

Herman, R., Roy, P. & Kyle, F. (2013). Dyslexia and deaf children. British Association of Teachers of the Deaf Newsletter, 2013(May), pp. 47-48.



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Original citation: Herman, R., Roy, P. & Kyle, F. (2013). Dyslexia and deaf children. British Association of Teachers of the Deaf Newsletter, 2013(May), pp. 47-48.

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Dyslexia and deaf children

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Literacy difficulties are more widespread among deaf children than hearing children, but reasons for their problems differ. Hearing children are likely to be described as dyslexic and once diagnosed, can benefit from specialist support, whereas for deaf children, their hearing difficulties are seen as primary. Given the genetic basis of dyslexia (Pennington & Olson, 2005), it is probable that some deaf readers will be affected and indeed teachers often suspect this is the case. However, it is complicated to tease apart the nature of deaf children's reading difficulties because so many have delays in reading.

Our interest in dyslexia in deaf children arose from a referral to the Compass Centre at City University London. B was a signing deaf child with hearing parents and a family history of dyslexia. B was failing to progress in reading and his teacher suspected dyslexia but could not get a confirmed diagnosis. As a consequence, B was unable to benefit from the specialist support available to hearing children with dyslexia. Having previously used dyslexia-sensitive measures effectively with oral deaf children who were good readers (Gravenstede & Roy, 2009), we decided to investigate B's case. Our findings did suggest dyslexia; however, the lack of information about typical reading profiles among deaf children and the dearth of tests designed specifically for deaf children made it difficult to be sure.

We successfully obtained funding to collect normative reading data from a representative sample of 80 oral deaf children. We targeted Year 6 because by this stage, children would be expected to have established reading skills and if not, teachers urgently need to know since transfer to secondary education is imminent. Although a diagnosis of dyslexia is possible at a younger age among hearing children, this would not be possible given the reading delays that many deaf children experience. Data from a large sample of same age deaf children would provide a useful backdrop against which to compare the profiles of deaf children who struggle more than most with reading. The study was limited to oral deaf children in the first instance, since research has shown them to follow a similar route to reading as hearing children (Kyle & Harris, 2010). This phase of our research is now completed and we are currently analysing the data. At the same time, we have embarked on the next phase, a parallel study with deaf children who sign.

We carefully piloted our test battery as we were not sure whether children would be able to access all the tests, many of which were presented orally (see Appendix). Our researcher was skilled at communicating with deaf children and adopted a deaf-friendly style of test administration. Children were tested in a quiet room with good lighting to allow full access to speechreading cues. SSE or BSL was used to present test instructions where needed, according to teacher recommendation. Children responded using spoken language only. For some tests, additional practice items were included to help children understand what was expected. Following the pilot, testing commenced throughout the UK. Almost all children we saw were able to complete the test battery (only three could not). Our final sample comprised 79 oral severely-profoundly prelingually deaf children aged 10-11 years and 20 hearing children with diagnosed dyslexia for comparison with our deaf group.

From our analyses using the test norms, half the deaf children we tested emerged as good readers, with scores for single word reading within the average range for hearing children. However, half were poor readers with below average scores. This was a larger proportion than

expected, given that almost two thirds were cochlear implant users and many were early identified. Furthermore, all deaf children who were poor readers (and a number who were not) had very low scores for expressive vocabulary. In comparison, the hearing dyslexic group contained a much smaller proportion of children with poor reading and of these, very few displayed language difficulties.

Although we did find some deaf children with profiles similar to those of hearing children with dyslexia, only a few of these were among the poorest deaf readers. Many other poor deaf readers also found the dyslexia sensitive measures challenging, indicative of underlying phonological deficits. Use of a range of measures has helped to profile children's strengths and difficulties, essential for identifying targets for intervention.

Our research has established that it is possible to use reading and dyslexia-sensitive tests developed for hearing children successfully with oral deaf children. However, professionals testing reading in deaf children need to have specialist communication skills to ensure that testing is effective and achieves valid scores. We have been able to identify measures that are sensitive to dyslexia in both hearing and deaf children and some that are effective with one but not the other group. Interestingly though, the measures that were the most informative in our deaf sample are exactly the same as those that research has identified as being most predictive of reading and dyslexia in hearing children (Hulme & Snowling, 2013).

In addition to identifying some with a dyslexic profile, our findings highlight the ongoing reading difficulties faced by a significant proportion of oral deaf children, despite recent developments in earlier identification of deafness and improvements in amplification. Most of these children had good speech and might not at first glance appear to have problems related to their deafness. Nevertheless, many were behind in their reading.

From those deaf children who do read at age level, we can see that reading difficulties are not an inevitable consequence of childhood deafness. We need to identify those who fall short and evaluate the severity and nature of their reading difficulties in order to assess individual needs. Deaf children who struggle with reading have language and phonological deficits; both areas must be targeted in intervention. From analysis of the reading profiles of poor readers, it is our view that interventions known to be effective with hearing dyslexic children may also be effective for many deaf children who are poor readers. Deaf children need early and ongoing support to develop the language and phonological skills that underpin literacy. With better understanding of their reading difficulties we can deliver more effective interventions and ensure that all deaf children succeed in reading.

Acknowledgments: We thank the Nuffield Foundation for their generous funding, Zoe Shergold for collecting the data and all the children, families and teachers who took part. We will publish further details from the first phase of our research in the coming year - see the project website for updates: <http://www.city.ac.uk/health/research/research-areas/lcs/reading-and-dyslexia-in-deaf-children>. We are currently seeking severely-profoundly prelingually deaf children who sign (or who use sign to access the curriculum) who are in Years 5 and 6 to take part in the next phase. Please telephone Catherine Barnett 020 7040 8466 or email Catherine.barnett.1@city.ac.uk for information.

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Appendix: Measures

Target	Test
Nonverbal skills	British Abilities Scales II (BAS) Matrices, Pattern Construction
Speech intelligibility	Speech Intelligibility Rating Scale
Speechreading skills	Test of Child Speechreading
Vocabulary	English One Word Picture Vocabulary Test
Reading skills: decoding	BAS Single Word Reading Test
	Dyslexia Portfolio Non-Word Reading Test
	York Assessment of Reading Comprehension (YARC) Letter-Sound Knowledge Test
Reading skills: rate and comprehension	YARC Passage Reading Test: Reading Accuracy, Reading Rate, Reading Comprehension
Spelling skills	BAS Single Word Spelling Test
Phonological skills	Phonological Assessment Battery (PhAB): Naming Speed Test Fluency Test: Alliteration, Rhyme, Semantic (non-phonological) Rhyme Awareness Test Phoneme manipulation tasks: Spoonerisms, Phoneme Deletion Test (Dyslexia Portfolio) Recall of Digits Forwards and Backwards (Dyslexia Portfolio)
Sequential organisation skills	Recall of Sequences: days of the week, months of the year