

Institution: University of Sheffield
Unit of Assessment: 4 - Psychology, Psychiatry and Neuroscience
Title of case study: Improved screening for dyslexia worldwide
<p>1. Summary of the impact</p> <p>There are over 3 million dyslexic people in the UK. Without support, disproportionate numbers of dyslexic children end up with low literacy skills, unemployed, and with significantly higher incidence of mental health problems. Low literacy is a major cost both to schools and subsequently.</p> <p>It is now well established that early identification and intervention is the most effective method of reducing these problems. Sheffield researchers have been pioneers in 'translational dyslexia' – developing theory and turning it into applied action. They were the first in the world to use the science of learning to develop a theory of dyslexia; the first to publish a normed screening test that could be used by teachers for effective early diagnosis; and the first to develop and validate a combined screening and support package that could be used by teachers for early intervention.</p> <p>These innovations have led to impacts on a range of levels: the screening tests have been used for hundreds of thousands of children in the UK, and translated into eight further languages; and the interventions have been cited as examples of best practice for practitioners in England and Wales, and in India.</p>
<p>2. Underpinning research</p> <p>Nicolson and Fawcett were the first to establish that dyslexic children frequently show difficulties in acquiring any skill where fluent, smooth, automatic performance was needed, and their automaticity deficit hypothesis (<i>Cognition</i>, 1990, 35,159-82) stimulated a range of theoretical and applied investigations via research undertaken (with funding from Leverhulme and MRC) over the period 1993-6. This research (now with 200 citations on Web of Science and 440 on Google Scholar, reflecting its strong impact within and outside academia) led to important developments in theoretical causal explanations for dyslexia at the level of cognitive performance for speed and automaticity, impaired subcortical functioning in the cerebellum [R4], and then a 'neural circuit' level for procedural learning [R3], which was able to account for all the developmental disorders within the framework of the cognitive neuroscience of learning. This theoretical work has been highly influential in dyslexia research, now involving three of the major theories, all with strong academic influence and citations.</p> <p>Undoubtedly, however, the 'translational' outcomes are of broader impact [R1-R2]. Analysis established that dyslexic children between 8 and 17 showed difficulties in a range of simple skills associated with learning, but not directly related to reading. It is therefore possible to test for 'risk' levels <i>before</i> a child fails to learn to read, and this understanding led to the development of the first screening test for pre-readers – a battery of simple tests that take 30 minutes for a teacher to administer, and provide a profile of performance as well as a composite 'dyslexia index'. The availability of each individual child's 'profile' of scores on the range of sensory, cognitive and motor skills was then used to underpin the third phase of research, supported by the Nuffield Foundation, which led to the development of cost-effective intervention methods [R5-6].</p> <p>The Psychological Corporation (later Pearson Education) first published the Sheffield tests between 1996 and 1998, including tests for ages 4.5-6.5 (Dyslexia Early Screening Test – DEST,1996), 6.5-16.5 (Dyslexia Screening Test – DST, 1996,) and 16.6-70+ (Dyslexia Adult Screening Test – DAST, 1998,). There are 240 references on Google Scholar, which includes the applied base, including 98 for the DST. These three tests provide measures of fluency, as well as accuracy across a range of skills, and can be compared with norms to identify a profile of strengths and weaknesses. DEST was the first test ever to use theory to determine a predictive test for</p>

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dyslexia before a child failed to learn to read. The tests have been welcomed by both the major umbrella charities for dyslexia, the British Dyslexia association and Dyslexia Action.

The tests are unique in the breadth of coverage of skills and have been designed to empower teachers to recognise and identify learning difficulties, consistent with the 1994 Department for Education UK Code of Practice that requires schools to identify and support problems within the classroom [R1-R2].

The research moved into a broader, more applied arena in 2007, with the appointment of Fawcett to a Chair in Child Research at Swansea University. Fawcett continued to collaborate with Nicolson in Sheffield over this period, and returned to work with the University of Sheffield on retirement in January 2011.

3. References to the research

- R1. Fawcett, A.J.; Nicolson, R.I. (1999). Performance of dyslexic children on cerebellar and cognitive tests. *Journal of Motor Behavior*, 31, 68-78. doi: [10.1080/00222899909601892](https://doi.org/10.1080/00222899909601892) (80 citations)
- R2. Nicolson, R.I.; Fawcett, A.J. (1995). Balance, phonological skill and dyslexia: Towards the Dyslexia Early Screening Test. *Dyslexia Review*, 7, 8-11 (Journal of Dyslexia Action)
- R3. Nicolson, R.I.; Fawcett, A.J. (2007). Procedural learning difficulties: reuniting the developmental disorders? *Trends in Neurosciences*, 30, 135-41. doi: [10.1016/j.tins.2007.02.003](https://doi.org/10.1016/j.tins.2007.02.003) (58 citations)
- R4. Nicolson, R.I.; Fawcett, A.J.; Dean, P. (2001) Developmental dyslexia: the cerebellar deficit hypothesis, *Trends in Neurosciences*, 24, 508-12 doi: [10.1016/S0166-2236\(00\)01896-8](https://doi.org/10.1016/S0166-2236(00)01896-8) (248 citations)
- R5. Nicolson, R.I.; Fawcett, A.J.; Moss, H.; Nicolson, M.K.; Reason, R. (1999). Early reading intervention can be effective and cost-effective. *British Journal of Educational Psychology*, 69, 47-62. doi: [10.1348/000709999157563](https://doi.org/10.1348/000709999157563)
- R6. Fawcett, A.J.; Nicolson, R.I.; Moss, H.; Nicolson, M.K.; Reason, R. (2001). Effectiveness of reading intervention in junior school. *Educational Psychology*, 21, 3, 299-312. doi: [10.1080/01443410124914](https://doi.org/10.1080/01443410124914)

4. Details of the impact

Dyslexia leads to major difficulties at individual, organisational and societal levels (see Hakkaart-van Roijen et al., 2011). The cost-effectiveness of an intensive treatment protocol for severe dyslexia in children has been assessed at around €58,000 per quality-adjusted life year (QALY) for primary school children (*Dyslexia 17*: 256-67). There is therefore great scope for translational dyslexia research. All three interconnected strands of the Sheffield translational work – theory, diagnosis, and intervention – have led to impact in their own right, and in combination. Consequently, the availability, which started with the Sheffield tests, of screening and support has had a major impact worldwide.

Impact on educational practice nationally: uptake

The Dyslexia screening tests (DST) produced by Sheffield have been heavily used in UK educational establishments. The success of the first editions led to second editions in 2004, still with strong sales, with the DST split into two age ranges (6.5-11.5 and 11.6-16.5) to allow the tests to be more sensitive at each age range. The most recent sales data from Pearson, the distributor for the kits, indicate sales from 2008-12 [S1] of around [text removed for publication] kits per year, together with further re-sale of forms, and show that the DST-J (aimed at primary school children) and DST-S (aimed at secondary school children) reach not only schools but also children's services, clinics, learning centres, individual practitioners, psychology teams, therapy centres and

universities. The adult test, the DAST, is extensively used in employment and in the University sector to identify potential problems.

Impact on national education policy and practice

Ten-week intervention studies based on DEST/DST-J profiles [R5-R6] have been identified as an example of best practice in terms of effectiveness and cost-effectiveness [S2]. The DEST/DST series of tests were identified as the most highly used screening tests in a report to the Scottish government drawn from 100% of Scottish schools. Demand for training in the use of screening tests is high and increasing, with the British Dyslexia Association mounting 38 training sessions annually for both the primary and secondary sectors [S3]. As the major screening test for adults, a subset of tests from the DAST was chosen to identify dyslexia in 8,809 34-year-olds from the 1970 British Cohort study. In June 2008, Fawcett's written and spoken evidence as Advisor to the Welsh Assembly government led to national policy recommendations [S4] that endorse the importance of early screening for dyslexia. This approach is now ongoing in 36 primary schools in South Wales and newly adopted for Pembrokeshire. The Welsh language version is recommended nationally and has been developed in conjunction with Dyslexia Wales, whose head describes it as "*a vital tool for the assessment of children in Wales who are taught through the medium of Welsh.*" [S5]

The potential for use of the test with other disabilities was illustrated by Action Duchenne, whose screening and intervention programme identified a profile of difficulties amenable to support (the charity won the National Lottery Education Award for this study, in November 2011). "*These screening tests are particularly appropriate for a range of developmental disabilities, because they cover a broad range and measure fluency as well as accuracy.*" [S6].

Impact internationally: translations into other languages

In many countries, including the Balkans and India, learning difficulties have been stigmatised, so that parents have been reluctant to seek help for their children. Dyslexia is only recognised in two states in India, and children are not diagnosed until age 12 or above, leading to significant mental health issues. The availability of screening and support that can be delivered by teachers can cut into this cycle and so the test has been universally welcomed [S7]. Dr Sunil Karande, paediatrician, noted "*Thank you for developing the DST-J India, which has tremendous potential for resolving some of the issues related to SpLD in India.*"

The most successful screening test in terms of sales and usage, the DST-J for ages 6.5-11.5, has been translated into Dutch, Spanish, Indian and Welsh and normed and published by Pearson Education. The strongest overseas uptake is in the Netherlands, where [text removed for publication] full kits and [text removed for publication] sets of record forms have been sold annually over this period. Figures from Pearson India show sales of [text removed for publication] kits during the first eleven months of its availability. Export of the English versions has been steady, with [text removed for publication] full kits and [text removed for publication] sets of record forms exported in 2012 [S1]. The screening tests have also been translated into other languages and normed for use in many countries, including Greece, Israel, South Asia, the USA and the United Arab Emirates.

International development and policy

As a consequence of her high profile internationally, Fawcett was appointed as "Special Envoy to the World" for Dyslexia International and undertook a range of international profile-raising visits. These include:

- Invited presentation and launch of DST-J India at the World Education Summit, New Delhi, 2012. Press coverage noted 'the importance of the DST-J India in bringing about a change in the way schools identify and support the special learning needs of children with dyslexia [S7]'.
- Invited presentations and collaboration with the University of Tuzla in Bosnia led to an invitation to Fawcett to lead a €500,000 Tempus proposal on screening and support for dyslexic students

in HE, selected as best practice for inclusion in Tempus@20, 2011. Adult screening tests were normed for Bosnia and used to identify dyslexic students (it had previously been feared that the project would fail because no dyslexic students had been recognised). Four TV companies broadcast material from the final conference. As a direct consequence, legislation was brought in to recognise dyslexia in higher education, and a dyslexia association was set up to provide support for children and parents in schools [S8].

- Invited presentation by Fawcett in South Africa in 2008 on screening and intervention to voluntary group SAALED led to the introduction of free teacher training to South Africa with the University of Johannesburg (potential 200 teachers annually from 2012)
- Invited presentation in Singapore on early screening in 2009 led to the adoption of an early intervention policy by the Dyslexia Association of Singapore (DAS) [S9]. *"If we can work with the preschool fraternity, to identify children at risk of dyslexia, I think that would be very good, and a big step towards helping these children much earlier. From the results of the past few years, over 80 per cent of students on our preschool programme are subsequently diagnosed with dyslexia."* [S9]. DAS has its own pre-school assessment programme that helps to identify children who could be dyslexic, used in conjunction with DEST [S9].
- Invited presentation in Sarawak at the 1st Asia Pacific conference on Dyslexia in June 2013 led to a commitment from the Minister of Welfare to universal early screening beginning at pre-school level, to allow for the implementation of appropriate interventions.

Public education and understanding

An important aspect of the screening tests has been in helping parents, pupils, teachers and researchers to fully appreciate the range of difficulties experienced in dyslexia. As Vice President of the British Dyslexia Association, Fawcett was responsible for compiling and editing the 2013 Handbook on Dyslexia for parents, teachers and dyslexic adults. A key component was an article by Nicolson on Positive Dyslexia, a new discipline that builds on the ability to diagnose weaknesses, as represented in the DSTs, but goes beyond that to focus on the other side of the coin, the strengths. This work has already inspired a set of symposia in the USA and has captured the imagination of the dyslexia community on both sides of the Atlantic, with a slideshare presentation attracting nearly 15,000 viewings since November 2012 [S10].

5. Sources to corroborate the impact

- S1. Letter from Education Manager, Pearson Education, 2013.
- S2. Caravolas, M., Kirby, A., Fawcett, A.J., Glendinning, K. (2012) Research into dyslexia provision in Wales: literature review on the state of research for children with dyslexia. (<http://tinyurl.com/oeva6rk>, page 38) corroborates that the intervention has been identified as best practice.
- S3. Screening for dyslexia (<http://tinyurl.com/pqfcoff>).
- S4. National Assembly for Wales Enterprise and Learning Committee (2008). *Support for People with Dyslexia in Wales*. National Assembly for Wales (<http://tinyurl.com/qf7bdq2>). The Committee report cites or includes oral evidence on 24 occasions.
- S5. Letter from Director, Dyslexia Wales
- S6. Letter from Director, Action Duchenne
- S7. Letter from Marketing Manager, Pearson India
- S8. Letter from Project leader, Tempus Bosnia
- S9. <http://www.das.org.sg>
- S10. Positive Dyslexia: working to our strengths (<http://tinyurl.com/ptquxe8>).

