework of the general approaches adopted in this field. Although a number of interventions are broadly used in settings (including homes) where deaf children and young people are educated across the UK, this guide presents only research evidence based on published interventions. There are other interventions that can potentially benefit all children or all children and young people with special educational needs (SEN) but these are outside of the scope of this guide.

[1] The full REA is available from https://gov.wales/sites/default/files/statistics-and-research/2019-09/effectiveness-educational-interventions-support-children-young-people-hearing-impairment_1.pdf

What is deafness?

The term ‘deaf’ is used in this report to refer to children and young people with all levels of permanent or temporary hearing loss, from mild to profound, in one or both ears. The term ‘Deaf’, with a capital ‘D’, is used in this report only when there is indication in the literature that this is the preferred term the children and young people use themselves.

Limited auditory input can present challenges when learning and accessing teaching. There are at least 2,625 deaf children in Wales[2]. Deaf children are a diverse group comprised of a range of needs (e.g. with regards to the level of hearing loss they’ve experienced, the type of amplification they require, the change in hearing loss they’ve experienced, their mode of communication and the age they were when they received their diagnosis). Also, 23 per cent of deaf children in Wales and 22 per cent of deaf children in England are recorded as having a SEN, most commonly severe learning difficulties.

The degree of hearing loss, measured in decibels (dB), is categorised below[3].

- Mild hearing loss: 21-40dB.
- Moderate hearing loss: 41-70dB.
- Severe hearing loss: 71-95dB.
- Profound hearing loss: in excess of 95dB.

The degree of hearing loss affects the access that a person has to sounds but is not necessarily indicative of the learning needs of the child. However, a mild hearing loss can lead to inattention, language delay and speech problems. Mild hearing loss can have implications for language development, particularly in the early years when children are still developing language. Children with moderate hearing loss do not perceive all speech sounds at normal conversational level. These children may show inattention, language delay, speech problems, learning problems and social/emotional difficulties as a result of feeling isolated. They typically respond well to language and educational activities with the help of amplification. In severe hearing loss, language and speech will not develop spontaneously. Without amplification (e.g. hearing aids, cochlear implants), with severe hearing loss cannot hear sounds or normal conversations. Lastly, children with profound hearing loss without amplification/cochlear implants are missing out on incidental learning through overheard conversations and are likely to have severe language delay, speech problems, and possible related learning difficulties.

The impact that the hearing loss has on the development of deaf children and young people depends on the individual and the surrounding circumstances (e.g. family’s ability to communicate with a deaf child). It is important to note that with the

[2] (CRIDE, 2018) *CRIDE 2018 report for Wales.* www.ndcs.org.uk/media/4315/cride-2018-wales-report-final-english.pdf

[3] (2011) *Recommended Procedure: Pure-tone air-conduction and bone-conduction threshold audiometry with and without masking.* BSA. www.thebsa.org.uk/wp-content/uploads/2014/04/BSA_RP_PTA_FINAL_24Sept11_MinorAmend06Feb12.pdf

appropriate support, deaf children and young people can achieve on a par with their hearing peers.

In the last 10 years the field of deaf education witnessed two major technological advancements that might be expected to have an impact on deaf children's academic skills and success in school. The first is the introduction of newborn hearing screening and the second is the increasing effectiveness of hearing aid technology, including cochlear implants. In the UK, the implementation of universal newborn hearing screening (UNHS) began in 2000 and was completed in 2005, potentially reducing the mean age of diagnosis of prelingual hearing loss from 17 months to a few weeks.

Partially linked to the technological advancements is the transformation of the educational settings for deaf children and young people with closure of schools for the deaf and greater emphasis on mainstream education. In Wales, 81 per cent of school-aged deaf children attend mainstream schools, 8 per cent attend mainstream schools with resource provisions, and 10 per cent attend special schools not specifically for deaf children[4]. It is worth noting here that there are no schools for the deaf in Wales. Also related to the technological advancements is the preferred mode of communication of deaf children and young people. Data from the Consortium for Research into Deaf Education (CRIDE) shows that 87 per cent of deaf children communicate using only spoken English or Welsh in school or other education settings, and 10 per cent use sign language in some form, either on its own or alongside another language.

It is only within the framework of these diverse needs and characteristics of deaf children that interventions reported in literature can be considered in relation to their effectiveness in supporting children's learning and access to learning.

[4] (CRIDE, 2018) *CRIDE 2018 report for Wales.* www.ndcs.org.uk/media/4315/cride-2018-wales-report-final-english.pdf

Support for deaf children and young people (approaches and interventions)

Types of intervention

Educational outcomes for deaf learners can be considered as falling into two broad areas.

1. Access to learning, irrespective of where the learners are placed in the range of educational provisions (special schools, schools for the deaf, hearing resource provisions, mainstream schools, homes, etc.).
2. Development of skills which allow learners to be self-determining agents in their own lives.

The first area is concerned with equal access to education. The second area is concerned with developing independent learners within the school environment, as well as preparing them for adult life, independent living and employment. These areas have been considered through examining the notion of 'access' with a particular focus on:

- access to learning - inclusive practice and differentiation ensuring that the child's environment is structured and modified to promote inclusion, learning and access to the core curriculum, the culture of the educational setting and broader social inclusion
- learning to access - teaching provision that supports the child to learn independence skills and develop their agency in order to afford more independent learning and social inclusion. This is sometimes referred to as the expanded core curriculum (ECC).

This model is essentially a mechanism for mapping a pedagogical and curriculum response to the distinctive educational needs of deaf children and young people.

For the purpose of the REA, intervention areas were categorised into 11 overlapping intervention areas, each of which requires a balance between 'access to learning' and 'learning to access,' communication, literacy, mathematics, access to examinations, mobility and independence, cognitive skills, social and emotional functioning, use of technology, teaching support, teaching strategies, and inclusion.

Who can put the interventions into practice?

A wide range of people can effectively put these interventions into practice. Specialist teachers and professionals have specialist training to carry out assessments of need, as well as the technical knowledge to design and/or undertake some teaching approaches. Related to this, deafness is a low incidence condition that many teachers and parents/carers will be unfamiliar with. Therefore, specialist professionals also have an important advisory role. These specialists include: qualified Teachers of the Deaf (ToD), specialist teaching assistants, communication support workers and educational audiologists.

Nevertheless, the implementers in many interventions include teachers and teaching assistants, and parents/carers. This is because many approaches are implemented within normal school and home life and often require consistency of implementation and practice.

Outcomes

The interventions and approaches in deaf education usually focus upon teaching and an environment that provides access to what would be recognised as parts of a traditional school curriculum (i.e. through the use of ‘access to learning’ interventions and approaches). Therefore, these interventions and approaches often seek to develop communication, literacy and academic attainment more generally. Other interventions and approaches commonly focus upon developing skills that would be recognised as independence skills. Hence, these interventions and approaches seek to develop young people’s ability to navigate and access their physical and social environment (i.e. through the use of ‘learning to access’ interventions and approaches). It is also recognised that these targeted outcomes are inter-related.

What the research says about the effectiveness of the interventions

The REA broadly focuses upon deaf education generally, rather than upon a specific intervention area. Even so, 85 sources were identified that met the inclusion criteria. This suggests that relatively little evidence exists concerning the relative efficacy of educational interventions in this field.

Of the evidence gathered, about half were case studies or small sample multiple baseline studies (45 out of 85 interventions; 53 per cent) rarely incorporated control groups. Incorporation of control groups was extremely difficult because of ethical considerations (i.e. deaf children in the control group would not benefit from the intervention). Almost half of the identified interventions employed experimental or quasi-experimental design (i.e. where deaf children are not allocated to a control or to an intervention group randomly) given the diversity and low incidence/numbers of the deaf population. It is also interesting to consider the countries where these interventions were developed. The majority of the evidence came from the USA, Canada, Israel, New Zealand and Europe, and included a range of ages, settings and severity of hearing loss. Only 2 out of 85 interventions were developed in the UK. This raises questions about the implications and appropriateness of these interventions in the UK (i.e. where the national curriculum, and generally the way deaf education is conceptualised, is different). It is worth mentioning that a very small number of the identified interventions (28 out of 85) focused on supporting children and young people with mild to moderate hearing loss. This is not surprising; children with mild to moderate hearing loss are usually overlooked as they are seen as having only minor difficulties.

In this section we present a summary of the effectiveness of the interventions identified in the REA within each of the selected 11 educational strategy areas under the headings ’Description of educational area’, ‘Nature of evidence in this area’, ‘Key findings’ and ‘Implications.’

Communication

Description of educational area
Communication is a broad concept encompassing a wide range of approaches. For the purpose of the REA, this area was defined as studies describing interventions that were to support the development of communication skills, including early communication and language development.

Language (either sign or spoken) is important for the communication skills of deaf children and young people. Good communication skills are established early in life and the role of the family on the development of these skills is crucial.

Given the importance of communication and language (either spoken or sign language), intervention studies mainly focus on supporting communication skills from an early age and as a result promote inclusion of deaf children in mainstream educational settings. Advances in technology (i.e. digital hearing aids and cochlear implants) provide better access to speech and, as a result, improve communication skills for deaf children who use spoken language. Hence, the use of auditory training

for children and young people with cochlear implants has been the focus of a number of interventions. Despite the access to sounds that technology provides for deaf children and young people, this does not restore typical hearing levels. Thus, even with the advances in technology, deaf children still require support/adaptations from professionals to ensure that their needs are appropriately met.

Given that 90 per cent of deaf children are born in hearing families, with no prior experience of deafness, it is important to ensure that families of deaf children are effectively and appropriately supported from the offset[5]. Thus, the role that the parents/carers play in the development of the early communication skills of deaf children is recognised, and parent-child communication is one of the focus areas of the identified interventions.

Nature of the evidence in this area

A total of 15 sources were identified in the area of communication. Twelve of these sources were rated as providing 'moderate to strong' evidence, and three as 'impressionistic to moderate' for this area within the REA. The majority of identified interventions focused on:

- the development of speech production and spoken language acquisition targeting the principles of natural auditory-verbal education, emphasising the need for families to be engaged in the programme
- training both phonological awareness and working memory to improve spoken language acquisition
- the effect of parent-child interaction and the effect of parent-implemented language intervention on communication skills of deaf children.

Key findings and implications

There is clear evidence that interventions to develop the spoken language skills of deaf children have to be implemented from an early age: early identification, and as a result early intervention, is key to language development.

Video feedback was used in interventions to promote parental self-esteem and parent-child communication[6]. In this intervention facilitated by researchers) parents/carers identified a family aspect regarding communication with their child that they would like to change (e.g. "I want to see if I can get [child's name]'s attention when I call his name"). Three sessions of video recordings of a parent-child interaction during play at home demonstrating positive behaviour of the targeted aspect were then replayed and reviewed by the researcher and the parent/carer. This intervention was effective for parents/carers with children with prelingual congenital hearing loss aged three years. Outcomes of the intervention included enhancement of the quality of parent-child interaction and parental self-esteem. However, this intervention provided little evidence of the development of the child's communication and language skills per se. Peripatetic ToD, sometimes in

[5] https://www.ndcs.org.uk/media/1283/right_from_the_start_campaign_report_final.pdf

[6] Lam-Cassettari, C., Wadnerkar-Kamble, M.B. and James, D.M. (2015). 'Enhancing Parent–Child Communication and Parental Self-Esteem With a Video-Feedback Intervention: Outcomes With Prelingual Deaf and Hard-of-Hearing Children'. *Journal of Deaf Studies and Deaf Education* 20(3), 266–274.

conjunction with their speech and language therapist colleagues, can offer families systematic language intervention courses.

There is strong evidence that the development of spoken language of deaf children can only be supported effectively when also targeting other aspects of development interlinked with language, such as phonological awareness and cognitive skills.

Evidence on the effectiveness of auditory training and other 'early interventions', focusing on the development of listening and spoken language skills, is inconclusive. Play-therapy based interventions such as auditory verbal therapy emphasise speech and listening and equip parents/carers with the skills to maximise their deaf child's speech and language development[7]. Although these early interventions can develop the speech production and listening skills of deaf children, the interventions identified in the REA lacked details of their implementation and effectiveness.

Although little evidence was provided, musical training can potentially play a role in speech interaction between deaf and hearing children.

The use of a whole-school approach of using sign language to promote communication between deaf and hearing children was evident in only one intervention. This intervention involved weekly sessions for children, staff and peers, starting with basic signs and progressing with incentives such as prizes and a points system through the weeks. Signing was encouraged both in the classroom and at playtime. The evidence of the effectiveness of this intervention is inconclusive as it is based only on one case study. However, it is suggested here that this aspect of communication is closely linked to the aspect of 'interaction' and further evidence is provided in the sections of inclusion and social and emotional functioning.

Literacy

Description of educational area

Literacy is a broad concept encompassing a wide range of intervention approaches. For the purpose of the REA, this area was defined as studies describing interventions that were designed to support the development of reading and/or writing skills. In order to develop appropriate interventions to support deaf children, identification of the factors that influence the various aspects of reading and writing is essential. Language skills are interlinked with literacy skills, and even with early identification and enhancement in technology, deaf children require continuing support to develop their literacy skills.

In terms of access to literacy, vocabulary and phonological awareness have been found to be the more consistent predictors for deaf children's reading skills. The studies identified in the REA focused either on one or both of those aspects to support the literacy of deaf children.

[7] Diller, G., Graser, P. and Schmalbrock, C. (2001). 'Early natural auditory-verbal education of children with profound hearing impairments in the Federal Republic of Germany: results of a 4 year study. *International Journal of Pediatric Otorhinolaryngology,* 60(3), 219–226.

Nature of the evidence in this area

Literacy is one of the most researched areas in the field of deaf education. A total of 36 sources were identified within the quality rating undertaken for the REA, with 25 rated as being 'moderate to strong' and 11 as 'impressionistic to moderate'. Only four intervention studies focused on writing skills, reflecting the scarcity of evidence in this area of literacy. The two underlying core components of reading (i.e. phonology and vocabulary), as outlined in the simple view of reading[8], have been targeted separately in the majority of the interventions. Although few in number, interventions focusing on a range of strategies to promote reading in deaf children have provided strong evidence.

Key findings and implications – phonology

There is clear evidence that phonology plays a crucial role in the development of the reading skills of deaf children but this has been established relatively recently. The following implications can be drawn.

- Phonological instruction has its greatest impact on the early stages of reading development, before formal schooling and as a result, effective interventions typically include either preschoolers or children in early years.
- There is strong evidence that phonological awareness and, as a result, the reading skills of deaf children, can be enhanced by explicit instruction focusing on blending that provides a secure strategy for reading. Effective interventions were delivered by teachers on explicit phonics instruction and included deaf children with a mild to profound hearing loss in a range of educational settings. In practice, the intervention comprised of a systematic, explicit remedial phonics programme (i.e the Reading Mastery I curriculum[9] adapted to meet the visual representation needs of deaf children (e.g visual phonics and a computer tutor)[10].
- Visual phonics address the visual representation needs of deaf children and as a result can assist in acquisition of phonemic skills. However, this evidence is only based on USA studies. Studies on the use of 'visual phonics by hand' (the system used in the UK) were not identified in the literature.

There is strong evidence that explicit instruction on morphology and phonology can individually have an impact on reading skills of deaf children. The intervention included primary school-aged children with various degrees of hearing loss and both hearing aids and cochlear implants. In practice, the intervention was delivered to two groups who received training either on phonology (i.e. production of specific phonemes at the end of the words) in the first training session, or morphology (i.e. grammatical structures) during the second session, and vice versa[11].

[8] Hoover, W. A., and Gough, P.B. (1990). 'The Simple View of Reading'. *Reading and writing*, 2(2), 127–160.

[9] Engelmann, S. and Brunner, E.C. (1995). *Reading mastery I*. Columbus, OH: Science Research Associates.

[10] Trezek, B.J. (2005). 'The Efficacy of Utilizing a Phonics Treatment Package with Middle School Deaf and Hard-of-Hearing Students'*. Journal of Deaf Studies and Deaf Education,* 10(3), 256–271.

[11] Bow, C.P., Blamey, P.J., Paatsch, L.E.and Sarant, J.Z. (2004). 'The Effects of Phonological and Morphological Training on Speech Perception Scores and Grammatical Judgments in Deaf and Hard-of-hearing Children'. *Journal of Deaf Studies and Deaf Education,* 9(3), 305–314.

Key findings and implications – vocabulary

Vocabulary is one of the two core elements underpinning reading skills. It is important to note here that deaf children often miss out on incidental learning/vocabulary through overheard conversation. There is a discrepancy between the need for interventions intended to increase vocabulary for preschool children who are deaf and the actual level of research interventions undertaken. Most young children who are deaf would benefit from a targeted intervention using evidence-based instructional methods (i.e. direct instruction). There is a growing body of research on vocabulary interventions with preschool children who are deaf. The evidence on the effectiveness of interventions explicitly targeting vocabulary skills offers the following steer.

- There is strong evidence to suggest the use of story book reading with explicit instructions can enhance the learning of novel words by deaf children. The intervention was effective with preschool children with a bilateral hearing loss of various degrees.
- Interventions using augmentative signs were found to be effective for 9 to 11-year-old deaf children using sign language in special schools. In practice, children were presented with pictures of imaginary creatures and pseudo-words. Half of the words were accompanied by an augmentative pseudo-sign. Improvements for deaf children were noted for learning new words that had been taught with a sign.

The evidence on the use of software to promote vocabulary skills of deaf children is inconclusive. There is little evidence to suggest the use of technology itself has a direct effect on vocabulary skills. However, there is strong evidence that the use of interactive software (e.g. the use of animated tutors) to provide explicit vocabulary instruction is effective.

Key findings and implications – a range of strategies

In contrast to interventions that focus on specific elements that promote reading, the most effective interventions are the ones targeting various strategies that contribute to reading achievement. The following implications can be drawn.

- There is strong evidence that the use of visual phonics in conjunction with explicit teaching of vocabulary can support early reading of deaf children.
- Explicit teaching of phonological awareness, vocabulary, alphabetic and letter-sound knowledge provides the foundations of literacy. For instance, one of the most effective interventions providing strong evidence is the 'Foundations for Literacy'[12]. Designed in the USA, it is the only literacy curriculum specifically for deaf children, providing systematic, intensive and explicit instruction to target the skills underpinning reading: phonological awareness, alphabetic knowledge, word reading, vocabulary and narrative skills. The key to the success of interventions focusing on improving the above skills is the systematic and explicit way in which these skills are taught.

[12] Lederberg, A.R., Miller, E.M., Easterbrooks, S.R. and McDonald Connor, C. (2014). 'Foundations for Literacy: An Early Literacy Intervention for Deaf and Hard-of-Hearing Children'. *Journal of Deaf Studies and Deaf Education,* 19(4), 438–455.

- Thematically related play may lead to increased interaction with the reader, increased participation and satisfaction, and positive emotion, particularly in children with hearing loss for whom early engagement in literacy is crucial to long-term success.
- Shared book reading can be effective in promoting the production of narrative quality and comprehension of deaf children but mostly when it is paired with use of manipulatives (i.e. objects related to the content of the story).

Key findings and implications – writing

Writing skills, although less researched than reading skills, were the focus of a number of effective interventions. An observation worth noting is that although (as discussed in the introduction of this section) reading and writing are complementary skills and are underpinned by the same core components (i.e. phonemic awareness, phonological awareness and orthography), the identified interventions on writing for deaf children focused solely on writing skills and provided no link to reading. A distinction can be drawn between those identified interventions of writing instruction that focus on writing as process and those that focus on writing as product. Writing instruction taught as process is more effective than instructions where the focus is on creating the writing product. The research evidence offers the following steer.

- Essay writing of deaf children and college students can be promoted by offering enhanced grammatical instruction on essays (i.e. a plus sign before each successfully produced grammatical structure and a minus sign before each incorrect grammatical structure). Specific instruction on correct and incorrect grammar can enhance deaf students' performance on productive grammatical knowledge. These interventions were found to be effective for those college students with a profound/severe hearing loss and a mean age of 20 years.
- The use of a holistic approach to teaching writing, and specifically teaching children to write for a variety of audiences with a given purpose, is effective for enhancing their essay-writing skills.
- Teaching deaf children to write by making direct links between fingerspelling, sign words and English words (i.e. the lexicalised fingerspelling, the sign, and the English word are matched) can promote deaf children's writing skills. The intervention was delivered to deaf children aged between 4 and 14 years educated in settings using both spoken and sign language. While it seems likely that the same strategy would work with Welsh words, research has not explored this directly.

Although there is some evidence that teaching writing as process can enhance the writing skills of deaf children, most of the evidence is dated and does not come from the UK. Given that deaf children have lower achievement in writing than reading, parental, preschool and school-based interventions should focus on enhancing writing, in combination with reading.

Mathematics

Description of educational area

For the purpose of the REA, this area was defined as studies describing interventions that had a focus on examining the effect of instruction/teaching/training to support mathematical skills.

Attainment for deaf children in this category is traditionally low. The importance of incidental learning (often a difficulty for deaf children) is highlighted in these interventions. Unlike other areas of learning, mathematical achievement seems to be unrelated to hearing thresholds. Other possible factors have been researched: developmental delays in language; disrupted experience of early (mathematical) learning in the home, especially quantitative concepts; a low level of specialist mathematical teaching; and differences in information processing. Language as a contributor seems to be a favourite possibility, considering the complex use of mathematical language.

Nature of the evidence in this area

A total of five sources met the inclusion criteria for the REA. In terms of quality, three were rated as being 'moderate to strong' and two as 'impressionistic to moderate.' These interventions focused on teaching techniques to problem solve, particularly in relation to time sequence problems and multiplication. One intervention aimed at the promotion of early mathematical concepts naturally, in the home, showed an effect of altering parents'/carers' communicative behaviour in a positive direction.

Key findings and implications

As typical hearing children progress through the education system they are assumed to be able to deal with word problem-solving activities mentally, but deaf children may need visualising means to solve word problems successfully. The first effective interventions demonstrate strong evidence that:

- teachers should not avoid 'story problems'[13] (due to deaf children's vulnerability to impaired language skills) and instead use them as a teaching tool to encourage thinking skills, including synthesis of the child's word knowledge into the problem at hand
- deaf students can successfully tackle mathematical word problems when explicitly taught techniques of modelling a strategy, visualisation of word problems through drawings and diagrams, and through the use of manipulatives.

On the other hand, there is only impressionistic evidence on the effect of training parents/carers of deaf children to change their behaviour and the mathematical language they use in the home to stimulate their children's early learning of mathematical concepts. Lack of vicarious learning of early mathematical concepts can be mitigated by training and encouraging parents/carers to use mathematical language at home from an early age, but training the parents/carers to change their children's behaviour is difficult to trace and record.

[13] A story problem, also known as a word problem, requires you to read a problem (often a real-life scenario) and decide on the operation to perform in order to get the answer and solve the problem.

There is little evidence on the effect of peer-tutoring deaf children on mathematics acquisition. In practice, a hearing peer who was proficient in mathematics tutored a secondary aged profoundly deaf girl in four key mathematical components for twenty minutes every day[14]. After a brief period of intervention, 70 per cent accuracy was achieved in the key objectives but it is unclear how this method is different from previously tried methods by teachers.

Specialist mathematical teaching skills should be part of ToD training as this knowledge has a direct impact on the choices that ToD make about the mathematical curriculum. Teaching deaf children explicit strategies, including visualisation techniques, on how to approach mathematical word problems is one way to contribute to the development of problem-solving skills, which are absolutely pertinent to the acquisition of independent skills by deaf learners.

Access to assessments and examinations

Description of educational area
This strategy area has a focus on studies describing the relative success of different assessment accommodations/modifications and of different ways to provide access to exams. Formal testing of children through national assessments and public examinations is a central feature of most education systems. However, for deaf learners, their linguistic difficulties and the access to written forms of assessments can be a barrier to their ability to perform under standard examination conditions. Under the Equality Act all schools, colleges, universities and awarding bodies are obliged to provide arrangements for all deaf learners to access examinations in a fair way.

There is a range of access arrangements for deaf learners, including:

- additional time for assessments / examinations
- modified language papers - the language and sentence structure can be changed so that deaf learners find it easier to answer the questions
- a live speaker - someone who will read out a transcript of a recording for exams that have pre-recorded parts
- a reader - the transcript is read out for deaf learners who face difficulties with processing written information
- oral language modification - a person clarifies the wording of the question during the exams
- British Sign Language (BSL) interpretation - a BSL interpreter signs the questions or paper and the learner's reply in BSL is filmed.

Qualified ToD can act as assessors to the above accommodations, except where acting as an oral language modifier (for which additional specific training is required[15]).

[14] Burley, S., Gutkin, T. and Naumann, W. (1994). 'Assessing the efficacy of an academic hearing peer tutor for a profoundly deaf student' *American Annals of the Deaf,* 139(4), 415–419.
[15] (2015). *Access arrangements for your child's examinations*. National Deaf Children's Society. www.ndcs.org.uk/information-and-support/education-and-learning/getting-additional-support/getting-additional-support-wales/exam-access-arrangements/

Whether or not learners will need alternative arrangements to access their assessments or exams will depend on the individual learner and on the nature of their deafness.

Nature of the evidence in this area
No sources were identified within the REA.

Key findings and implications
There is no empirical research exploring the relative efficacy of different access arrangements for deaf learners. Nevertheless, descriptions of the available approaches to access arrangements are more established [16] [17] . The literature describes approaches that seek to make accommodations and modifications to assessments to aid inclusive learning and environments. This suggests the following implications.

- Deaf learners should be enabled to adapt their learning environment and, where possible, take responsibility for their own access arrangements at school so that they can appropriately access assessments and examinations.
- Arrangements for access to assessments and examinations for deaf learners should primarily meet the learner's needs, mirror the arrangements in place in their standard classroom and be part of their everyday learning.
- Technology (e.g. use of radio aids) has potential value for deaf young people as it provides a means to efficiently access assessment materials. This does assume that technology is embedded in young people's standard classrooms and in the home settings[18], and that professionals are knowledgeable about managing the latest technologies[19].
- ToD must ensure that the access arrangements are appropriate and meet the learner's needs. The ToD plays an important role in assessing the needs of a deaf learner and subsequently providing support.

Mobility and independence

Description of educational area
For the purpose of the REA, this area was defined as studies describing the effect of instruction/teaching/training to support mobility, independence and living skills. Although mobility and independence have been considered together in this report, in the field of deaf education, interventions in relation to mobility mainly concern deaf learners with complex needs, whereas independence is a skill pertinent to all deaf learners.

[16] https://hwb.gov.wales/draft-curriculum-for-wales-2022/reading-and-numeracy-assessments/personalised-assessments/national-reading-and-numeracy-tests-test-administration-handbook-191010/
[17] https://www.jcq.org.uk/exams-office/access-arrangements-and-special-consideration/regulations-and-guidance/access-arrangements-and-reasonable-adjustments-2019-20
[18] www.ndcs.org.uk/documents-and-resources/how-radio-aids-can-help/
[19] Allen, S., Mulla, I., Yen Ng, Z., Archbold, S.and Gregory, M. (2017). *Using radio aids with pre-school deaf children.* Research report commissioned by the National Deaf Children's Society and conducted by The Ear Foundation.

Given the difficulties that deaf students might face in language, social and emotional development and lack of exposure to social cues that are found in sound, there is an overemphasis on scaffolding and explicit instruction but little emphasis on developing the living and independent skills of deaf children[20]. For example, providing one-to-one support to deaf children can sometimes hinder the opportunities for the child to take ownership for their own learning. It is suggested that deaf adolescents leave school with few 'life skills' as choices are made for them, in the majority of cases without their understanding or consultation. It is suggested in the reviewed studies that some deaf learners experience a 'shock' when they exit education where their needs were met (e.g. arrangement of interpreters or communication support workers) and take responsibility for their own lives and make their own decisions[21].

Nature of the evidence in this area

Two interventions were identified in the REA, one focusing on balance skills of deaf students without disabilities and the other on independent living skills of deaf students with additional needs. In terms of quality, they were both rated as being 'moderate to strong'.

Key findings and implications

Given the centrality of independence within the conceptual framework and the ECC it is surprising that there was little evidence of evaluations of educational interventions which met the REA criteria. Based on the emphasis on the use of technology by the two identified intervention studies and the limited evidence on independence skills of deaf children and adolescents, the following implications can be drawn.

- There is moderate to strong evidence that inclusion of balance exergames in the everyday school life of students with deafness can increase their motor abilities as well as their interest in physical exercise classes. This intervention was effective for deaf young people with severe hearing loss aged 17–19 years in mainstream schools. However, the exergames do not appear to be more effective than traditional exercise.
- There is only moderate evidence of the effectiveness of using high-tech devices to support the teaching of independent living or vocational skills to deaf adolescents with developmental disabilities. The evidence is moderate based on the small number of participants (i.e. four deaf students aged 17–19 years of age with developmental disabilities in a special school) in the identified intervention.

Beyond these areas, the REA did not identify any evidence of successful interventions or evidence of general principles of mobility and independence education. Given the concerns raised about the development of independence among this group, it is crucial to broaden our understanding of how deaf children can be best supported to develop their independence skills. There is an increasing need to understand exactly how independence skills can be supported and this need becomes more pertinent when considering the experience of deaf adolescents transitioning from school to independent working life.

[20] Powers, S. (2001). 'Investigating Good Practice in Supporting Deaf Pupils in Mainstream Schools'. *Educational Review*, 53(2), 181–189.

[21] Valentine, G. and Skelton, T. (2007). 'Re-defining 'norms': D/deaf young people's transitions to independence'. *Sociological Review*, 55(1), 104–123.

Cognitive skills

Description of educational area

For the purpose of the REA, this area was defined as studies describing the effect of instruction/teaching/training to support a range of cognitive skills (e.g. theory of mind, metacognitive strategies, working memory).

Cognitive development is central in the education of deaf children as language and cognition are inextricably linked. Thus, the language delay of deaf children can have an impact on their cognitive development in a number of ways. In addition, cognitive standardised assessments are developed for hearing children, not taking into consideration the language variability of deaf children and the additional needs some deaf children might have. However, language-free assessments for nonverbal intelligence, such as the Test of Nonverbal Intelligence Fourth Edition (TONI-4)[22] developed for those with questionable or limited language ability, can be used with deaf children[23]. Research on the cognitive skills of deaf children has primarily focused on specific aspects: visual attention, problem-solving, flexible thinking, social cognition and theory of mind.

Nature of the evidence in this area

A total of six sources met the inclusion criteria for the REA. In terms of quality, five were rated as being 'moderate to strong' and one as providing 'impressionistic' evidence. The identified research focused on problem-solving and flexible thinking, metacognition and theory of mind and social cognition.

Key findings and implications

There was little evidence of evaluations of educational interventions that met the REA criteria.

The effect of music lessons on auditory processing and working memory was explored only by one intervention. In practice, a group of 14 severe to profoundly deaf children, who received music training for 1 hour a week for 2.6 years on average, was compared to a group of 14 deaf children who did not receive any music lessons[24]. The evidence on effectiveness of music training to promote working memory was inconclusive.

Interventions using virtual reality games were effective in promoting problem-solving and flexible thinking of deaf children aged 8–11 years with moderate to profound hearing loss. In practice, the children were asked to play three virtual reality games involving the control of three-dimensional blocks for 15 minutes a week over a period of three months.

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[22] www.pearsonassessments.com/store/usassessments/en/Store/Professional-Assessments/Cognition-%26-Neuro/Non-Verbal-Ability/Test-of-Nonverbal-Intelligence-%7C-Fourth-Edition/p/100000612.html

[23] Mayer, C., Watson, L., Archbold, S., Ng, Z.Y. and Mulla, I. (2016). 'Reading and Writing Skills of Deaf Pupils with Cochlear Implants'. *Deafness & Education International*, *18*(2), 71–86.

[24] Rochette, F., Moussard, A. and Bigand, E. (2014). 'Music lessons improve auditory perceptual and cognitive performance in deaf children'. *Frontiers in Human Neuroscience,* 8.

Problem-solving has to be emphasised and supported using technology throughout the school years. Training deaf children on problem-solving tasks from a very young age can be beneficial and a skill that has to be developed early in life to achieve independence at a later stage in life.

The use of thought bubbles and other strategies based on false-belief tasks is an effective way to promote theory of mind to deaf primary school children with severe to profound hearing loss. The pictorial training using thought bubbles was effective as deaf children not only gained understanding of the theory of mind concepts following their training, but they were also able to generalise their gains to a new type of false-belief task[25].

Metacognition (thinking about thinking) is a strong predictor of different aspects of learning. For instance, reading comprehension (the area with the most difficulties for deaf learners) can be promoted by providing deaf children with effective strategies to monitor their own understanding and to solve any problems they face. Despite the inextricable link between cognition and language, none of the interventions identified here attempted to support language alongside cognitive skills or even recognised that cognitive skills cannot be promoted effectively when language fluency is absent. Further evidence may be needed to understand the full complexities of cognitive skills and their relationship to language fluency and theory of mind.

Social and emotional functioning

Description of educational area

For the purpose of the REA, this area was defined as studies describing the effect of instruction/teaching/training to support self-esteem, peer relationships, friendships and peer acceptance.

It is well established that good social skills and the ability of children and young people to manage their behaviours and friendships is important for their development, and a significant predictor for both academic and future success. Some deaf children and young people can face difficulties in communicating, initiating/entering and maintaining interactions with their peers in inclusive settings. It is evident that deaf children and young people need support from early life, not only to identify other people's emotions but also to understand and regulate their own emotions. It is important to acknowledge that deaf children and young people can be vulnerable to experience challenges and/or social isolation as a result of being deaf in a hearing-orientated society. For this reason, deaf children have an increased vulnerability to difficulties concerning emotional well-being.

Nature of the evidence in this area

A total of 10 sources met the inclusion criteria for the REA. In terms of quality, seven were rated as being 'moderate to strong' and three as providing 'impressionistic' evidence. Most of the interventions involved deaf children of preschool age and with a specific degree of hearing loss (i.e. severe to profound). Most of the intervention

[25] Wellman, H.M., and Peterson, C.C. (2013). 'Deafness, Thought-Bubbles and Theory-of-Mind Development'. *Developmental Psychology,* 49(12), 2357–2367

studies were designed and implemented in the USA and abroad; there were no identified studies in the UK.

Key findings and implications
The urgency to promote socio-emotional skills of deaf individuals, especially of secondary age, is not reflected in the published intervention studies. Practice to support social and emotional skills of deaf children should take into consideration the following aspects, as identified by the available evidence.

- Strategies such as prompting and modelling targeted social skills by teachers can only promote the interactions of deaf children with their hearing peers if used as part of an inclusive curriculum and not in isolation[26]. In practice, classroom teachers modelled and prompted targeted social skills to a group of deaf children aged 4–6 years. Social skills intervention as part of an inclusive curriculum has an impact on the peer social behaviour of deaf children (i.e. solitary and parallel play was significantly reduced as a result of the intervention).
- Promotion of interaction between deaf and hearing children using activities to raise deaf awareness (such as explaining what deafness is) is an ineffective intervention when used in isolation. Raising deaf awareness among hearing children in inclusive settings should be developed as part of an inclusive curriculum, taking into consideration academic and language skills as well as the communication needs of deaf children.
- Deaf children's understanding of their own complex emotions and recognition of other people's emotions can be supported by targeting emotion words.

There is strong evidence about the effectiveness of comprehensive intervention studies, such as the Promoting Alternative Thinking Strategies (PATHS programme)[27], which focus on a number of different skills (i.e. self-control, emotional understanding, interpersonal relationships and social problem-solving skills). This programme can easily be adapted in the UK and incorporated in the curriculum.

The available evidence highlighted that children who are deaf still face challenges and difficulties in communicating, initiating/entering and maintaining interactions with hearing peers; further research concerning interventions that promote their social interactions in inclusive education is pertinent. There was a lack of evidence of studies including preschool deaf children and those with mild to moderate hearing loss. Thus, interventions should also target children with varying degrees of hearing loss, including children with mild to moderate hearing loss.

Use of technology

Description of educational area
For the purpose of the REA, this area was defined as studies describing the effect of instruction/teaching/training using educational, enabling and access technology.

[26] Antia, S.D. and Kreimeyer, K.H. (1997). 'The Generalization and Maintenance of the Peer Social Behaviors of Young Children Who Are Deaf or Hard of Hearing'. *Language, Speech and Hearing Services in Schools,* 28, 59–69
[27] Greenberg, P. and Kusche, C.A. (1998). 'Preventive Intervention for School-Age Deaf Children: The PATHS Curriculum'. *Journal of Deaf Studies and Deaf Education,* 3(1), 49–63.

There are many areas of the curriculum that hold potential difficulty for deaf children, notably those that are heavily language-based and those relying on literacy skills. It has been hoped that new technologies might help to 'unlock' these areas for deaf children in a variety of ways. It is important to note that the use of technology like radio aids across home, school and leisure environments can be really beneficial for the language and social and emotional development of deaf children and young people. However, studies focusing solely on a medical intervention (e.g. cochlear implant operation) or solely on the provision/use of a technical aid (e.g. hearing aid, radio aid) were outside the scope of the REA report and were excluded.

Nature of the evidence in this area

A total of nine sources met the inclusion criteria for the REA. In terms of quality, three were rated as being 'moderate to strong' and six as providing 'impressionistic' evidence. The identified interventions mainly focused on the three broad areas of:

- technology and behaviour – use of digital technology, especially software packages, to motivate students to engage and maintain attention on specific tasks
- technology and comprehension – use of technology to support deaf children's understanding of a particular subject matter
- technology and other aspects of learning – use of technology to support vocabulary acquisition and use of telepractice as an alternative to face-to-face auditory verbal therapy.

Key findings and implications

The majority of the interventions discussed above focused on the use of different types of technology to support deaf children's learning of different subjects (e.g. reading comprehension and vocabulary). Thus, the majority of the identified interventions in this category focused on how technology can enhance/support 'access to learning' for deaf children. However, there were also interventions identified that aimed at supporting aspects of the expanded core curriculum, ultimately leading to acquisition of independent skills by deaf children – 'learning to access' (e.g. interventions on minimising disruptive behaviour and enabling concentration). Based on the above evidence, the following implications can be drawn.

- Telepractice can be used in deaf education specifically to promote independent skills of deaf children. There may be other applications yet to be found, particularly in situations where families live remotely from treatment centres such as cochlear implant, speech and language or paediatric centres.
- There is little and inconclusive evidence of the use of technology to teach employment-related language to deaf students and of the use of 3D games for enhancing reading comprehension skills of deaf children.
- However, print to text technology can have a clear application in the field of live captioning and transcription services for deaf young people. In addition, there are apps that convert speech to text without a mediating stenographer.
- In addition, technology holds potential that traditional means cannot offer, such as extra embedded elements with a single click (hyperlinks technology), embedded videos of new signs, redesign of storybooks with new fonts and font sizes, and new text and illustrations that can directly amplify meaning.

Overall, careful design and implementation of applications and software, together with a corresponding pedagogy are required to ensure success for deaf children.

Teaching support

Description of educational area

For the purpose of the REA, this area was defined as studies describing the use of various teaching support techniques and configurations to support children's learning. This commonly involves support offered by non-teaching staff, e.g. learning support assistants or teaching assistants. While the use of teaching assistants in the education of deaf children appears to be common practice in Western countries, there appear to be few empirical studies evaluating their role.

Nature of the evidence in this area

No sources were identified that met the inclusion criteria for the REA.

Key findings and implications

No educational intervention in relation to teaching support specifically for deaf children and young people has been identified in the REA. This is interesting given the common use of teaching assistants in the support and education of deaf children. Indeed, many of the interventions described throughout this report are commonly supported and implemented by teaching assistants. While empirical evidence that details the effectiveness of particular approaches in the use of teaching support has not been identified, it seems likely that teaching assistants can provide a valuable role in relation to:

- 'access to learning' (e.g. ensuring that instructions for various activities are presented in an accessible way for deaf students)
- 'learning to access' (e.g. reinforce children's independence skills by encouraging them to take responsibility for checking their audiology equipment is working).

The challenge in the management of this valuable role is mainly in relation to the nature of adult support, which if not balanced carefully may prevent the development of independence skills and personal agency, and the development of relationships between deaf learners and their peers. Particular concerns are raised regarding the impact of a teaching assistant on a teacher's opportunity to develop understanding and awareness of deaf students' specific needs[28].

[28] Salter, J.M., Swanwick, R.A. and Pearson, S.E. (2017). 'Collaborative Working Practices in Inclusive Mainstream Deaf Education Settings: Teaching Assistant Perspectives. *Deafness & Education International*, 19(1), 40–49.

Teaching strategies

Description of educational area

For the purpose of the REA, this area was defined as studies examining the use of teaching strategies/approaches to support learning of deaf children that have a particular focus upon pedagogy. The overarching aim is to provide deaf children with strategies they can use/adapt in many situations based on 'learning to access'. The strategies discussed above form the basis of the strategies discussed in other sections of this report. For example, visual aids (i.e. diagrams, etc.) are used in mathematics to promote deaf children's understanding of word problems.

Nature of the evidence in this area

No sources were identified that met the inclusion criteria for the REA.

Key findings and implications

No interventions were found specifically in relation to general teaching strategies for deaf children. However, looking at the general principles of strategies used to support the learning of deaf children in various areas (e.g. literacy, maths, social and emotional, etc.), the following implications can be drawn.

- The strategies used by teachers and parents/carers should emphasise the importance of providing opportunities to develop social interaction skills ('learning to access').
- Strategies and approaches should emphasise the importance of providing opportunities for deaf children to gain independent skills.
- Systemic strategies and approaches should aim to adapt the environment to promote access to participation and learning. For instance, appropriate seating arrangements, use of radio aids and use of classroom amplification systems support access to learning for deaf children.

Use of technology (e.g. use of interactive software) can support learning and academic achievement of deaf children.

Inclusion

Description of educational area

For the purpose of the REA, this area was defined as studies examining the use of environmental adjustments, inclusive practice and peer, teacher and parental training to support and enable the learning environment.

Research regarding inclusion of deaf children has mainly focused on factors leading to the successful inclusion of deaf children in the mainstream environment.

Nature of the evidence in this area

Only two interventions were identified in this area and in terms of quality of evidence they were both rated as being 'moderate to strong'. Both studies employed

interventions conceptualising inclusion as 'resolving the barriers leading to learning'[29] and ultimately contributing to 'learning to access'.

Key findings and implications

Only two intervention studies were identified under 'inclusion' as an educational strategy. However, both interventions are based on the fact that ToD are 'agents of change' either by adapting the environment or by influencing others around the child (e.g. their peers) to meet the needs of deaf children and ultimately contribute to 'learning to access'. Based on the two intervention studies identified, the following implications can be drawn.

- The intervention included arrangement of the physical environment through changes such as seating, lighting and organisation of resources to reduce visual and auditory distractions, using carrels or partitions. The intervention was effective for deaf children with additional disabilities (i.e. motor delays, intellectual disabilities and behaviour, attention and hyperactivity issues) aged between 9 and 11 years old in a school for the deaf[30]. Outcomes for children included enhancement of academic engagement and reduction of disruptive behaviour.

The use of activities (e.g. signing classes for hearing children and deaf awareness) to bring deaf and hearing peers together might have a positive effect on inclusion of deaf children but is only based on moderate evidence.

[29] Booth, T. and Ainscow, M. (1998). *From Them to Us: An international study of inclusion in education*. Routeledge.

[30] Guardino, C. and Antia, S.D. (2012). 'Modifying the Classroom Environment to Increase Engagement and Decrease Disruption with Students Who Are Deaf or Hard of Hearing'. *Journal of Deaf Studies and Deaf Education*, 17(4), 518–533.

Other points to consider when designing and implementing intervention programmes

When designing and implementing intervention programmes for deaf children and young people, practitioners should consider several things. Some key considerations are presented below, but there may be other factors affecting the specific child or setting that should also be considered.

Degree of hearing loss

Most studies do not address the impact or effectiveness of the intervention in relation to the degree of hearing loss. In addition, studies refer to deaf children and young people without providing explicit/specific information in relation to the severity of hearing loss. A very small number of the identified interventions (28 out of 85) focused on supporting children and young people with mild to moderate hearing loss. This is not surprising; children with prolonged temporary loss, unilateral loss and mild to moderate hearing loss are usually overlooked and seen as having only minor difficulties. There is an urgency to identify the unmet needs of these groups of children in order to inform appropriate and effective interventions for these children.

Age and effectiveness

There is a gap in the evidence base regarding the effectiveness of interventions targeted at older deaf young people (over-16s) and whether the effectiveness of interventions differs with age.

Only 15 out of 85 identified studies focus on participants in secondary education and only nine targeted young people over 16. Thus, with this limited evidence it is difficult to draw conclusions on the effectiveness of the support on the independent living skills in secondary years and beyond.

Setting type and effectiveness

Most of the interventions could be flexibly adapted and implemented effectively in a variety of settings (i.e. schools for the deaf, mainstream settings). There was no evidence that setting type had a particular impact on the effectiveness of an intervention. However, it is important that practitioners recognise and take into consideration the characteristics of the children educated in different settings.

Intervention length and effectiveness

It is important that each intervention is implemented for long enough to achieve positive outcomes. However, there was no conclusive evidence suggesting that the length or duration of an intervention had a significant impact on the effectiveness of that intervention.

Environmental audits

When implementing intervention for deaf children and young people, environmental audits should take place. It is important to ensure that learning and teaching take place in rooms that provide a good listening environment and have good acoustics.

Assessment tools

The review did not seek to identify assessment procedures (the focus was upon educational interventions). However, the planning of the interventions, and ultimately their effectiveness, was based on the outcome measures used. There is a range of available assessments of a child's developmental progress. However, caution is needed when considering appropriate assessments for deaf children. Standardised assessments in the various educational areas have been developed and standardised on the hearing population. Thus, although standardised assessments provide information of the performance of the target sample in comparison to the population and therefore enable comparisons between groups (e.g. between hearing and deaf children), the appropriateness of these assessments to evaluate deaf children's developmental progress is doubtful. For instance, deaf children's underachievement in reading comprehension can be partially attributed to the fact that the comprehension questions asked in the standardised tests required the children to make inferences to provide the correct answer[31]. However, many deaf children find inferences like these, which draw on world knowledge, challenging.

A comprehensive discussion and evaluation of the assessments in the areas of communication, language, functional listening, literacy, mathematics, cognitive development and social/emotional development commonly used in the UK with deaf children and young people (although not all specifically designed for deaf children) is available from the National Deaf Children's Society[32].

Assessments designed for deaf children, young people and adults whose first language is BSL are available from the Deafness, Cognition and Language Research Centre at University College London[33]. This is an important resource for the Deaf community and families of deaf children, enabling them to request assessment using accessible tests normed on deaf people like themselves.

In relation to standardised assessments in the Welsh language, the first standardised receptive vocabulary test normed specifically on Welsh-speaking children is the Prawf Geirfa Cymraeg[34]. There are two versions of this test for children aged 7-11 years.

However, as communication and inevitably language is one of the main aspects for which specialist support is needed, many interventions do require specialist staff that

[31] Harris, M., Terlektsi, E. and Kyle, F. (2017). 'Literacy Outcomes for Primary School Children Who Are Deaf and Hard of Hearing: A Cohort Comparison Study. *Journal of Speech, Language and Hearing Research*, 60(3), 701–711.
[32] https://www.ndcs.org.uk/assessments
[33] https://dcalportal.org/tests
[34] Gathercole, V. C. M., & Thomas, E. M. (2007). Prawf Geirfa Cymraeg, Fersiwn 7.11. *Prawf Geirfa Cymraeg, Fersiwn 7.11*. www.pgc.bangor.ac.uk.

are able to communicate in the appropriate language and are able to access language-appropriate resources.

Progression

Educational progression is generally understood in relation to most of the intervention areas discussed, e.g. progress in literacy, communication, mobility or use of technology. However, the range of interventions presented means that educators are faced with dilemmas as to where to put their efforts. Should interventions be chosen that have emphasis upon equal access or development of individual agency (i.e. emphasise 'access to learning' or 'learning to access')? Examples of this include:

- use of social stories versus promoting and modelling of targeted social skills
- use of sight vocabulary versus teaching of visual phonics
- anticipatory adjustments versus teaching of self-advocacy skills.

These decisions are not about the relative efficacy of particular interventions, but what individual stakeholders and policies deem to be the 'right thing to do' (e.g. in relation to how access to a 'broad' and 'balanced' curriculum is conceptualised in a particular educational context). Nevertheless, there are very practical and pragmatic challenges for parents/carers, teachers and young people to navigate.

Throughout the REA, the 'access to learning'/'learning to access' distinction helps to reveal some of these dilemmas and provides the basis to make informed decisions about the type of interventions most appropriate at a given time. A key part of this decision-making process is linked to the developmental age of the deaf child, and to accounting for the preferences of the child and their parents/carers. To some extent, the evidence identified in the REA offers some steer about which approach works and at which point in the young person's development. However, it is important to stress that the needs of deaf children have to be looked at on an individual case-by-case basis. There is no single intervention that will necessarily work for every single deaf child.

Development and implementation of interventions require professionals with specialist training. It also requires professionals who can take a researcher-practitioner role, that is be able to:

- assess individual children and modify interventions appropriately based upon evidence of progress
- emphasise that interventions should increasingly seek to promote young people's independence and agency over time.

Professional roles

The ‘educator’ (using the term in a general sense to refer to an appropriate adult) must make use of information from assessments and then make decisions about interventions that may be beneficial to the given child’s learning and development. Drawing upon the educational strategies identified in the REA, these interventions may focus upon environmental and resource adjustments, pedagogy or curriculum (or most commonly combinations of all these things). The challenge for the educators involved is deciding upon the appropriate combination of interventions and having the appropriate skills to implement them.

Specialist staff are needed to undertake and/or advise on additional learning provision and inclusive practice and differentiation. While the availability and organisation of professionals varies in different countries, in England and Wales the traditional coordination of this complex arrangement of educational support is generally undertaken by qualified ToD. Given deafness is a low incidence need, mainstream education practitioners are unlikely to develop or retain specialist knowledge through their ongoing practice (as they will only rarely come across a deaf child). This makes the advice on interventions they receive from ToD especially important.

Other considerations

Other key considerations that practitioners might want to think about when planning or delivering support to deaf children and young people include:

- a holistic approach to the children participating in interventions, taking into consideration their family’s choice on communication approaches
- whether or not a specific intervention is appropriate or can be adapted to meet the needs of children in Wales. Although a number of interventions are broadly used in schools for the deaf and resource provisions across the UK, these are not evidence-based
- any ethical implications or concerns associated with the particular intervention or approach
- the practical implications associated with its implementation. For example, a number of the identified interventions use technology (e.g. interactive software) as the main resource for the delivery of the intervention. The appropriateness, compatibility and availability of the technology, as well as the capability (skills and experience) of those using the technology to implement the intervention, should be taken into account. In addition, some of the identified interventions are available with a fee.

What progress might be expected from using intervention programmes for deaf children and young people?

The evidence indicates that the interventions did, in most cases, lead to positive outcomes for deaf children and young people. These centred on:

- improved attainment and academic performance – for example, school readiness, improved reading skills, improved mathematical skills and reasoning
- improved social skills and communication – with peers, teachers and/or others, improved sign or spoken language, emotional recognition
- improved cognitive skills – for example, improved problem-solving skills, improved theory of mind, flexible thinking
- improved well-being – for example, improved mental health.

As was evident in the REA, the most effective interventions were those where two or more of the above outcomes were targeted. Optimal outcomes can be found for deaf young people if attention is given to associated interventions concerned with ‘access to learning’ and ‘learning to access’. An important point to consider is that it is unclear from the identified evidence whether the improvements seen continue when the intervention is no longer provided. This is because most studies did not assess the students once the intervention stopped. It is important, therefore, to ensure that progress is closely monitored if and when intervention is stopped.

Successful outcomes for deaf children and young people will only be achieved when the balance between ‘access to learning’ and ‘learning to access’ is the right one, and emphasised from early years. Parents/carers should receive the right support from professionals to be able to communicate effectively with their child (either using sign or spoken language) from early years.

Information sources

- The National Deaf Children's Society (NDCS) – a charity for deaf children and young people.
  www.ndcs.org.uk/
- British Association of Teachers of the Deaf (BATOD)
  www.batod.org.uk/
- Action on Hearing Loss – UK's national charity helping people who are confronting life-changing deafness, tinnitus and hearing loss.
  www.actiononhearingloss.org.uk/
- National Sensory Impairment Partnership (NatSIP)
  www.natsip.org.uk/
- BID services – a charity promoting choice and independence for people who are deaf, hard of hearing, visually impaired or have a dual sensory loss.
  www.bid.org.uk/
- British Deaf Association – a UK membership organisation and registered charity run by Deaf people for Deaf people.
  bda.org.uk/our-work/
- The British Society of Audiology – a society to advance audiological research, learning, practice and impact.
  https://www.thebsa.org.uk/

Contacts

Further information about this document is available from the following.

- Dr Emmanouela Terlektsi, University of Birmingham
  www.birmingham.ac.uk/staff/profiles/education/terlektsi-emmanouela.aspx
- Angie Wootten, University of Birmingham:
  www.birmingham.ac.uk/staff/profiles/education/wootten-angela.aspx
- Welsh Government
  additionallearningneedsbranch@gov.wales

Glossary

Acronym/Key word	Definition
BSL	British Sign Language
CRIDE	Consortium for Research into Deaf Education
dB	Decibels
ECC	expanded core curriculum
educational strategy	umbrella term used to describe an area of intervention (e.g. literacy, communication)
HI	hearing impairment
REA	rapid evidence assessment
SEN	special educational needs
ToD	Teacher of the Deaf