

Impact case study (REF3)

Institution: Oxford Brookes University		
Unit of Assessment: 4, Psychology, Psychiatry and Neuroscience		
Title of case study: Improving identification and support of individuals with movement and handwriting difficulties through development of assessment tools for practitioners		
Period when the underpinning research was undertaken: 2005–2010		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Anna Barnett	Professor in Psychology	[text removed for publication]
Period when the claimed impact occurred: 1 August 2013 to 31 July 2020		
Is this case study continued from a case study submitted in 2014? Y		
<p>1. Summary of the impact</p> <p>Movement and handwriting difficulties can make everyday activities and progress in education more challenging. Better assessment results in more support for young people with these difficulties.</p> <p>This research programme led to the development of a new suite of standardised assessment tools. These are published by Pearson Clinical UK, and have helped occupational therapists (OTs) and other health practitioners, teachers and educational psychologists make diagnoses, identify needs and plan support for individuals to help them achieve their potential.</p> <p>The main beneficiaries of the Movement ABC-2 Test and Checklist and two handwriting tests (DASH and DASH 17+) are young people with movement and handwriting difficulties, health and education professionals, and the test publisher.</p> <p>This case study was included in REF2014, and the continuing impact is described here.</p>		
<p>2. Underpinning research</p> <p>Extensive research led to the development of four new standardised tools to assess motor competence and handwriting skills in children and young people aged 3–25:</p> <ul style="list-style-type: none"> the second edition of the Movement ABC Test and teacher Checklist (MABC-2, 2007) [R1] for 3–16-year-olds the Detailed Assessment of Speed of Handwriting (DASH, 2007) [R2] for 9–16-year-olds the DASH 17+ (2010) [R3] for 17–25-year-olds. <p>Anna Barnett, Professor in Psychology, led the development and standardisation projects, resulting in the publication of all four new tests by Pearson Clinical UK.</p> <p>The first edition of the MABC Test and Checklist was published nearly 40 years ago (MABC; Henderson & Sugden, 1982). Professor Barnett joined the original authors as project director to develop and produce the second editions. The MABC-2 Test assesses three areas of motor development: manual dexterity, ball skill and balance. The MABC-2 Checklist provides a complementary description of the child's movement in the classroom context.</p> <p>Professor Barnett's involvement led to substantial improvements, including a simpler structure for the Checklist making it easier to score, revision of Checklist and Test items to improve reliability, and extension of the age range. Her expertise in standardisation and psychometrics also supported the provision of UK norms and the introduction of standard scores. The MABC-2 is used with a range of conditions (e.g. Autism spectrum disorder, dyslexia, children born prematurely), but</p>		

its main impact has been in the field of developmental coordination disorder (DCD). It has supported practitioners to diagnose in line with formal criteria of international classification systems (DSM-5 and ICD-11). The MABC-2 replaces older assessments, as a more robust and practical tool. The Bruininks-Oseretsky Test of Motor Proficiency (BOT-2, 2005) is the closest competitor, with North American norms. It tests a similar range of motor skills but also tests other aspects such as strength, which can make results hard to interpret.

People with DCD often have difficulty with handwriting. Other groups, including those with dyslexia, also struggle with this skill. Teachers are concerned with handwriting difficulty because it can severely limit academic progress. Professor Barnett used her expertise in handwriting skill development and the difficulties seen in DCD to develop two new handwriting assessment tools – **DASH** and **DASH 17+**. These are the only comprehensive tests of handwriting that provide UK normative data and standard scores for students aged 9–25.

The large standardisation projects for these tests involved working with expert panels, design of equipment and record forms, training over 150 testers across the UK, and production of the instruction and technical manuals. It was critical to test a representative sample, and this was achieved by using information from the 2001 Census on age, gender, geographical location, race/ethnicity and socio-economic status. The psychometric properties of the tests were also examined, and Professor Barnett conducted several studies to achieve this. The large national samples and the validity and reliability of the tests are reported in the published test manuals and in international peer-reviewed journals [R4, R5, R6].

Funding for these projects was obtained from Action Medical Research (PI Barnett, £51,301, 2005), Harcourt Assessment (PI Barnett, £102,479, 2005) and Pearson Assessment (PI Barnett, £29,957, 2009). Professor Barnett led the research, conducted in collaboration with colleagues in education at the University of London and the University of Leeds (Sugden, Henderson, Scheib) and with assistance from a statistician (Schulz) at the University of Hertfordshire.

3. References to the research

1. *Henderson, S.E., Sugden, D.A. & Barnett, A.L. (2007). *The Movement Assessment Battery for Children – 2nd Edition Manual*. London: Pearson. ISBN: 9780749136017. This includes instructions for administration and scoring of the **MABC-2 Test** and **MABC-2 Checklist**. [There are commercially available translations of the manual in French, Italian, Dutch, German, Spanish, Swedish, Norwegian, Danish, Brazilian Portuguese, Slovakian, Czechoslovakian, and Chinese (Mandarin). There are unpublished translations (or research translations) in Japanese, Thai, US Spanish, Vietnamese, Korean and Hebrew].
2. *Barnett, A., Henderson, S.E., Scheib, B. & Schulz, J. (2007). *The Detailed Assessment of Speed of Handwriting (DASH)*. London: Harcourt Assessment. ISBN: 9780749136406. [Research translations of the manual are also available in Italian, Brazilian Portuguese and Maltese].
3. *Barnett, A., Henderson, S.E., Scheib, B. & Schulz, J. (2010). *The Detailed Assessment of Speed of Handwriting 17+ (DASH 17+)*. London: Pearson Assessment. ISBN: 9780749149253.
4. Schulz, J., Henderson, S.E., Sugden, D.A. & Barnett, A. L. (2011) Structural validity of the Movement ABC Test – 2nd Edition. *Research in Developmental Disabilities*, 32(4), 1361-1369. doi:10.1016/j.ridd.2011.01.032. This paper presents a detailed examination of the factor structure of the test, based on data collected as part of the standardization process. The findings demonstrate the validity of the test structure, supporting division into the three component parts: manual dexterity, balls skills and balance.
5. Barnett, A.L., Henderson, S.E., Scheib, B. & Schulz, J. (2009) Development and standardisation of a new handwriting speed test: the DASH. *British Journal of Educational Psychology Monograph Series II*, 6, 137-157, DOI:10.1348/000709909X421937. ISSN: 1476-9808. This paper outlines the development of the DASH and justification for inclusion of a range of writing tasks to provide a comprehensive assessment. Age effects on the tasks are reported.
6. Barnett, A.L., Henderson, S.E., Scheib, B. & Schulz, J. (2011) Handwriting difficulties and their assessment in young adults with DCD: Extension of the DASH for 17-25 year olds. *Journal of Adult Development*, 18 (3), 114-121, DOI: 10.1007/s10804-011-9121-3. This paper outlines the

development of the DASH17+ and provides a case study illustrating its use in supporting students. Age effects on the tasks are reported.

*Copies of test manuals available on request from Oxford Brookes Research & Business Development Office.

4. Details of the impact

Use of the tests worldwide, including translated versions, deliver the benefits outlined below.

Benefits for people with movement/handwriting difficulties

The MABC-2 is used to identify children with these difficulties and confirm a diagnosis of DCD. DCD affects 5–6% of all school-aged children. For example, a clinical scientist from Sunny Hill Health Centre at BC Children's Hospital in Canada reports: 'Because the MABC-2 is user- and child-friendly and is normed for children as young as 3 years, it is an ideal tool to facilitate earlier identification of this disorder ... identification and intervention are necessary to alter the developmental trajectory and improve outcomes of affected individuals. The MABC-2 is the critical first step to initiating this process ... the MABC-2 has allowed me (and many others) to identify children with DCD, which has increased awareness of this disorder' [S1]. And a parent says that 'with the use of the Movement ABC report I was able to return to my son's GP with the findings and only then a referral was made ... I do not believe my child would have received his diagnosis and subsequent intervention without the assessment and report' [S3].

DASH/DASH 17+ help to identify children and young people with slow handwriting. This is common in DCD and also in dyslexia (affecting 10% of the population), and other conditions such as autism. Diagnosis can relieve distress for the affected person, and gives access to support. This means students can benefit from classroom accommodations, 'reasonable adjustments' in examinations and understanding from teachers to boost self-confidence and enhance academic performance. The charity Action Medical Research says: 'The DASH test enables teachers and therapists to better understand the problems children with DCD, and some other conditions, have with handwriting. This helps to ensure children get support to help them perform as well as they can, especially in exams' [S2]. For example, a student with dyslexia and writing difficulties reports: 'I am really slow with my handwriting ... when my tutor got the results (from DASH) I was allowed to use a computer for my exams. This helps me a lot' [S3].

From sales of test record forms between 2014 and 2020 [S4] it is possible to determine that 612,475 individual assessments have been made worldwide using the MABC-2 Test, 164,120 with the Checklist and 384,877 with DASH/DASH 17+. These figures are probably an underestimate, as practitioners may not always use a published record form, and translated versions are not included.

Benefits for health and education professionals

Use of the tests in clinical practice

A leading UK charity, Action Medical Research, states: 'The MABC-2 test is now one of the most popular and respected tests worldwide for the assessment of motor skills' [S2]. The test is widely used in clinical practice pathways for paediatric services nationally and internationally [S5]. For example, the lead OT from a specialist autism school in London says: 'We formally assess pupils at their key transition points ... to see what accommodations they may need' [S5]. Another clinical lead for paediatric OT in London says: 'we have a DCD pathway for onward referral to our Child Development Centre colleagues – within this formal pathway, we encourage clinicians to use MABC-2 prior to making the referral' [S1]. An associate professor in the Department of Occupational Science and Occupational Therapy, Vancouver, Canada says: 'As part of our standard clinical practice, I routinely administer the MABC-2 ... To build capacity of community clinicians to make the diagnosis of DCD, my team and I have developed evidence-based toolkits for occupational therapists and community pediatricians. These documents advocate for the use of the MABC-2 to assist in determining if children meet the criteria for DCD. The DCD Toolkit for Pediatricians has been circulated to all members of the British Columbia Pediatric Society and the resource has been posted on their website' [S1].

In developmental medicine, clinicians are often also involved in research. An example is use of the

MABC-2 Test in studies of prematurely born infants. A professor of paediatrics at the Stanford University School of Medicine, USA describes how the test has been used in an NICHD Neonatal Research Network study: 'this introduced the tool into use for the 15 participating US study sites, and many have integrated the tool into their clinical or site-specific research batteries ... I have found the Movement ABC-2 to be an extraordinarily useful tool, both for research and for clinical applications' [S1]. This is also reflected in the 1280 citations for the MABC-2 Test in academic journals since 2014 [S4].

UK and international sales figures show that a range of practitioners use the tests [S4]. In the UK 53% of MABC-2 kits are bought by OTs, 10% by physiotherapists and 3% by doctors/paediatricians. It is also bought by speech and language therapists and psychologists. In the UK 11% of DASH kits are bought by OTs and 3% by clinical psychologists.

Use of the tests in educational settings

The DASH tests are used to provide evidence, enabling students with handwriting difficulties to access special arrangements from primary to higher education. A trainer of specialist literacy teachers at the Institute of Education, UCL says: 'the DASH is an invaluable tool for practitioners in helping to identify where support is required and to monitor progress' [S6]. A specialist dyslexia assessor says: 'For older students, the DASH is also used to support access arrangement recommendations under Joint Council for Qualifications (JCQ) regulations' [S6]. A specialist tutor at a college of further education in London says: 'I use the DASH17+ test of free writing speed routinely as part of assessments for access arrangements in exams. It is well suited to the purpose' [S6]. The chief executive of the Professional Association of Teachers of Students with Specific Learning Difficulties (Patoss) confirms this: 'Many of our members in UK schools report they use the DASH as evidence in applications for supporting access arrangements' [S6]. UK figures show that 74% of sales of the DASH are to schools and 9% to educational psychologists [S4].

Recommendations in national and international guidelines

The MABC-2 Test is recommended in the International Guidelines on DCD [S7]. This publication by cross-disciplinary international experts in the journal *Developmental Medicine & Child Neurology* is the standard worldwide guide to assessment in research and clinical practice in DCD. It was first published in 2012 by the European Academy of Childhood Disability (EACD) and updated in 2019 following international consensus meetings and systematic reviews. The international recommendations have recently been translated into Chinese (Mandarin) [S6]. A professor in occupational therapy at BC Children's Hospital, Canada states: 'the MABC-2 is considered the gold standard assessment for determining Criterion A of the Diagnostic and Statistical Manual, 5th edition (DSM-5) diagnostic criteria for DCD as per international clinical practice recommendations' [S2].

The MABC-2 and DASH tests are recommended by the SpLD Assessment Standards Committee (SASC) for the assessment of specific learning difficulties in the UK [S8]. The DASH tests are also included in the list of resources recommended by Patoss and the JCQ that guide teachers applying for access arrangements for pupils in the UK [S9]. The DASH tests are also recommended as 'essential' assessments in clinical practice guidelines for OTs in Western Australia [S5].

Benefits for the test publisher

The worldwide sales figures are proof of commercial success [S4]. Pearson Clinical UK describes the tests as 'internationally best-selling assessments'. Data from author royalty statements indicates that the number of kits and test manuals sold between 2014 and 2020 is over 2,500 for MABC-2, over 7,500 for DASH and over 2,000 for DASH 17+ (current kit price £1000, £130 and £76 respectively). With additional revenue from the sale of record forms and MABC-2 Checklists there was overall net revenue of over £2.5 million in the assessment period. This excludes translated versions. Further evidence of commercial success is shown in a report from a senior product manager at Pearson Clinical UK [S4], confirming that they 'have committed to developing a third edition (Movement ABC-3) [and] to developing a second edition (DASH-2) ... data collection is planned to commence in 2021'.

5. Sources to corroborate the impact

1. Corroborative statements from health/allied health professionals, including (i) a Clinical Scientist from Sunny Hill Health Centre, Canada and (ii) Professor of Pediatrics, Stanford School of Medicine, USA.
2. Corroborative statement from leading UK charity, Action Medical Research for Children <https://action.org.uk/research/successes/developing-tests-dcd>
3. Corroborative statements from individuals with movement/handwriting difficulties and their families including (i) a student with dyslexia and handwriting difficulties, (ii) the parent of a child with movement difficulties and (iii) a case study from the Action Medical Research website.
4. Confidential sales information and usage estimates from Pearson Clinical UK regarding the number of translations and status of sales of the MABC-2 and DASH tests to clinicians in the UK and overseas. Estimates are provided of the number of children assessed. 1280 citations of the MABC-2 Test in publications listed on Google scholar from 2014 to 2020.
5. Examples of clinical pathways and guidelines including those from (i) a specialist Autism school in London, UK (ii) a Paediatric Occupational Therapy Service in London, UK, (iii) 'DCD Toolkit for Pediatricians' from the DCD Advocacy Toolkit, University of British Columbia, Canada, (iv) 'DCD' and 'Motor dysgraphia' clinical practice guidelines for Occupational Therapists in Western Australia.
6. Corroborative statements from education professionals – including (i) a trainer of specialist literacy teachers and assessors of dyslexia at the Institute of Education, UCL, (ii) a specialist dyslexia assessor and specialist tutor at a college of Further Education, (iii) Chief Executive of the Professional Association of Teachers of Students with Specific learning difficulties (SpLD).
7. International Guidelines on DCD – guidelines for clinicians recommending use of the MABC-2 Test for assessment and diagnosis in a clinical setting. Blank et al (2019) International clinical practice recommendations on the definition, assessment, intervention and psychosocial aspects of developmental coordination disorder. *Developmental Medicine & Child Neurology*, 61, 242-285. [Web of Science 'highly cited paper'; 159 Google Scholar citations]. [Chinese translation in Hua, J. et al. (2020) *Developmental Medicine & Child Neurology*. <https://doi.org/10.1111/dmcn.14693>].
8. List of recommended tests published by the SpLD Assessment Standards Committee (SASC) for the assessment of specific learning difficulties (SpLD) in Further and Higher Education. [SASC Post-16 Test List-Final June 2020 -amended July 2020](#)
9. Castiglione, L (2018). Assessing the need for Access Arrangements in Examinations: A practical guide. Fifth Edition. Published by Patoss, Professional Association of Teachers of Students with Specific Learning Difficulties in association with the Joint Council for Qualifications (JCQ). ISBN: 978-0-9539315-5-2 <https://www.patoss-dyslexia.org/Books/-NOW-OUT-Assessing-the-Need-for-Access-Arrangements-in-Examinations-Fifth-Edition>
10. Confidential information extracted from Pearson Clinical UK author royalty statements indicating the number of sales of MABC-2 and DASH/DASH17+ kits and test manuals.